Efficient Solution overcoming Bimodal Propagation in 850nm-VCSEL-based Radio over G.652-Fibre Systems

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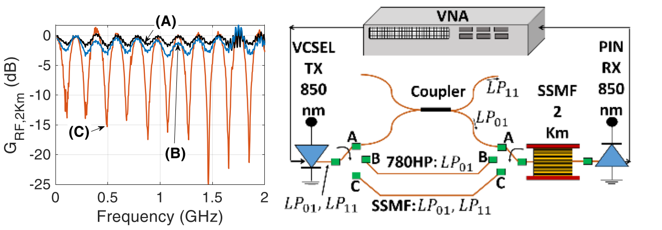
Conveniently exploiting commercial couplers designed for 1550nm, a Radio-over-Fibre link efficiently operating at 850nm over the standard G.652 single mode fibre is presented. Additional features entailed by the proposed solution are highlighted.

Keywords: 850nm Vertical Cavity Surface Emitting Lasers, Radio-over-Fibre

1. Introduction

Optical links for radio and digital communications can be realized by exploiting the low cost and power consumption of Vertical Cavity Surface Emitting Lasers (VCSELs) operating at 850nm. This laser sources are mostly employed for connections of few tens of meters realized with Graded Index Multimode Fibres (GI-MMF), often utilized in datacentres [1]. However, their use is also attractive in conjunction with the widely spread Standard Single Mode Fibre (SSMF) infrastructure, e.g. for the realization of short-medium range 5G front-hauls [2]. In this case, a primary necessity is to minimize modal dispersion and modal noise, caused by the bi-modal propagation featured by SSMF at 850nm. A low-core-diameter fibre patch (e.g. 780HP) provides an effective out filtering of the higher order mode [2]. This paper presents a further solution to the problem, which, besides comparable effectiveness, presents additional potential functionalities, including integrability with already existing 1550nm systems. Its characterization will be performed referring to the Radio-over-Fibre (RoF) transmission of a Long-Term Evolution (LTE) signal of 20MHz bandwidth at 700MHz.

2. Experimental characterization

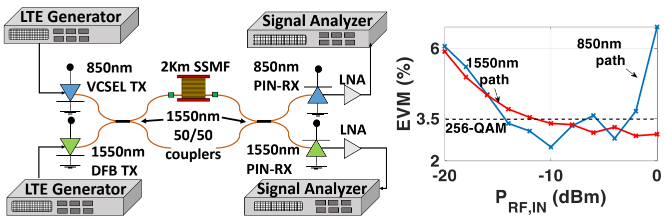


(a) (b)

Fig. 1 Measured normalized RF Gain $G_{RF,2Km}$ of the RoF link (a) in the **A**,**B** and **C** configurations of the Experimental Setup (b).

As illustrated in [3] within a different context, typical 1550nm couplers, when fed at 850nm, perform a separation of the LP_{01} and LP_{11} modes at the two output ports. Fig. 1a, referred to a 2Km RoF link, confirms that the use at 850nm of a 50/50 coupler designed for 1550nm (curve A) mitigates the effect of modal dispersion over SSMF (curve C), in a comparable measure as the mode filtering patchcord (curve B). It must be however observed that an average insertion loss of about 6dB is present in both A and B case of Fig. 1b.

The proposed solution presents a potentially useful additional feature of allowing the integration of 850nm and 1550nm transmission on the same SSMF. Fig.2a reports the system realized to emulate this configuration, where both 850nm and 1550nm RoF systems share the same SSMF infrastructure. The performances of a 2Km link in terms of Error Vector Magnitude (EVM) are shown in Fig. 2b where it can be appreciated that for appropriate values of the input RF powers ($P_{RF,IN}$) the LTE Standard requirements for 256QAM (i.e. EVM<3.5%) are correctly met for both systems.



(a) (b)

Fig. 2 Experimental setup (a) and results (b) of the EVM measured at 750 MHz for the two different channels with respect to $P_{RF,IN}$.

3. Conclusion

The beneficial use of 1550nm optical couplers within 850nm-VCSEL based RoF links exploiting the SSMF infrastructure is demonstrated. The integrability of this solution within already existing 1550nm systems is further described as its additional potential functionality.

References

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