

Investigation of Edge Treatment Shape and Added Aperture on Total Radiated Power from Parallel Plate Structure

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Edge treatments have been used in a wide variety of applications such as serrating or rolling the edges of parabolic dishes to reduce diffraction or serrating the edges of the ground plane for a microstrip patch antenna to reduce ground plane edge effects. In previous work by the authors, it was shown that serrations can also effectively be used to reduce cavity effects and reactive loading in structures with parallel plates. The impact of the size and dimensions on the serrated structure performance was analyzed and design guidelines were given. As expected, it was found that the amount of radiation (directly impacting the performance of the structure in reducing cavity effects) was related to the size of the serration – forcing the serrations to be physically larger than may be desired for many applications. Additionally, only one type of edge treatment, triangular serrations, was investigated.

This work will present an investigation of different geometric shapes as edge treatments and their resulting radiation characteristics versus electrical size. Additionally, an investigation of leakage-enhancing structures on the edge treatment, to increase the amount of power radiated for a given electrical size, will be shown. The leakage-enhancing structures are apertures inserted in the edge treatment, including shapes such as circles, quadrilaterals, and triangles whose positions and electrical sizes within the antenna's edge treatments, have been varied. A parametric investigation using a full-wave solver will be presented on the radiation characteristics (directivity and beam shape) and input impedance for both edge treatments and leakage-enhancing apertures when electrical size (length and width), shape, and positions are varied. Finally, observed trends in the investigation of the edge treatment shapes and leakage-enhancing aperture configuration will be discussed along with general guidelines for improved radiated power.