

RSoft Application: Optical Vs. Electronic Dispersion Compensation

Polarization-Multiplexed Coherent Systems

Overview

A system designer at a major European telecom carrier wanted to explore whether in-line optical compensation of dispersion or post-detection electrical dispersion compensation was the right choice for multi-wavelength coherent systems.

The Challenge

- ▶ In high-speed, multi-channel, long-haul data transport systems, fiber dispersion is a major limiting factor.
- ▶ Deployment of dispersion-compensating fibers is expensive and add to higher loss and increased fiber nonlinearities.
- ▶ Dispersion management measures impact capital and operating budgets.

The Solution

RSoft™ OptSim™ provides models and options to analyze dispersion in detail. Analysis can be done in terms of maximum tolerable span loss, ensuring a given BER (also called “span budget”) for all-optical and electronic dispersion compensation cases.

The Result¹

In systems using standard, single-mode fibers (50GHz spacing), the maximum span budget is 25dB for electronic dispersion compensation (EDC) with 1.5dB penalty compared to a no-dispersion case (dotted line in Figure 1).

Optical dispersion compensation (ODC) results in approximately 1dB deterioration in tolerable span budget (Figure 2), suggesting that EDC is a clear winner.

EDC provides significant capital expenditure savings, since it does not require dispersion-compensating fiber and can work for both greenfield and brownfield network deployments.

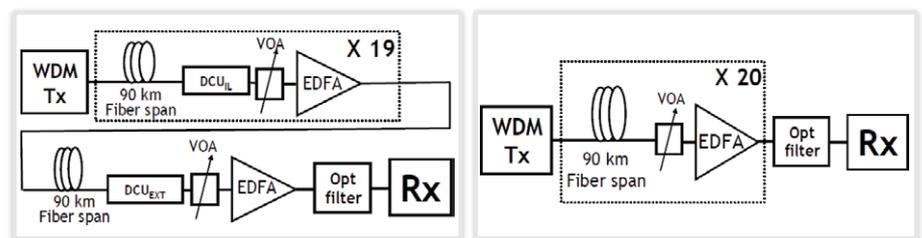


Figure 1. Schematic block diagram of the high-speed long-haul system with in-line optical compensation of dispersion (left) and post-detection electrical compensation of dispersion (right)

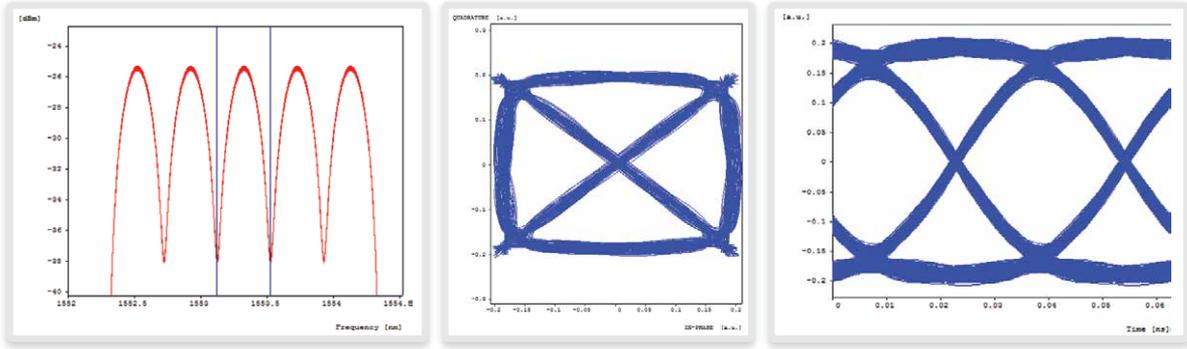


Figure 2. Spectrum at the transmitter (left), signal constellation (middle) and eye diagram (right)

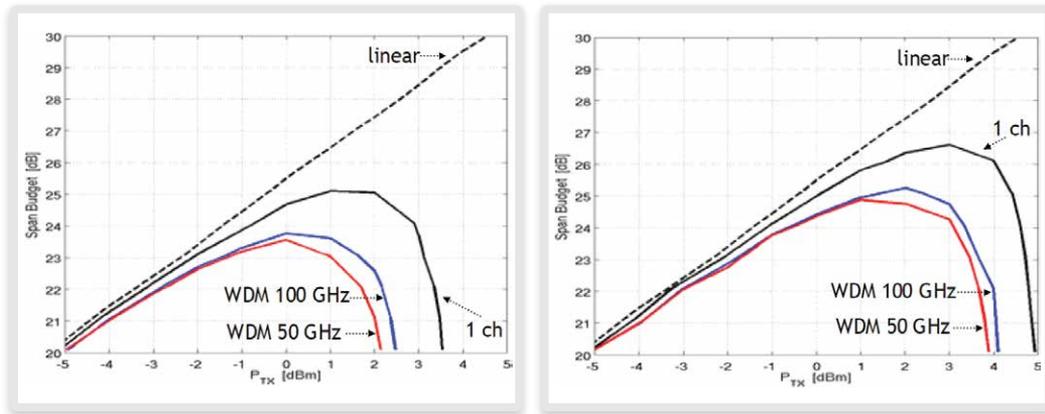


Figure 3. Comparison of performance between optical and electronic dispersion compensations

¹A. Carena, V. Curri, P. Poggiolini, F. Forghieri, "Optical vs. electronic chromatic dispersion compensation in WDM coherent PM-QPSK systems at 111 Gbit/s", Proc. OFC/NFOEC 2008, JThA57, 2008.

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