Public Abstract
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In this research work, a metamaterial lens constructed from cubic high dielectric resonators (CHDR) embedded in a low dielectric slab was placed in front of a circular patch and a fractal patch antenna respectively, in order to characterize the effects on the antenna parameters, specifically the gain. The CHDR based metamaterial lens was designed to have a negative refractive index at 10.4 GHz, which was determined through the extraction of the constitutive parameters from the s-parameters. The optimum distance of lens placement was then determined in order to maximize the antenna gain for both cases.

A methodology for optimizing the metamaterial lens design is also presented, which is based on the Drude dispersion model applied to a homogeneous metamaterial. The model determines the optimum placement and geometry of the metamaterial lens in order to maximize antenna gain for a source radiating spherical electromagnetic waves. Finally, in order to demonstrate the advantages of a CHDR based metamaterial lens over a metallic split-ring resonator (SRR) based lens, for high power applications, the structures were subjected to electromagnetic radiation and their thermal properties were studied.