Abstracts

Hybrid High Temperature Superconductor/GaAs 10 GHz Microwave Oscillator: Temperature and Bias Effects

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Hybrid YBa/sub 2/Cu/sub 3/O/sub 7-x/ superconductor/GaAs microwave oscillators have been designed, fabricated and characterized. The planar oscillators were built on a single 10 mm x 10 mm LaAIO/sub 3/ substrate. The active elements in the hybrid oscillators were GaAs MESFETs. A ring resonator was used to select and stabilize the frequency. A superconducting ring, resonator had a loaded Q at 77 K which was 8 times larger than the loaded Q of a ring resonator fabricated out of copper. S-parameters of the GaAs FET were measured at cryogenic temperatures and used to design the oscillator, which had a reflection mode configuration. The transmission lines, rf chokes and bias lines were all fabricated from YBa/sub 2/Cu/sub 3/O/sub 7-x superconducting thin films. The performance of the oscillators was measured as a function of temperature. The rate of change of the frequency as a function of temperature was smaller for an oscillator patterned from a pulsed laser deposited film than for an oscillator patterned from a sputtered film. As a function of bias at 77 K, the best circuit had an output power of 11.5 dBm and a maximum efficiency of 11.7 %. The power of the second harmonic was 25 dB to 35 dB below that of the fundamental, for every circuit. At 77K, the best phase noise of the superconducting oscillators was -68 dBc/Hz at an offset frequency of 10 kHz and less than -93 dBc/Hz at an offset frequency of 100 kHz. At an offset frequency of 10 kHz, the superconducting oscillator had 12 dB less phase noise than the copper oscillator at 77 K. The superconducting oscillators at 77 K had 26 dB less phase noise than the copper oscillator operating at 300 K.

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