High Quality tunable Brillouin optoelectronic oscillator

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Abstract

An optical scheme to improve the quality of an RF signal is proposed. The 6 dB linewidth is reduced to sub hertz and the low frequency noise below 1 KHz is reduced about 10 dB. The scheme utilizes a Brillouin-semiconductor optical amplifier (SOA) ring laser fitted with an RF intensity modulator and an APD detector. The experimental results show cavity modes with FSR of 30.57 KHz due to Brillouin fiber length of 6.6 km and 6 dB bandwidth of 780 mHz typical of Brillouin lasers. The gain of the SOA balances out most of the losses in the ring mainly that due to the RF modulator. The modulated optical signal beats at the APD. The optical loop acts as a cavity filter to the RF signal. A jitter in the cavity resonances due to temperature variations is completely eliminated from the output beat signal. There is a 10 dB increase in the phase noise at the FSR frequency and its harmonics. The setup is tested with signals generated by different sources and to frequencies up to 10 GHz, the limit of the APD. Sources with RF linewidth less than the optical FSR produces one output mode with sub-hertz line width. For larger line width signals more than one RF frequency is produced, separated by the FSR, each showing the Brillouin linewidth.

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