Abstracts

V-band high-power low phase-noise monolithic oscillators and investigation of low phase-noise performance high drain bias

T. Kashiwa, T. Ishida, T. Katoh, H. Kurusu, H. Hoshi and Y. Mitsui. "V-band high-power low phase-noise monolithic oscillators and investigation of low phase-noise performance high drain bias." 1998 Transactions on Microwave Theory and Techniques 46.10 (Oct. 1998, Part II [T-MTT] (Special Issue on New Developments in the Design of Microwave and Millimeter-Wave Oscillators)): 1559-1565.

This paper reports on the excellent performance of V-band monolithic high electron-mobility transistor (HEMT) oscillators, and discusses oscillation characteristics on drain bias. With regard to output characteristics, double-hetero (DH) HEMT (especially with a high-density Si-planar doped layer) are superior to single-hetero (SH) HEMT's. A monolithic microwave integrated circuit (MMIC) oscillator has been developed with a planar doped DH HEMT and has achieved the peak output power of 11.1 dBm at a 55.9-GHz oscillation frequency. Phase noise of -85 dBc/Hz at 100-kHz offset and -103 dBc/Hz at 1-MHz offset have been achieved at a drain voltage of 5.5 V and a gate voltage of 0 V. These characteristics have been achieved without any buffer amplifiers of dielectric resonators. This study has revealed that the phase noise decreases as drain voltage increases. This phenomenon is caused by lower pushing figure and lower noise level at a low-frequency range obtained under a high drain voltage. It is because the depletion layer in the channel is extended to the drain electrode with increase of drain voltage, resulting in the small fluctuation of the gate-to-source capacitance. We also investigate low-frequency noise spectra of AlGaAs-InGaAs-GaAs DH HEMT's with different bias conditions. The low-frequency noise decreases for more than 3 V of the drain voltage. A unique mechanism is proposed to explain this phase noise reduction at high drain voltage.

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