Generation of High Quality Microwave Signal Using Different Optoelectronic Techniques

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Abstract

Generation of a high quality microwave signal based on optical electronic components using oscillation or using filtration have been investigated and implemented experimentally. The experimental results of signal generation using optoelectronic oscillator (OEO) are taken for three different long delay optical fiber lengths. The generated signal has a narrow bandwidth (less than 200 Hz) at carrier frequency of 2.31 GHz with phase noise less than ī80 dBc/Hz at 1 kHz offset. Second proposed scheme to improve the quality of an RF signal is presented (optoelectronic Brillouin filter). The 6 dB linewidth of the filter output is reduced to sub hertz and the low frequency noise below 1 kHz is reduced about 10 dB. The scheme consists of a Brillouin-semiconductor optical amplifier (SOA), ring laser fitted with an RF intensity modulator and an APD detector. 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 two different microwave sources and at frequencies up to 10 GHz, the limit of the used 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 proposed models for both systems are given.

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