Abstracts

Miniaturized artificial-transmission-line monolithic millimeter-wave frequency doubler

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Millimeter-wave signals are typically generated by frequency multiplication in modern single-chip or multichip module (MCM) systems. Consequently, the multiplication efficiency, spurious rejection, and size of the frequency multiplier ultimately limit the integration level and cost of these systems. This paper points to the size reduction of millimeter-wave frequency doublers by evaluating artificial transmission lines (ATL's) as a means to minimize the size of the low-impedance shunt stubs. As a result, we developed a 40-GHz frequency doubler, which used only 0.6-mm/sup 2/ area on a monolithic microwave integrated circuit. Despite the area minimization, the doubler exhibited state-of-the-art conversion loss of 1 dB over 10% bandwidth and rejected the fundamental frequency signal by more than 20 dB over 25% bandwidth. Reported herein is the novel simulation of the frequency doubler with active harmonic loads. Included in this paper are theoretical evaluation and simulation of ATL's with models for lumped components and verification of the results by electromagnetic simulation. Due to the high efficiency, low area requirement, and over 20-dB rejection of the fundamental signal, this miniaturized ATL frequency doubler can be used as a building block in the generation of local-oscillator signals in single-chip and MCM millimeter-wave systems.

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