

Abstracts

Millimeter-Wave Diode-Grid Phase Shifters

W.W. Lam, C.F. Jou, H.Z. Chen, K.S. Stolt, N.C. Luhmann, Jr. and D.B. Rutledge. "Millimeter-Wave Diode-Grid Phase Shifters." 1988 Transactions on Microwave Theory and Techniques 36.5 (May 1988 [T-MTT] (Special Issue Commemorating the Centennial of Heinrich Hertz)): 902-907.

Monolithic diode grids have been fabricated on 2 cm square gallium-arsenide wafers with 1600 Schottky-barrier varactor diodes. Shorted diodes are detected with a liquid-crystal technique, and the bad diodes are removed with an ultrasonic probe. A small-aperture reflectometer that uses wavefront division interference was developed to measure the reflection coefficient of the grids. A phase shift of 70° with a 7 dB loss was obtained at 93 GHz when the bias on the diode grid was changed from -3 V to 1 V. A simple transmission-line grid model, together with the measured low-frequency parameters for the diodes, was shown to predict the measured performance over the entire capacitive bias range of the diodes, as well as over the complete reactive tuning range provided by a reflector behind the grid, and over a wide range of frequencies from 33 GHz to 141 GHz. This shows that the transmission-line model and the measured low-frequency diode parameters can be used to design an electronic beam-steering array and to predict its performance. An electronic beam-steering array made of a pair of grids using state-of-the-art diodes with 5 Ω series resistances would have a loss of 1.4 dB at 90 GHz.

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