

MO Frequency Stability Requirements for Coherent Ladar.

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ABSTRACT

Coherent ladar applications and techniques are beginning to be considered for various applications both commercial and military. These include high resolution velocity measurements, remote vibration measurements, optical synthetic aperture implementations, and others. In order to obtain high fidelity information, particularly in vibration sensitivity or Doppler sensitivity for synthetic aperture, the quality or fidelity of the transmitted signal must be very high. Laser transmitters, as other transmitters, tend to drift frequency in time, creating a limitation on the signal fidelity that can be achieved. Large time-bandwidth modulated transmitted waveforms will also require high degree of phase control and ultimately also limit the return signal fidelity that can be achieved.

In this paper we present a description of the phase noise present for a coherent heterodyne and homodyne ladar and derive the requirements needed to achieve various performances. We show the impact to laser stability requirement of single MO vs separate transmitter/LO combination. We present a mitigating approach using a delay line of the transmitted signal as a reference to compensate and correct phase noise. Experiments were carried out with results demonstrating the efficacy of this approach.