Abstracts

Some Fundamental and Practical Limits on Broadband Matching to Capacitive Devices, and the Implications for SIS Mixer Design

A.R. Kerr. "Some Fundamental and Practical Limits on Broadband Matching to Capacitive Devices, and the Implications for SIS Mixer Design." 1995 Transactions on Microwave Theory and Techniques 43.1 (Jan. 1995 [T-MTT]): 2-13.

In a given frequency band, the achievable match between a capacitive microwave or millimeter-wave device and a resistive source is limited by the capacitance of the device and its series inductance. The fundamental limit on the match bandwidth is examined for three circuits: 1) parallel RC, 2) parallel RC with series L, and 3) parallel RCL with series L. The broadband matching theories of Bode (1945) and Fano (1950) are used, the latter modified to avoid the standard low-pass to band-pass mapping in case 2) because the terminals of the capacitance are not generally accessible for connection of the requisite parallel inductor. The results are fundamental to the design of broadband mixers, multipliers, switches, and detectors using Schottky diodes or SIS junctions. Practical limitations imposed by the minimum realizable dimensions of millimeter-wave integrated circuits fabricated by standard photolithography are discussed in the context of SIS mixers with series arrays of junctions, and an example of a coplanar SIS mixer design is given. For a series array of IV devices with a given total resistance, it is shown that there is an upper limit to N, below which the theoretical match bandwidth depends only on the RC product of the devices and not on the series inductance of the array.

❑ Return to main document.