MILLIMETER- AND SUBMILLIMTER-WAVE PLANAR VARACTOR SIDEBAND GENERATORS

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Millimeter- and submillimeter-wave sources can be used for a variety of applications ranging from molecular spectroscopy to wireless communications. However, there is a lack of frequency tunable sources at these wavelengths. A sideband generator (SBG) can be used to generate frequency tunable sidebands from a fixed source, and is therefore a commonly used device. In this paper, the design and optimization of a 600GHz varactor sideband generator will be presented. A novel circuit configuration will be used that allows for simple and robust component assembly while allowing good conversion efficiency. The integration of the diode with the embedding circuit enhances mechanical robustness and makes the circuits easy to handle compared with a whisker-contact diode structure. A nonlinear analysis was used to determine the optimum varactor diode parameters for use at 600GHz, yielding an anode diameter of $1.8mm$ and an epitaxial layer doping of $1\times10^{17}\,cm^{-3}$. A 200 GHz SBG was also designed and implemented as a proof-of-principle. Results are achieved and presented. The upper sideband conversion loss was less than 10dB over a wide range measured by a subharmonic mixer and Agilent Spectrum Analyzer 8565E. A photograph of an open SBG block is shown in the figure below.