



Contribution ID: 12

Type: POSTER

## A TOSA/ROSA-Based Optical Transmitter (MTx+)/Transceiver (MTRx+) for High-Energy Physics Experiments

*Monday 10 December 2018 14:40 (10 minutes)*

We present a dual-channel optical transmitter (MTx+) and an optical transceiver (MTRx+) for front-end read-out electronics. MTx+ utilizes two Transmitter Optical Sub-Assemblies (TOSAs) (Truelight Part No. TTF-1F59-427) and MTRx+ uses a TOSA and a Receiver Optical Sub-Assemblies (ROSA) obtained from CERN. Both MTx+ and MTRx+ receive multimode fibers with standard Lucent Connectors (LCs) as the optical interface and can be panel or board mounted to the motherboard with a standard Enhanced Small Form-factor Pluggable (SFP+) connector as the electrical interface. MTx+ and MTRx+ employ a dual-channel Vertical-Cavity Surface-Emitting Laser (VCSEL) driver ASIC called LOClD65. LOClD65 is designed in a commercial 65-nm CMOS technology with a power supply of 1.2 V. Each channel of LOClD65 can be individually turned on or off. LOClD65 features input and output equalizers. LOClD65 is packaged in a 24-pin 4 mm x 4 mm open-cavity Quad-Flat No-leads (QFN) package. MTRx+ has a GBTIA embedded in the ROSA. We design an optical latch to hold two LC connectors and two TOSAs/ROSA together and a metal cage to attach the module to the motherboard. We printed prototype latches with a 3-Dimension printer and are producing latches in injection molding. The prototype cage has been fabricated. The dimension of MTx+/MTRx+ is 44.5 mm (length) x 18.2 mm (width) x 5.8 mm (height). Each transmitter channel of MTRx+/MTRx+ is tested to operate up to 14 Gbps with typical power dissipations (the VCSEL included) of 68.3 mW/channel and 62.1 mW/channel at the VCSEL voltages of 3.3 V and 2.5 V, respectively. MTx+ and MTRx+ survive 4.9 kGy(SiO<sub>2</sub>). MTx+ and MTRx+ with an evaluation board can be obtained for further development.

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**Session Classification:** Poster section

**Track Classification:** Front end electronics and readout