4. Conclusion

We have validated the silicon-photonic platform's suitability for FWM-based wavelength conversion of phase modulated signals over a broad spectrum as well as the ability to simultaneously convert multiple channels with mixed formats. In the first demonstration we demonstrated the concept of broadband wavelength conversion of 10-Gb/s DPSK signal over 100 nm utilizing the phase-preserving properties of the all-optical interaction. We observed constant 1-dB power penalty after wavelength conversion for all the examined probe-idler separations. The results affirm the feasibility of format-transparent continuous wavelength converters operating over 100-nm probe-idler detuning using silicon-based FWM devices. We then continued to demonstrate packetized dual-wavelength conversion of mixed-format signals, enabling simultaneous operation with different modulation formats and multi-channels at high bit rates in chip-scale devices. The increased power penalty when scaling to two channels is mainly attributed to the cross phase modulation between the probe signals. Improved performance can be obtained by further optimizing power levels of the probe signals which would allow minimizing deleterious nonlinear cross-talk and still maintaining good optical signal-to-noise ratio (OSNR) of the converted signals. These demonstrations validate the suitability of the CMOS-compatible silicon-photonic platform for flexible low-cost all-optical processing systems and highlight the ability to process multiple data formats on a single platform.

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