Resonance scattering of plane electromagnetic waves of GHz range by ring dielectric linear structures

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Resonance backscattering at the main magnetic mode of linear structures consisting of subwave dielectric elements in the form of planar thin rings excited by the displacement currents of an incident plane electromagnetic wave of GHz range have been investigated. It is shown that the magnetic field at the main resonance frequency for a single ring is concentrated inside the ring and in the near-field zone, whereas for structures consisting of two or more rings the magnetic field is also registered in the far-field zone. The amplitude of the reflected signal at the fundamental magnetic mode increases with an increase in the number of rings. Due to the magnetic coupling of the rings, additional resonance peaks of the scattered radiation occur both in the near- and far-field ring zones. The number of additional peaks increases with an increase in the number of the rings. The main magnetic resonances measured in the spectrum of electromagnetic fields for one and two planar rings coincide with the calculated resonance frequencies. The observed effect of scattering of a plane electromagnetic wave from an ordered system of dielectric rings in the far-field zone at the fundamental resonance frequency of a magnetic dipole makes it possible to use this system to design dielectric mirrors with a negative magnetic response at the fundamental magnetic resonance and at the split frequencies.