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Resonant Characteristics of Aperture Type FSS and Its Application in Directivity Improvement of Microstrip Antenna

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ABSTRACT

In this paper, we propose an aperture type frequency selective surface (FSS) by employing an array of 12×12 unit cell elements and its resonant characteristics is analyzed. A resonant cavity antenna is then formed by the ground plane substrate and the FSS superstrate. The high reflective behavior of the proposed FSS at an offset of the resonance is then utilized for improving the performance of this cavity antenna. The impedance bandwidth and directivity are improved up to 0.66 GHz and 8.95 dBi, simultaneously at an optimum gap of 17.6 mm between the antenna substrate and FSS superstrate. For validation purpose, prototypes of both patch antenna and FSS, are fabricated and characterized. A fairly good agreement is achieved between the measured and simulated results.

Keywords: Microstrip antenna, FSS, Superstrate, Directivity, Aperture.

1. INTRODUCTION

The two artificial surfaces; frequency selective surfaces (FSS) and metasurfaces, are being widely used in a variety of applications [1-18], [19-25], respectively. These surfaces usually consist of two-dimensional infinite extent periodic array of conductors or aperture elements on one side of the dielectric substrate. Conceptually, the two surfaces are different [26]. The FSS are realized by characterizing either transmission or reflection in the neighborhood of the resonance element [27]. The metasurfaces, on the other hand, can be characterized by the electric and magnetic polarizabilities of its constituent scatterers or surface susceptibilities [28].