GaAs varactor multipliers based on transferred substrate technology

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Abstract

There is a demand for millimetre wave and sub-millimetre wave power sources to be used as local oscillators in heterodyne radiometers for remote sensing, atmospheric physics and radio astronomy. An ideal source for most of these applications should exhibit high output power, efficiency, large bandwidth and high thermal stability.

We report here on the design and evaluation of high efficiency frequency doublers which provide useful power at millimetre and sub-millimetre wavelengths. The active device is a single GaAs chip consisting of a linear array of 4/6 planar schottky varactors which have been subsequently transferred on to Aluminium Nitride in order to improve the power handling capability and hence the efficiency. The so-called transferred substrate multipliers improves the efficiency of the component by around 15% compared to similar designs on the original GaAs substrates. The varactor chip and quartz microstrip circuit are embedded in a split waveguide block. The transferred substrate multipliers exhibit an efficiency of around 30 % at 160 GHz for an input power of 60 mW, and a 20% efficiency at 332 GHz for an input power of 40 mW.