Abstracts

Coplanar-waveguide-based terahertz hot-electron-bolometer mixers mproved embedding circuit description

P. Focardi, A. Neto and W.R. McGrath. "Coplanar-waveguide-based terahertz hot-electron-bolometer mixers mproved embedding circuit description." 2002 Transactions on Microwave Theory and Techniques 50.10 (Oct. 2002 [T-MTT]): 2374-2383.

Series-fed coplanar-waveguide embedding circuits have been recently developed for terahertz mixers using, in particular, superconducting devices as sensors. Although these mixers show promising performance, they usually also show a considerable downward shift in the resonating frequency when compared with calculations using simplified models. This effect is basically caused by parasitics due to the extremely small details (in terms of wavelength) of the device and to the connection of the remaining circuitry (i.e., RF filter). In this paper, we present an improved equivalent-network model of such devices that agrees with measured results. We first propose a method to calculate the characteristic impedance and propagation constant of the coplanar waveguide, etched between two semi-infinite media, which connect the receiving slot antennas to the superconducting device. In the formulation, we take into account, for the first time, the radiation power leakage. We then describe the procedure to calculate the reactances due to the detailed geometry of the mixer device and circuit and we correct the input impedance, calculated with a commonly used simplified network. Finally, by comparing our results with a complete set of measured data, for seven mixers in the range between 500 GHz-3 THz, we analyze the features of our model and propose further improvements. Useful guidelines for designing terahertz mixer circuits are also given.

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