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Bandwidth Enhancement of Cavity-Backed Slot Antenna Using Perturbation in SIW Cavity

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ABSTRACT— In this paper, a novel technique for bandwidth enhancement of Substrate Integrated Waveguide (SIW) cavity-backed slot antenna is presented. Bandwidth improvement is achieved by separating the resonant frequency of two degenerated modes TE_{120} and TE_{210}. This can be done by perturbation technique, creating a corner cut, in the SIW square cavity. With proper dimension of the corner cut, the bandwidth of the slot antenna is increased. The proposed antenna has a few advantages including low profile, light weight, easy fabrication with low cost and convenient integration with planar circuit.

KEYWORDS: Cavity-backed, Substrate integrated waveguide (SIW), degenerated modes and slot antenna

I. INTRODUCTION

With the rapid advances of wireless communication systems, low profile antennas with good radiation characteristics are in great demand, especially in some applications such as satellite, aircraft, and radar communication. Slot antennas are very suitable due to their favorable characteristics such as low profile and easy integration with planar circuits. However, one evident drawback of slot antenna is its two side's radiation. Unidirectional radiation can be produced by placing a quarter-wavelength cavity on the back side of the antenna. The conventional rectangle metallic cavity-backed slot antenna is large and it is not easy to integrate with planar microwave circuit. SIW technology was firstly proposed by Wu [1] are integrated waveguide-like structures fabricated using vias, two rows of conducting cylinders, embedded in a dielectric substrate. These vias connect two parallel metal plates of Printed Circuit Board (PCB). SIW waveguides have the same propagation characteristic as the classical rectangle metallic waveguides [2]. They also allow the integration of planar and non-planar structures on a same substrate.

Low-profile cavity-backed slot antennas based on substrate integrated waveguide (SIW) technology have been proposed in [3] and [4]. These antennas have good radiation performance and provide the advantages of low cost fabrication, low profile and easy integration with planar circuit. There are some inherent drawbacks in using a thin substrate in a cavity-backed slot antenna. The height of the substrate affects Q, quality factor, of the slot and cavity. A low height substrate increases Q of the antenna, which causes to obtain narrow bandwidth [3]. Overcoming this problem is an important issue in designing a low-profile cavity-backed slot antenna. Various methods have been proposed to overcome the narrow bandwidth of a cavity-backed slot antenna.