

Reconfigurable high-speed optical fibre networks: Optical wavelength conversion and switching using VCSELs to eliminate channel collisions

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Abstract

We experimentally provide an alternative solution to channel collisions through up-wavelength conversion and switching by using vertical cavity surface-emitting lasers (VCSELs). This has been achieved by utilizing purely optical wavelength conversion on VCSELs at the low attenuation, 1550 nm transmission window. The corresponding transmission and bit error-rate (BER) performance evaluation is also presented. In this paper, two 1550 nm VCSELs with 50–150 GHz channel spacing are modulated with a 10 Gb/s NRZ PRBS 2^7-1 data and their interferences investigated. A channel interference penalty range of 0.15–1.63 dB is incurred for 150–50 GHz channel spacing without transmission. To avoid channel collisions and to minimize high interference penalties, the transmitting VCSEL with data is injected into the side-mode of a slave VCSEL to obtain a new up converted wavelength. A 16 dB extinction ratio of the incoming wavelength is achieved when a 15 dBm transmitting beam is injected into the side-mode of a –4.5 dBm slave VCSEL. At 8.5 Gb/s, a 1.1 dB conversion and a 0.5 dB transmission penalties are realized when the converted wavelength is transmitted over a 24.7 km G.655 fibre. This work offers a low-cost, effective wavelength conversion and channel switching to reduce channel collision probability by reconfiguring channels at the node of networks.