Abstracts

Conversion Loss Limitations on Schottky-Barrier Mixers (Short Papers)

M. McColl. "Conversion Loss Limitations on Schottky-Barrier Mixers (Short Papers)." 1977 Transactions on Microwave Theory and Techniques 25.1 (Jan. 1977 [T-MTT]): 54-59.

A new set of criteria involving diode area, material parameters, and temperature is introduced for the Schottky-barrier mixer diode that must be considered if its usage is to be extended to the submillimeter wavelength region or cryogenically cooled to reduce the noise contribution of the mixer. It has been well established that, in order to reduce the parasitic loss as the frequency is increased, it is necessary to reduce the area of the diode. What has not been analyzed heretofore is the effect that a reduction in diode area can have on the intrinsic conversion loss L/sub 0/ of the diode resulting from its nonlinear resistance. This analysis focuses on the competing requirements of impedance matching the diode to its imbedding circuit and the finite dynamic range of the nonlinear resistance. As a result, L/sub 0/ can increase rapidly as the area is reduced. Results are first expressed in terms of dimensionless parameters, and then some respresentative examples are investigated in detail. The following conclusions are drawn: a large Richardson constant extends the usefulness of the diode to smaller diameters, and hence, shorter wavelengths; cooling a thermionic emitting diode can have a very detrimental effect on L/sub 0/; impedance mismatching is found, in general, to be a necessity for minimum conversion loss; and large barrier heights are desirable for efficient tunnel emitter converters.

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