High Bandwidth Active MMI-LD for High Speed Communication Application Using Split Pump Scheme

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Laser diode capable of high speed direct modulation is one of the key solution for short distance applications due to their low power consumption, low cost and small size features. Realization of high modulation bandwidth for direct modulated laser maintaining the above mentioned feature is needed to enhance the short distance, low cost data transmission. One of the promising approach is to push the carrier photon resonance (CPR) frequency by boosting up the photon density in modulation section and enhance it further by inducing resonance between two spectrally neighbored longitudinal modes of the laser cavity, generally known as photon photon-photon resonance (PPR). Strong secondary resonance peak in the modulation response, introduced by PPR results a significantly higher 3dB bandwidth. Moreover further enhancement is achieved by introducing a second resonance peak in modulation response, occasioned by the interaction of spectrally neighbored longitudinal mode inside the multimode section of MMI-LD cavity. Because of these enhanced dynamics owing to enhanced photon density and advantage of having multimode section to explore PPR in active MMI-LD, we have been able to successfully confirm a significantly wide direct modulation bandwidth of 15.2 GHz and shown in fig. 4. Aforementioned enhancement is almost double then the last reported direct modulation bandwidth of 8 GHz. Moreover, the advantage of having large multimode active pumping section behind the splitted modulation section is the key contributor for having higher photon density in modulation section without increasing the device length. Required photon density to achieve more than 40 GHz 3 dB bandwidth for direct modulation is also clarified for the future high speed design [2] in fig. 2 The relation between the mode separation and PPR frequency is presented as mode separation function of the lateral mode locked longitudinal mode in figure 7.

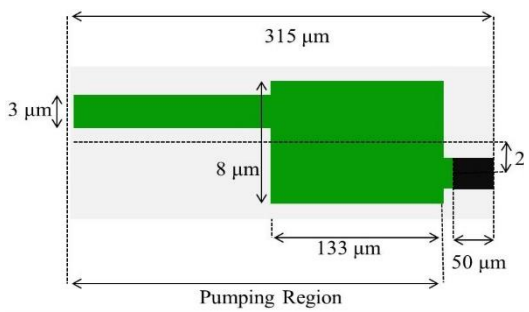

Fig. 1. Schematic view of active MMI-LD.

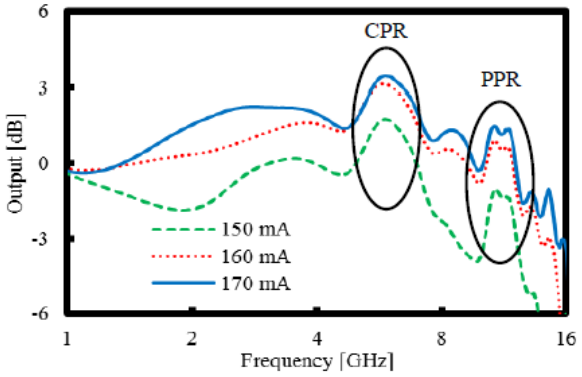

Fig. 2. Bias dependent small signal modulation response of split pump active MMI-LD.

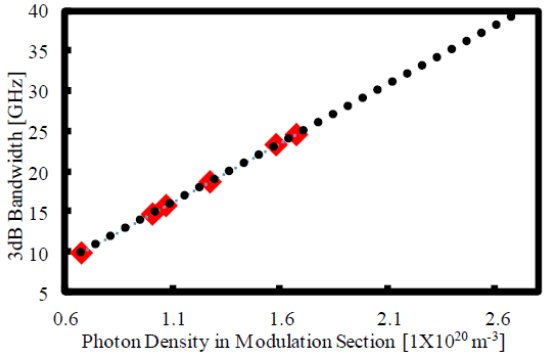

Fig. 3. Eye diagram 2.5 Gbps (Back to Back).

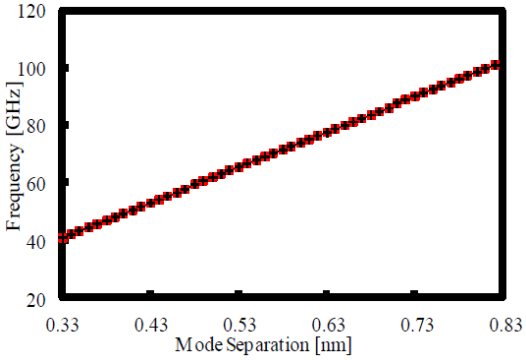

Fig. 4. PPR frequency as a function of mode separation.

References

[1] M. N. Uddin, et.al., ECIO-MOC – 2014. [2] M. N. Uddin, et.al., JJAP - 2014