

RSoft Application: Single Polarization Vs. Polarization Multiplexed Systems

Comparing Two Quadrature Phase Shift Keying (QPSK) Systems

Overview

A long-haul fiber-optic system designer in Europe wanted to evaluate cost-to-benefit upgrade options for single- vs. dual-polarized QPSK systems.

The Challenge

High-speed, long-haul fiber-optic systems demand superior spectral efficiency. Simulation-assisted design of multi-level, phase-modulated systems is computationally intensive. Since dual-polarized systems are complex, cost-to-benefit analysis becomes imperative.

The Solution

RSoft™ OptSim™ provides a time-domain split-step (TDSS) engine with no assumption on periodicity, making it ideal for modeling phase modulated coherent systems. Bit error rate (BER) as a function of required optical-signal-to-noise ratio (OSNR) is a commonly used performance metric for comparison.

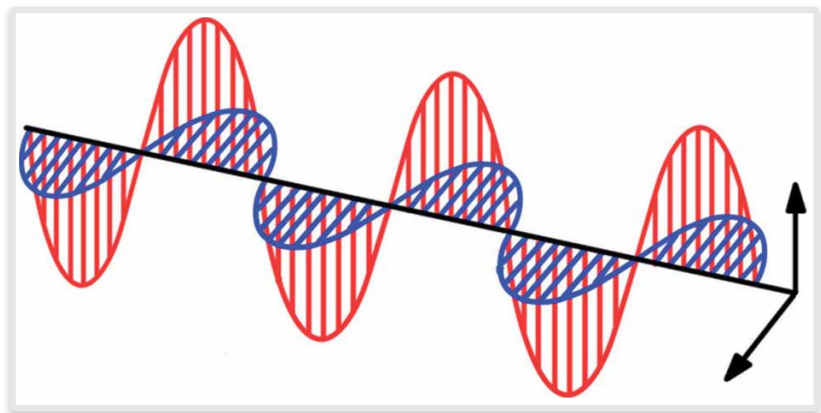


Figure 1. X- and Y-polarizations of an optical carrier

The Result

As shown in the OptSim analysis in Figure 2, for a reference pre-forward error correction (FEC) BER of 10^{-3} , PM-QPSK requires 2-dB lower OSNR than single-polarized QPSK, and 1.4-dB lower OSNR compared to single-polarized PSK. The savings in system power budget due to reduced OSNR requirement makes PM-QPSK a better choice compared to single-polarization phase modulated systems under study.¹

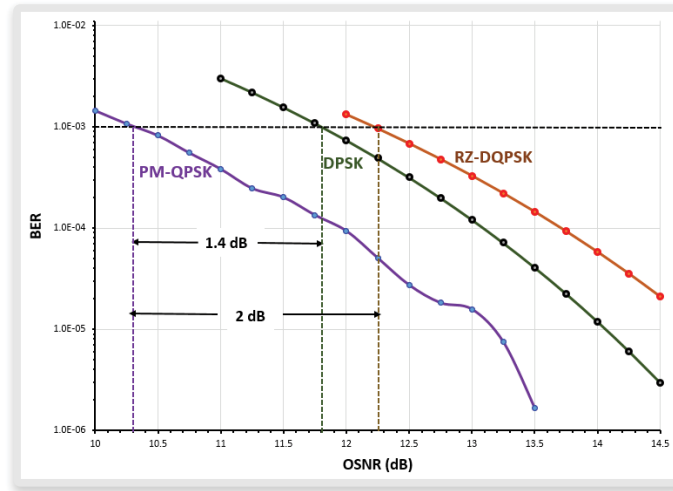


Figure 2. Comparison of receiver sensitivities of PM-QPSK, DPSK and RZ-DQPSK systems

¹J. Renaudier, et al., “Linear Fiber Impairments Mitigation of 40-Gb/s Polarization-Multiplexed QPSK by Digital Processing in a Coherent Receiver”, Journal of Lightwave Technology, Vol. 25, No. 1, Jan. 2008.

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