Abstracts

Indirect Subharmonic Optical Injection Locking of a Millimeter-Wave IMPATT Oscillator (Dec. 1986 [T-MTT])

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Large aperture phased-array antennas operating at millimeter-wave frequencies are designed for space-based communications and imaging. Array elements are composed of active transmit-receive (T/R) modules that are phase and frequency synchronized to a reference signal at the central processing unit by a fiber-optic (FO) distribution network. The implementation of FO links, synchronizing the millimeter-wave Iocal oscillators (LO's), imposes a great challenge. This paper presents results of indirect optical injection locking of a free-running 38-GHz (Ka-band) IMPATT oscillator over the Iocking range of 2-132 MHz, depending on the injected power level (amplifier gain). In the experiment, the nonlinearity of both the laser diode and the IMPATT oscillator is exploited to achieve 12th subharmonic injection locking. The overall system FM noise degradation of the reference signal is 16 dB at 500-Hz offset. The FM noise degradation is dominated by the theoretical limit of 20 log N, where N is the frequency multiplication factor used in subharmonic injection locking. Methods by which optical injection locking may be extended into 60 and 90 GHz are demonstrated.

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