Abstracts

Analysis and design of a planar antenna for a millimetre-wave emitter using TLM

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In this paper we investigate and design a planar patch antenna using the Transmission Line Matrix method (TLM). The planar antenna is part of a monolithic integrated millimeter-wave emitter, working in the 60 GHz range on a high resistivity silicon substrate. The active part will be realized by an negative impedance amplifier, here an IMPATT diode, the patch antenna is used as resonator as well as radiating element. For designing an appropriate resonator the design criteria are the desired frequency, an impedance match with the impedance of the IMPATT diode and the radiation characteristic and efficiency. For technological reasons a 525 /spl mu/m substrate had to be chosen, which naturally will deteriorate not only the radiation features of the antenna, but also the behaviour of the impedance. The requirements concerning the impedance are a very low real part of the input impedance of the antenna (/spl les/3/spl Omega/), smaller than the negative impedance of the IMPATT diode in order to enable exponentially increasing oscillations. The imaginary part of the antenna has to show a steep gradient above the resonant frequency up to values /spl ges/30, 40/spl Omega/. In order to find a design which will fulfil those critical requirements, a full wave analysis is demanded. The TLM method has proven to be a very powerful end flexible numerical method for the analysis of various planar and three-dimensional topologies, especially useful for the investigation of broadband structures, but yet has not been utilized extensively for the analysis of radiating structures. It will be shown, how TLM can be used for antenna modeling, the necessary steps for the design of the patch antenna will be demonstrated and results will be validated by comparison with spectral domain methods.

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