

# A Review on Slot Loaded Rectangular Patch Antenna for Dual Band Operations

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**Abstract**— This paper discusses the design of slot loaded rectangular patch antenna for dual band operations. In this dual band operation is obtained by embedding the slots in the radiating patch. These slots may be rectangular, circular so that the gain, VSWR, Return Loss, Bandwidth can be improved. Furthermore antenna characteristics such as gain, resonant frequency, Return Loss are analyzed and comparative results and measurements are presented.

**Key words:** Microstrip Patch Antenna, Slot Loaded Rectangular Patch Antenna

## I. INTRODUCTION

Nowadays, microstrip patch antenna is used in various applications such as radar and satellite communication, wireless LAN network. The microstrip patch antenna is used because it has low profile, mechanically robust, compact and light. The micro strip patch antenna is also commonly known as Printed antenna and it a type of radio antenna. Manufacturing of this microstrip patch antenna is inexpensive due to its simple two dimensional physical geometry. The Microstrip patch antenna is normally utilized for UHF and higher frequencies because the antenna size is directly proportional to the wavelength at the operating frequencies. It is comparatively easy to implement a series of patches on a large substrate by using litho graphic technique. By implementing this type of technique patch antenna can provide high gain. This has capability to provide high gain in a low profile so it is the only reason that these types of microstrip patch antennas are used in military and airplanes applications. The merits behind the patch antenna are to have polarization. This peculiar character makes use in many types of communication that has various types of requirements. The most frequently used microstrip patch antenna is rectangular microstrip patch antenna because it seems to be a shorten transmission line which is more or less one half of the wavelength. When the length of the antenna is reduced which in turn increases the dielectric constant of the substrate. In order to increase the gain and resonant frequencies slots are introduced in the patch antenna.

## II. LITERATURE SURVEY

Yuktith Chawanonphithak (2016) proposed, A miniaturized dual band v-shaped monopole antenna fed by v-stub. In this paper antenna has two resonant modes covering dual band for wireless standard, for operating in the IEEE 802.11, WLAN and IEEE 802.16e WiMAX. This antenna is printed on thick FR-4 substrate and the relative permittivity of 4.34 which is fed by cross v-strip line of 50Ω with SMA connector to improve gain and band width. The major drawback of this paper is it has narrow band width.

Ankita Sood, Poonam Verma(2016) proposed the paper, dual-band slotted Microstrip Patch Antenna is used

for various applications such as satellite communication and Radar application. In this paper the dual band antenna is designed by introducing a radiating patch on the antenna and two U shaped slit in order to attain a dual band frequencies. In this dual band patch antenna is operated at two different frequency bands such as 9.1 GHz and 14 GHz which is at in the range of X band (8-12GHz) and Ku (12-18GHz) band. This antenna is designed with perfect electric conductor (PEC) and the radiating patch is located above substrate of the Flame Retardant 4 which is a dielectric material and this substrate is a medium that connects the top radiating patch to the ground plane. In this paper dual band antenna is designed and simulated using user friendly software CST Microwave studio 2010. The significant downside of this paper is Reduced Radiation efficiency.

Gagandeep Singh Gill, Er. Hardeep Singh, Yadwinder Singh (2015) implemented the paper, the dual-band patch antenna is mapped out for Wi-Fi network and (WLAN) wireless communication, which is operated at two frequencies such as 2.45 and 5 GHz. The antenna has a rectangular patch of various dimensions W X L which is mounted on the top of dielectric substrate then Multiple T-shaped and rectangular slits are embedded on the patch of the antenna which is used to obtain the dual band operation of the antenna. The limitations that it has low power handling capacity. In this paper antenna is modeled by using ANSOFT HFSS.

Abdelmoumen Kaabala, Mustapha El halaoui, Saida Ahyoud, Adel Asselma (2015) in this paper it investigates about the performance of a microstrip antenna phased array which is implemented in an EBG. A novel EBG array configuration was implemented and the band gap features of mushroom like EBG has been studied This antenna design was verified by High Frequency Structural Simulator (HFSS), the simulated results shows that the EBG design approach is a good for a reduction in mutual coupling at particular frequencies between radiator element, which in turn increases antenna directivity. The drawback of this paper is that the structure of the antenna is very complex.

Aravind S, Saira Joseph, Mridula S, Binu Paulc, P Mohanan (2014) proposed a antenna which operates in dual band. In this paper, a UWB antenna is loaded with lower band and the antenna is planar and it has low profile which is suitable for wireless applications. In this paper, LTE facilitates to increase the speed of wireless data networks using improved digital signal processing and modulation techniques and it supports both frequency and time division duplexing. This antenna design achieves good input impedance match from 1.8 - 11GHz which is suitable for Global System for Mobile communication (GSM), Universal Mobile Telecommunication System (UMTS), Long Term Evolution (LTE) and Ultra Wide Band (UWB)

applications. This antenna results are simulated by using ANSOFT HFSS and CST microwave studio and the antenna is fabricated is using FR4 epoxy substrate.

Ambresh P. A., A. A. Sujata, A. M. Khan, P. M. Hadalgi, and P. V. Hunagund (2014) proposed this paper, in this paper a two rhombus shape slot loaded rectangular microstrip antenna for quad band operations. This type of quad bands are achieved by S and C band of frequencies 98

The Effect of slot is embedded on the patch was studied experimentally for enhancing the bandwidth. It was found that by using two rhombus shape slots on the patch element with copper as ground plane and the bandwidth is enhanced without affecting the operating bandwidth at C-band and S band respectively.

S.Princy,A.C.Shagar (2014) designed an antenna in this paper a simple patch antenna is designed for dual band operations. The dual band operations were obtained by embedding a rectangular shaped slot in the radiating patch. The dielectric material used is FR4 substrate with the specific dielectric constant of 4.34 having thickness of one mm and a microstrip line feeding method is used. The simulation was performed by using Advanced Design System (ADS) software. Furthermore, this antenna has a low profile, making it suitable for wireless devices and thus suitable for short range wireless communication.

H. Raggad, M. Latrach, A. Gharsallah and T. Razban (2013) proposed this paper, the design of a dual band rectangular Dielectric Resonator Antenna (DRA) was coupled to a narrow slot aperture that is fed by a microstrip line and These frequencies was controlled by changing the DRA dimension. The major drawback of this paper in which gain is reduced.

Arun Singh Kirar, Veerendra Singh Jadaun, Pavan Kumar Sharma (2013) implemented a circular patch antenna. In this Paper, circular patch microstrip antenna is designed to operate in dual band in order to increase the gain of the antenna. This Circular patch antenna has some advantages like light weight, flexible, slim and compact unit compare with current antenna used in dual band. This paper also presents the detail steps of designing the circular patch microstrip antenna and the simulated result. IE3D software was used to compute the gain, power, radiation pattern, and S11 of the antenna.

### III. RESULTS AND DISCUSSION

In survey paper [20], the micro strip patch antenna is operated at two different frequencies such as 3.24 GHz and 4.85 GHz and it has a good return loss of -15.54 dB and -23.21 dB respectively. In this antenna the substrate is made up of silicon in order to increase the performance of the antenna.

In the survey paper [2], Dual Band Microstrip Patch antenna a for X (9.1 GHz) and Ku (14 GHz) band has been successfully implemented. And simulated results of antenna which gives approximate -28 dB return loss at 9.1 Ghz frequency band and -24 dB return loss at 14 GHz band. The Shape and dimesions of the slots in the antenna improves the return loss. The results are discussed in figure I.

In the survey paper [9], dual band patch antenna used for Wi-Fi network and (WLAN) wireless communications which is operated at two frequencies such

as 2.45 and 5 GHz has been designed in this paper. The stimulated results are shown in figure II.

In survey paper [2], presents the study of two rhombus shape slot loaded rectangular microstrip antenna for dual band operation by embedding two rhombus shape slots on the patch with copper as ground plane, the bandwidth of C band is enhanced from 2.06 % to 20.4 % without affecting the operating bandwidth at C-band.

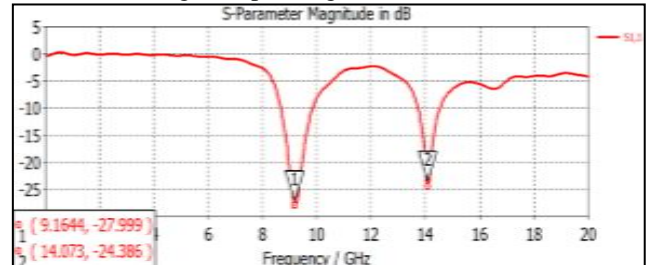


Fig. 1: Return Loss Vs frequency plot of patch antenna

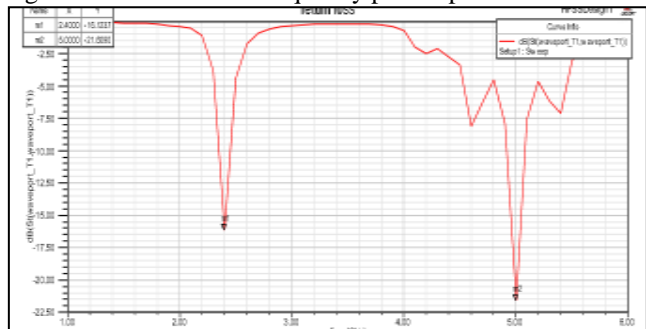


Fig. 2: Return Loss Vs frequency of patch antenna

The comparative analysis in the survey paper [4] shows that the stimulated micro strip antenna has very poor gain and bandwidth. Further enhancement of bandwidth does not affect the nature of radiation characteristics.

### IV. CONCLUSION

In this paper, gain, return loss and operating frequencies of the rectangular patch antenna were discussed and the various parameters such as Radiation pattern, VSWR is also discussed.

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