

A Highly-Efficient Planar Dielectric Radiating Structure

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For many years, planar metallic microwave structures such as microstrip patch antennas have been extensively used in telecommunications and sensor devices. The large popularity of the planar metallic microwave components is due to this fact that it is inexpensive to manufacture using modern printed-circuit technology. However, the efficiency of these elements is not high, especially at millimetre-wave frequencies. On the other hand, conventional dielectric microwave elements such as dielectric resonator antennas are three dimensional structures which are mostly fabricated from hard ceramics. The dielectric components offer several appealing features and performance advantages over their metallic counterparts (e.g., higher efficiency and bandwidth, miniaturized structure). However, three-dimensional ceramic-based structures involve a more complex and costly fabrication process which may restrict the wide use of dielectric antennas in wireless applications.

A novel highly-efficient planar dielectric antenna is presented in this work. As shown in Figure 1, the antenna consists of a thin layer of high-permittivity dielectric attached to a low-loss dielectric substrate. The thickness of the high-permittivity layer is much smaller than a wavelength in free space (i.e., in the micrometer range) and it can be precisely fabricated using screen printed ceramic thick-film technologies. The antenna is fed by proximity-coupled microstrip line. The high-permittivity layer is mainly utilized to change the boundary conditions and achieve a new radiating mode. Theoretical investigations are performed to derive closed-form expressions for the resonant frequencies of the antenna. Results on the antenna performance, including impedance bandwidth, radiation patterns, and efficiency, will be demonstrated, discussed, and compared to microstrip patch antennas and conventional dielectric resonator antennas in the conference.

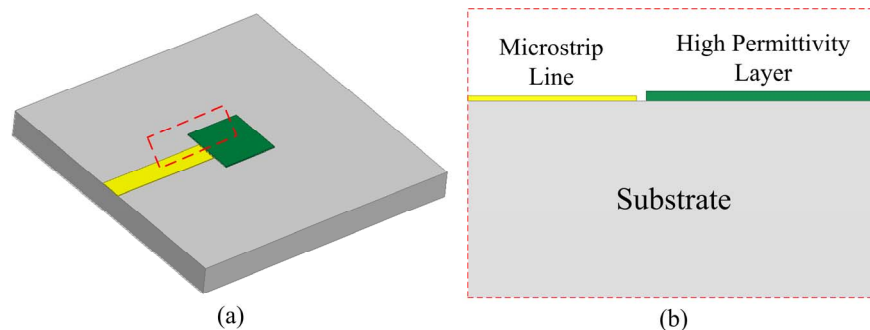


Figure 1: antenna configuration. (a) 3-D view; (b) side view.