SYNOPSYS®
Silicon to Software™

RSoft Application: Radio-Over-Fiber Microwave Photonic Link

Designing Fade-Resilient, Linear, Wide-Bandwidth, Large-Dynamic-Range Systems

Overview

A North American defense contractor wanted to verify linearity of an analog radio-over-fiber (RoF) link designed to transmit satellite data to Earth.

The Challenge

Because of their large capacity and immunity to electromagnetic interference, RoF links are attractive for carrying received low power analog RF signals from satellites. Achieving high, spurious-free dynamic range (SFDR) is a challenge. Intermodulation distortions (IMD) adversely impact SFDR; keeping IMD low requires appropriate measures for linearization of the link. Susceptibility to power fading due to chromatic dispersion is another challenge, requiring simulation-assisted design trade-offs.

The Solution

RSoft™ OptSim™ provides models and capabilities to simulate analog and digital RoF links and analyze linearity and IMD performance. A balanced-bridge Mach-Zehnder modulator (MZM) double-sideband, suppressed-carrier (DSB-SC) system with heterodyne-balanced receiver is an attractive design approach.

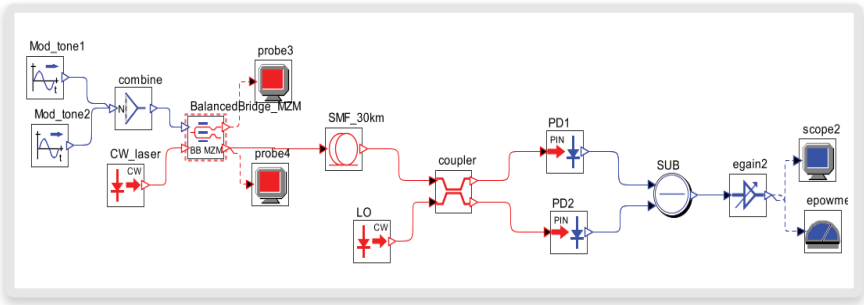

Figure 1. OptSim layout of a microwave photonic link

The Result

Power fading is strong in the intensity-modulated link (Figure 2, left, green curve) compared to uniform over frequencies for the suppressed carrier link (Figure 2, left, orange curve). DSB-SC with balanced detection improves link linearity (Figure 2, right). The design demonstrates low noise, wide bandwidth, high gain and dynamic range of operation.

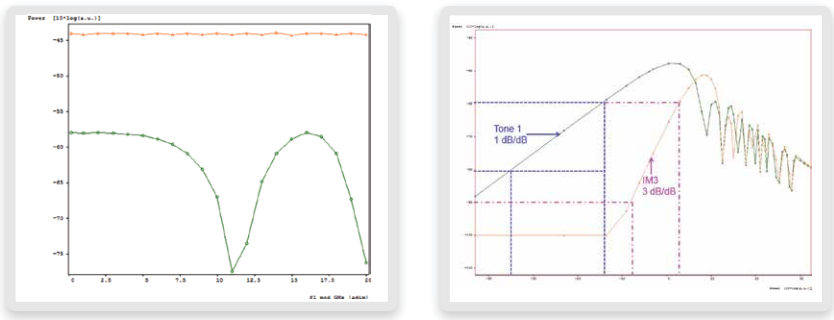

Figure 2. Power fading (left) and IMD (right) for the microwave photonic link of Figure 1

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