Abstracts

A K-Band Oscillator Locked to the First Water Resonance

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Locking a microwave oscillator to a rotational spectral line has the unique advantage that the frequency of oscillation is defined by the spectral line of the polar molecule involved and is thus immune to any drift caused by extraneous effects. In instruments and communication systems involving microwave sources, varying degrees of frequency stabilization are required. Frequency stabilization using the absorption line of a polar gas as the frequency reference standard obviates the need for external frequency reference sources. It thus provides a low cost alternative to phase locking the oscillator to a stable source. A Gunn diode oscillator has been locked to the rotational absorption line of water at 22 235.170 MHz. The water in vapor form was obtained from atmospheric air. The air was held in a vacuum chamber which was inserted in a Fabry-Perot open semiconfocal resonator. A sinusoidal electric field, the Stark field, was impressed upon the gas in the cavity which is coupled to the Gunn oscillator, thus modulating the water vapor absorption of microwave energy. The second harmonic of the Stark field was used to lock the Gunn oscillator. Working with the water spectral line (16/sub 16/-5/sub 23/) at 22 235 GHz, frequency stability of the order of ±50 KHz was achieved.

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