Abstracts

Amplification at 258 GHz Using a Saturated Gas Resonance

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A 258-GHz reflection amplifier was built which consisted of a cylindrical cavity (3 mm diam., 7 mm Iength) filled with hydrogen cyanide gas at pressures up to 0.1 torr. When the molecular resonance of the J = 2-->3 rotational transition of H/sup 12/C/sup 15/N and the cavity resonance coincided, about 100 µW of the monochromatic pump-power were sufficient to saturate the two-level quantum system. The pumped gas furnished a nonlinear (power-sensitive) impedance which was used to amplify weak AM-sidebands. The signal was reflected with a maximum gain of 20 dB and a bandwidth of 0.5 MHz. The variation of the amplification with gas pressure, pump power, frequency, Q-values, and cavity tuning was measured and analyzed. The low unloaded Q-value of the TE(0, 1, 11) resonator, the limited pump power available at 258 GHz, and matching difficulties prevented attainment of the theoretical gain-bandwidth product of 37 MHz at room temperatures. A measurement performed at 200°K indicated a threefold increase of this gain-bandwidth product.

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