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Slotted Microstrip Patch Antenna at 60GHz for Point to Point Communication

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***Abstract*- A compact slotted planar square ring-shaped micro strip antenna simultaneously suitable for point to point communication at 60 GHz is presented. The antenna is simulated by the software CST. CST, computer simulated technology simulator is employed to analyze the proposed antenna and simulated results on return loss, the E and H plane radiation pattern and polar plot gain is presented. The simulation and measurement result met the IEEE 802.1lad standard operate in 60 GHz band for point to point communication. The measured results shows a return loss of -26.69 db and the voltage standing wave ratio VSWR < 2 at 60 GHz indicating that the antenna is a good candidate for very high speed WLAN applications.**

Keywords-Slotted patch antenna, probe feed Micro strip antenna, point to point communication, WLAN

I. INTRODUCTION

Microstrip antennas are currently one of the fastest growing segments in the telecommunications industry and promise to become the preferred medium of telecommunications in the future. Microstrip antenna technology began its rapid development in the late 1970s. In the last decades printed antennas have been largely studied due to their advantages over other radiating systems, such as light weight, reduced size, low cost, conformability and possibility of integration with active devices.

In high performance point to point application where size, weight, cost, performance, ease of installation are constraints, low profile antenna is very much required. To meet these requirements, microstrip antenna is preferred. Although microstrip antenna has several advantages like low profile, light weight and simple to manufacture, it also has several disadvantages such as low gain, narrow bandwidth with low efficiency. These disadvantages can however be overcome with intelligent designs incorporated in whole antenna structures. One of the ways to overcome these problems is by constructing patch antennas in slotted square ring configuration. WLAN point to point application is based on IEEE 802.11a standard operates in the upper Unlicensed National Information Infrastructure (UNII) band (5.725 to 5.875 GHz). There is also an ongoing effort to migrate indoor WLAN network toward less congested higher frequency unlicensed spectrum band such as 60-GHz being considered for the gigabit per second 802.11ad standard.60-GHz Point to point communication has the potential for dramatically increasing radio link speed from current megabit per second to gigabit per second, while also improving radio system capacity and spectrum efficiency significantly [1]. Directional antenna are essential in 60 GHz band to mitigate the effect of multipath fading. This is acceptable for point-to point communication link with minimum multipath interference. Designed antenna could provide the infrastructure for future applications which is envisioned to need a faster data rate.

II. ANALYSIS AND DESIGN

The geometry of the proposed slotted MPA designed at 60GHz is shown in Fig. 1. A rectangular patch is employed as the antennas main radiating element. The patch is fed by a 50Ω coaxial cable. The antenna has overall dimensions of only 6 mm x 6mm with the electrical length of 0.297λ0 x 0.297λ0 at 60 GHz. The antenna is fabricated on a RogerRT5880 substrate of relative permittivity of 2.2, loss tangent 0f 0.0009, and thickness of 1.6 mm. Electromagnetic simulation software, CST Microwave Studio is used for simulation purpose.

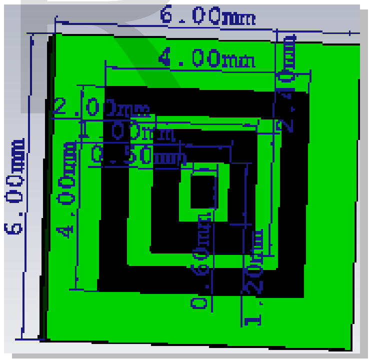

Fig. (1.1) Top view of designed antenna

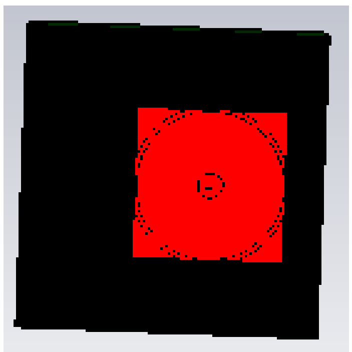

Fig.(1.2) bottom view of designed antenna

A copper plate with dimensions of 6mm * 6mm and thickness of 0.1 mm is used as the ground plane. Length of outer ring patch is 4 mm and width is 4 mm. Dimension of middle ring patch is 2mm *2.4mm and Dimension of inner ring patch is 0.5 mm *0.6mm. . This antenna has been designed to work at 60 GHz frequency. The complete structure of antenna has shown in Figure 1.

III .SIMULATION AND RESULTS

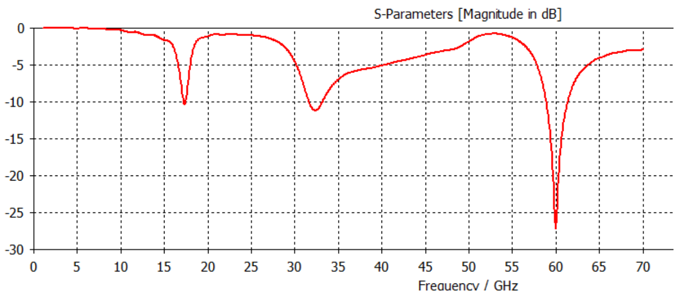

Fig.(2.1)Simulated Reflection Coefficient

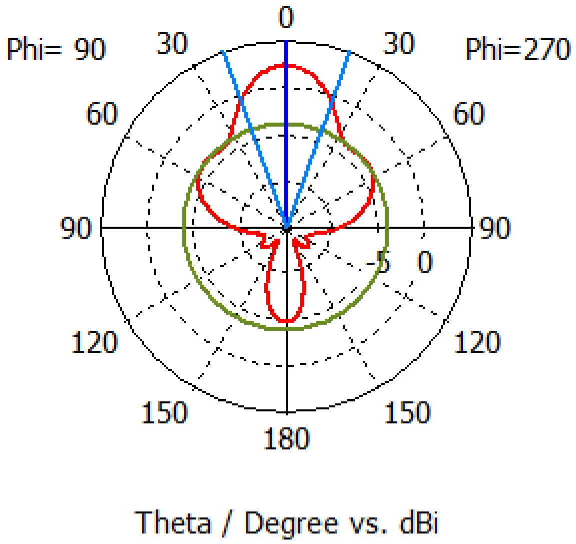

Fig. (2.3) Simulated radiation pattern for H-plane

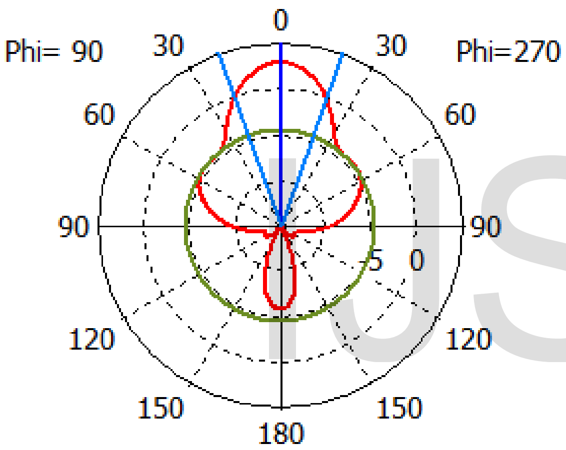

Fig. (2.2) Simulated radiation pattern for E-plane

The simulated reflection coefficient (S11) of the antenna is shown in Figure 2.1. The antenna resonates at 60 GHz with the impedance bandwidth of 2.6 GHz. The simulated radiation patterns for E- and H- planes are shown in Fig. 2.2 and Fig. (2.3). It can be seen that the proposed antenna provides nearly stable directional pattern in E–plane and H-plane typical of patch antenna.

IV. CONCLUTION

A compact square ring-shaped microstrip patch antenna has been designed for high-speed wireless communication systems. The refection coefficient is below −10dB from 58.80 GHz to 61.58GHz. At the same time, the antenna is thin and compact with the use of low dielectric constant substrate material. These features are very useful for worldwide portability of wireless communication equipment. The parametric study provides a good insight on the effect of various dimensional parameters. It provides guidance on the design and optimization of square ring -shaped microstrip patch antenna. By locating the feed point at the base rather than the center arm, the resonant frequency of the second resonant mode can be tuned without affecting the resonant frequency of the fundamental resonant mode. The bandwidth can be easily enhanced by increasing the height of substrate.

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