Abstracts

Millimeter-Wave Diode-Grid Frequency Doubler

C.F. Jou, W.W. Lam, H.Z. Chen, K.S. Stolt, N.C. Luhmann, Jr. and D.B. Rutledge. "Millimeter-Wave Diode-Grid Frequency Doubler." 1988 Transactions on Microwave Theory and Techniques 36.11 (Nov. 1988 [T-MTT]): 1507-1514.

Monolithic diode grids have been fabricated on 2-cm square gallium-arsenide wafers in a proof-of-principle test of a quasi-optical varactor millimeter wave frequency multiplier array concept. An equivalent circuit model based on a transmission-line analysis of plane wave illumination was applied to predict the array performance. The doubler experiments were performed under far-field illumination conditions. This approach facilitates detailed comparison between theory and experiment. A second harmonic conversion efficiency of 9.5 percent and output powers of 0.5 W were achieved at 66 GHz when the diode grid was pumped with a pulsed source at 33 GHz. This grid had 760 Schottky barrier varactor diodes. The average series resistance was 27 omagas, the minimum capacitance was 18 fF at a reverse breakdown voltage of -3 V. The measurements indicate that the diode grid is a feasible device for generating watt-level powers at millimeter frequencies, and that substantial improvement is possible by improving the diode breakdown voltage. The excellent agreement between experiment and the predictions of the theoretical model provide confidence in predictions of achievable CW output power levels of 2.5 W at a frequency of 188 GHz with an edge-cooled grid containing 1000 diodes.

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