illustrated in Fig. 7(a). The modulating signal was generated by the VNA electrical output in combination with a DC current source generating 1.5 mA. Both signals were combined by means of a T-bias. The VNA output was swept from 300 MHz to 4 GHz and the average power was set to be null. The input optical power at the MDR input was adjusted to 1 dBm. A −3 dB bandwidth of 1.8 GHz was measured, which means that the current applied can operate up to 1.8 Gbps without using any special driving technique [32], as shown in Fig. 7(b).

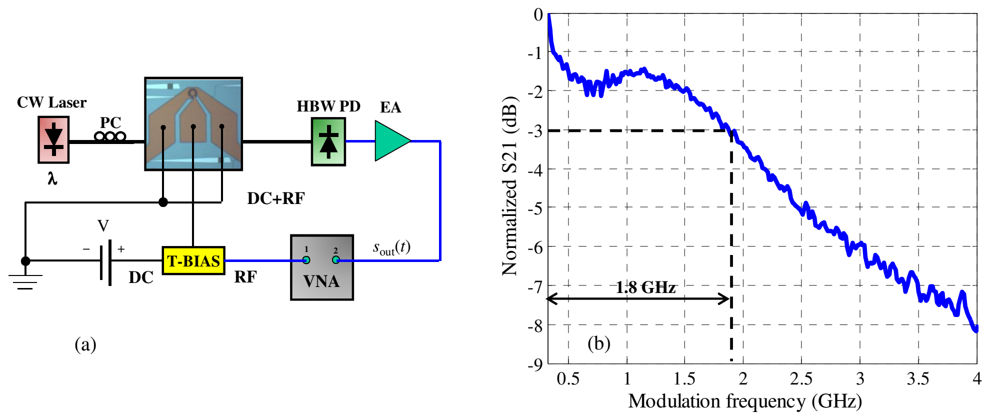

Fig. 7. (a) Experimental setup for measuring the parameter S21 of the III-V/SOI MDR. (b) Small-signal response S21 of the MDR.

5. Summary and conclusions

A novel ultra-small and low-power broadband MWP phase shifter based on a single III-V/SOI MDR in combination with OSSB modulation has been proposed and demonstrated. Quasi-linear and continuously tunable ~360° phase shifts have been experimentally obtained when considering radiofrequencies greater than 18 GHz. Phase shift tunability is accomplished by modifying the effective index through carrier injection in the III-V layer. As a consequence, the tunability speed is limited by the carrier dynamics in the semiconductor, which is in the scale of hundreds of ps. This fact greatly improves the performance compared to other similar Si-based approaches, in which the thermo-optic effect is used as tunable mechanism. A semi-analytical model has been derived, whose results are in good agreement with the measurements. Finally, the phase shifter is exploited for implementing complex-valued coefficients in tunable MWP filtering schemes. A proof-of-concept implementation involving two taps is demonstrated. Distortion-free and high-bandwidth filter responses with tuning range of ~100% over the FSR have been obtained.

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