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Bandwidth Enhancement of Electromagnetic Coupled Nonuniform H-Shaped Microstrip Patch Antenna for Higher Band of Wi-MAX Applications

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Abstract. The bandwidth enhancement of a stacked non-uniform electromagnetically coupled H-shaped Microstrip Antenna (SNHMA) with tapered edges is analyzed and simulated using the IE3D simulator. The proposed antenna prototype is drafted on FR-4 material and stacked further with an air discontinuity of 0.3 mm to the next layer. The various parameters optimized to achieve the best performance from the modified SNHMA primarily include a) length b) width of the patch c) air gap thickness. The redesigned antenna serves at two distinct frequencies with an elevated bandwidth of 30.85 % at the central frequency 5.762 GHz, approximately four times the bandwidth of the standard patch having the same dimensions. The simulated radiation patterns (E-plane and H-plane) are exhibited within the range of frequencies where the broadband response is observed. The specifications of the proposed structure make it promising for the higher band of Wi-MAX applications.

INTRODUCTION

Narrow-band microwave links demand semi-hemispherical coverage provided by patch antennas also known as printed antennas. They are extensively studied by the scientific community owing to its small size, light weight, low profile, ease of integration with active and passive devices and ability of mounting on planar, non-planar as well as rigid exteriors to form MIC's. However, they suffer from the disadvantage of low operating bandwidth and small gain value. Hence, it becomes very mandatory to evolve broadbanding techniques to optimize the antenna parameters along with increased gain and bandwidth.

The patch antennas (half-wavelength style resonators) serve best primarily in the TM_{01} and TM_{10} excitation modes which limits the commercial applications of these antennas. Several broadband techniques have been used to enhance the bandwidth by interpolating surface modification into patch configuration. The most common technique used to enhance the bandwidth and reduce the size of the patch is multilayer techniques in which multiple layers of substrates are either stacked vertically or arranged with an air gap between them.

In the present work, the lower layer is the ground plane which is approximately four times the patch dimensions. The second layer is the non-uniform H-shaped patch on a FR-4 substrate with tapered corners and the final layer is the topmost radiating 90 degree rotated non-uniform patch on a FR-4 substrate with tapered corners. An air-gap (0.3 mm) is introduced between the two substrate layers which are electromagnetically coupled to each other.