Magnetic and electric resonances in an dielectric rectangular circuit induced by a plane microwave

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Theoretical and experimental investigations of the main electromagnetic resonances excited by linearly polarized microwaves in a rectangular, thin, all-dielectric subwavelength circuit were performed. Displacement and polarization currents induced in this anisotropic circuit are shown to produce resonant magnetic and electric dipoles. The number of resonant modes in a rectangular circuit frame is much greater than in a thin flat ring. The LC magnetic resonances of an all-dielectric rectangular frame are interchanged by the electric ones, forming a complicated spectrum of electromagnetic resonances. These resonances are habitual to the quasi stationary fields in the near zone of the scattering frame. The spectra of these dipoles measured in the near zone of the rectangular circuit frames indicate a variety of resonances subject to the orientation of the frame with respect to the polarization and directivity of the incident radiation. The frames arrangement in three orthogonal planes, normal respectively to the electric component, the magnetic component and the wave vector of the driving wave, illustrate the multitude of narrow polarization-dependent resonances, ensuring the inversion of magnetic inductance and electric displacement in the rectangular frame. These rectangular circuit frames can be used as a multiresonant dielectric metaelements. This research was supported by The Ministry of Science and Higher Education of the Russian Federation (Agreement with Joint Institute for High Temperatures RAS No. 075-15-2020-785).