An 8×30 Gb/s InP Monolithically Integrated Directly Modulated Transmitter

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A high-speed integrated 8-channel transmitter fabricated using a generic InP integration platform is reported. The directly modulated lasers on a 100 GHz grid have 21 GHz bandwidth and operate up to 30 Gb/s per channel.
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Multi-wavelength transmitters are useful in several applications in short- to long-haul optical digital transmission, including data center networks, access networks and mobile backhaul. In this contribution, we report our recent results on directly modulated transmitter integrated circuits fabricated with a generic foundry model. In particular, we report the characterization of an 8-channel transmitter working up to 30 Gb/s per channel useful for short reach 200+ Gb/s applications.

The PIC has been fabricated with a generic integration technology [1] exploiting the InP platform at Fraunhofer HHI

A picture of the 8-channel integrated multi-wavelength transmitter is reported in Fig. 1. Eight directly modulated DFB lasers are butt-coupled on both sides to passive waveguides so that one output of each laser is terminated onto an integrated monitoring photodetector, and the other one is connected to the 2×1 coupling MMI. Cascaded MMI-based couplers combine all the laser signals. The single output waveguide terminates into a spot size converter, that widens the waveguide mode to maximize the overlap with a standard single mode fiber. The output facet is anti-reflection coated to minimize reflections. A number of additional electrical contacts are present on the chip surface so as to help in wire bonding and mounting the chip. The overall circuit footprint is 6×4 mm^2. Each DML is a complex-coupled distributed feedback laser, which incorporates a twin waveguide formed by active InGaAsP multi-quantum wells and a quaternary bulk layer, and is 200 μm long [2]. The emission wavelength can be selected between 1530 and 1570 nm. An integrated heater allows an output wavelength tuning of about 4 nm.

To test the digital response of the transmitter we used 2^{31}-1 non-return-to-zero (NRZ) modulated pseudo-random-bit-sequence (PRBS) at different data rates and amplified to around 3.3 V peak-to-peak (Vpp). These values allow to maximize the extinction ratio and at the same time optimize the eye diagram shape. The bias and Vpp working points were then slightly adjusted channel by channel and at varying the bitrates. Fig. 1 also reports the BER for all the 8 channels at 28 and 30 Gb/s, i.e., the maximum operating bitrates where all the channels were running error-free (with BER<10^{-9}). Two sample eye diagrams are also reported in the upper part of the figure showing clear eye data opening at both frequencies.

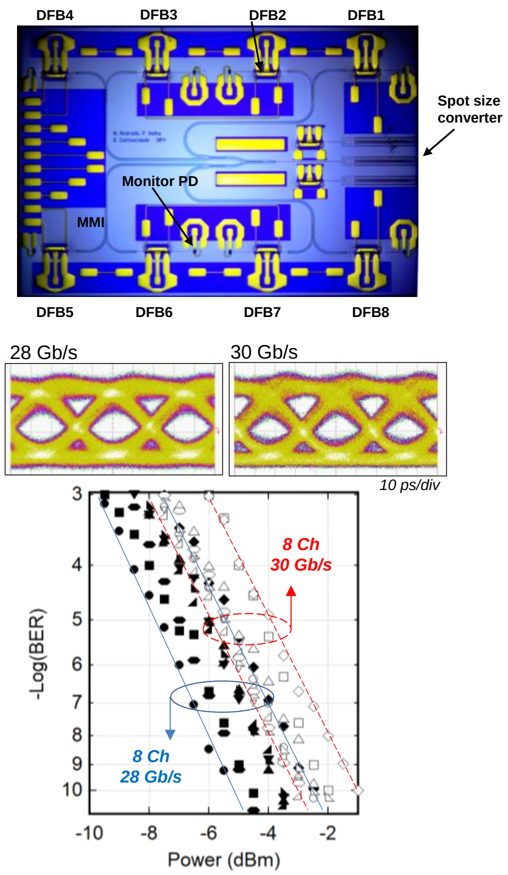

Fig. 1 Picture of the integrated transmitter and BER characterization.

We found a power sensitivity in the range -5.8 to -3 dBm for the 28 Gb/s channels, and in the range -3.6 to -1.5 dBm for the 30 Gb/s ones.

References

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