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RSoft Application: Modulation Formats for High-Speed WDM Systems

Dispersion Map Optimization for RZ, Duo-Binary, CSRZ-DPSK, RZ-DPSK at 40 Gbps

Overview

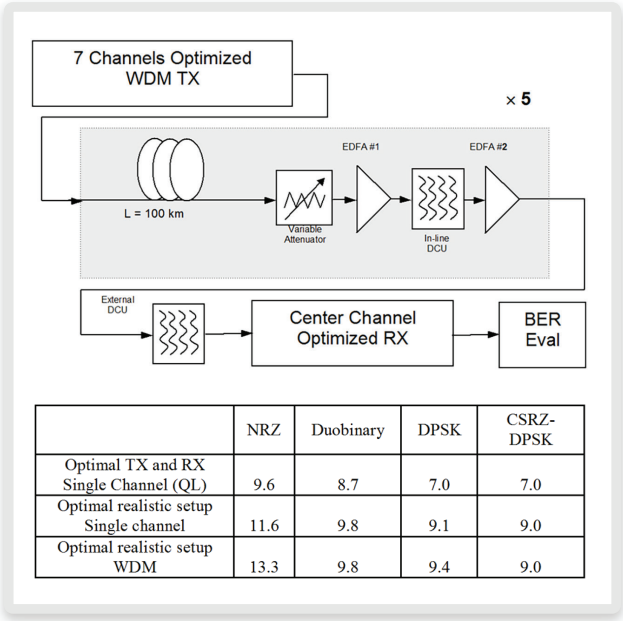
A transoceanic fiber-optic link designer needed to evaluate performance of different modulation formats for 40 Gbps from the perspective of resilience to dispersion tolerances and fiber nonlinearities.

The Challenge

Fiber dispersion and nonlinearities at high data rates limit transmission distances. The intensity and phase-modulated systems involve tradeoffs between design complexities and performance. Accurate performance estimates require complex multivariable analyses of loss and dispersion management, crosstalk and intersymbol interference (ISI).

The Solution

RSoft™ OptSim™ provides intuitive, parametric modeling of advanced modulation formats, optical amplifiers and dispersion management. The interplay of linear and nonlinear transmission impairments is modeled, and the impact of crosstalk and ISI is studied using filter bandwidths at transmitter and receiver levels.



	NRZ	Duobinary	DPSK	CSRZ-DPSK
Optimal TX and RX Single Channel (QL)	9.6	8.7	7.0	7.0
Optimal realistic setup Single channel	11.6	9.8	9.1	9.0
Optimal realistic setup WDM	13.3	9.8	9.4	9.0

Figure 1. Schematic of the layout used for comparing modulation formats (top) and table showing required OSNR for each format (bottom)

The Result

System parameters need to be carefully optimized for viable designs.[1] Tight optical filtering is a must at transmitter and receiver to limit ISI. NRZ is the least suitable and CSRZ-DPSK the most suitable modulation format in terms of resilience to nonlinear effects and dispersion compensation tolerances.

[1]G. Bosco, A. Carena, V. Curri, R. Gaudino, P. Poggiolini, "Modulation Formats Suitable for Ultra High Spectral Efficient WDM Systems", IEEE Journal of Selected Topics in Quantum Electronics, Vol. 10, No. 2, March/April 2004

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