Abstracts

Optimum bias conditions for linear broad-band InGaP/GaAs HBT power amplifiers (Dec. 2002 [T-MTT])

M. Iwamoto, C.P. Hutchinson, J.B. Scott, T.S. Low, M. Vaidyanathan, P.M. Asbeck and D.C. D'Avanzo. "Optimum bias conditions for linear broad-band InGaP/GaAs HBT power amplifiers (Dec. 2002 [T-MTT])." 2002 Transactions on Microwave Theory and Techniques 50.12 (Dec. 2002 [T-MTT] (Special Issue on 2002 International Microwave Symposium)): 2954-2962.

A design strategy for a linear broad-band InGaP/GaAs heterojunction bipolar transistor (HBT) power amplifier is presented. This design is based on the bias dependence of the nonlinear base-collector charge, as expressed in the C/sub BC/ versus V/sub CE/ and /spl tau//sub C/ versus I/sub C/ characteristics of the device. Using this technique, it is shown that the second- and third-order distortions have separate optimum bias conditions and, furthermore, there is an inherent tradeoff in optimizing the second- and third-order distortions. The strong bias dependence of the nonlinear base-collector charge and the tradeoff between the different orders of distortion are verified on two 24-dBm 0.5-11-GHz distributed power amplifiers optimized for second and third-order distortions, respectively. The experimental results show that the harmonic and intermodulation levels are sensitive to the different order derivatives of the f/sub t/ versus I/sub C/ curve. Specifically, second-order distortion is related to the slope of the f/sub t/ versus I/sub C/ curve and third-order distortion is related to both the slope and curvature of the f/sub t/ versus I/sub C/ curve. This design technique suggests the importance of HBT device design to minimize distortion in high-frequency broad-band amplifier designs. Furthermore, to minimize high-frequency distortion in HBT amplifiers across a wide range of bias, it is desirable to linearize the base-collector charge, where flat C/sub BC/ versus V/sub CE/ and f/sub t/ versus I/sub C/ characteristics are ideally desired.

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