Review of Bandwidth Enhancement of a Microstrip Patch Antenna with a Different Shape for WLAN Communication

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Abstract— Micro Strip patch antenna is an important concern in any communication either it is wired or wireless network. Wireless Communication is an important role in any type of communication. Microstrip patch antenna is generally used because of light weight cheaper cost and easily installed in any type of communication system. Here we are discussed about the different type and different structure of antenna for different application and also impedance matching technique by using different type of stub matching and slotting. Moreover in microstrip patch antenna which is self-organizing, to enhance the bandwidth as well as gain depending on structure of an antenna.

Keywords: WLAN Communication, Microstrip Patch Antenna, U-Slot Patch Antennas

I. INTRODUCTION

The discovery of patch antenna has been introduced by several authors, but in year 1960s the first microstrip patch antenna was introduce by Greig, Engleman, Deschamps and Lewi. After that in year 1970s many researcher come and started to various design of mathematical analyses for designing of microstrip patch antennas. Then over and done many different authors ongoing investigations on microstrip patch antennas (MSAs) like Hallid M. Pozar and there are others introduced a lot.[1] Throughout the years, many authors have proposed the microstript patch antenna for enhancing bandwidths or multiple-frequency operation in a single element.[2] Though, most of the researcher bear disadvantages related to the height, size or overall volume of the single element and the betterment in bandwidth suffers usually from a degradation of the other characteristics. During the course of development of this work, we have gone through many international papers and publications which helped in understanding the concepts of the microstrip patch antenna [5-6].The following section discusses some of the more important papers which were referred during the course of this work.

II. LITERATURE REVIEW

Mahrekh khan et al[1] designed a Dimensionally Invariance Resonant Frequency (DIResF) technique. It comprises features of DI and ResF method. DIResF technique is superior than Dimensional Invariance (DI) and Resonant Frequency (ResF) technique for quick prototyping. Here analysis of characteristic mode is done for some critical parameters like thickness of substrate, slot width, feed location variations, probe radius. Bandwidth obtained for DI and ResF techniques are 17.5% and 27.5% respectively.

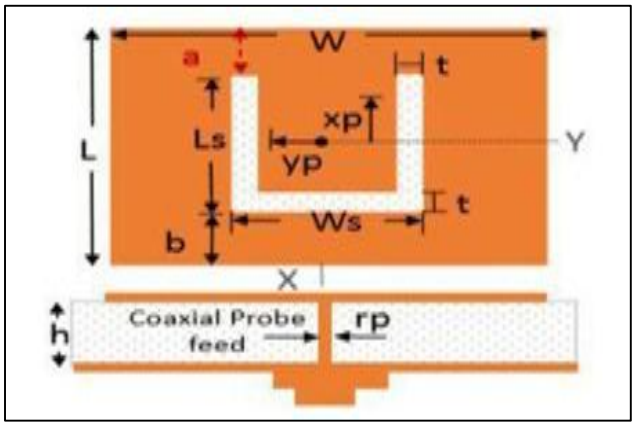

Fig. 2.1: Loaded U-Slot microstrip patch.

A. Patch Antennas With Modified Ground Planes[2]

Kaushik Mandal et.al**,** proposed the design and simulation of six printed microstrip antennas. The proposed design here provides incredible increment of bandwidth and gain simultaneously using U shaped patch and modified ground plane with an extremely thin substrate. The effects of ground plane's dimension and shape on impedance bandwidth are studied in this paper. The gain and bandwidth improvement by using U-shaped patch antenna used a two arms for a substrate poly tetra fluro ethylene (PTFE) substrate. The antenna with overturned U-shaped patch is presented in this literature for a square or circular shaped ground plane just under the U-shaped patch. In this the effect of structure and size that is it is meander, defected ground of infinite ground plane. The ground plane on impedance bandwidth is studied. The obtained impedance bandwidth of a proposed design is about 86.79% is obtained on circular shaped ground plane whose diameter is 36 mm. The gain of an proposed antenna is 4.1 dBi the results are confirmed experimentally.[2]

B. Dual-and multiband U-slot Patch Antennas[3]

Kai-Fong Lee, et.al, In this paper a impedance matching is has been achived by using a U-slot patch for bandwidth enhancement is presented. It is firmly observed that the U-shape antenna can be better for impedance bandwidth in surplus of 30% in the thickness of air substrate thickness of about excess of 20% for 0.08λ microwave dielectric substrate of an antennas with the same thickness. The U-slot was also used for planar microwave frequency antennas to introduce a notch for minimum interference. The main purpose for U-slot was to enhance the bandwidth rather than to developed the band notch.[3]

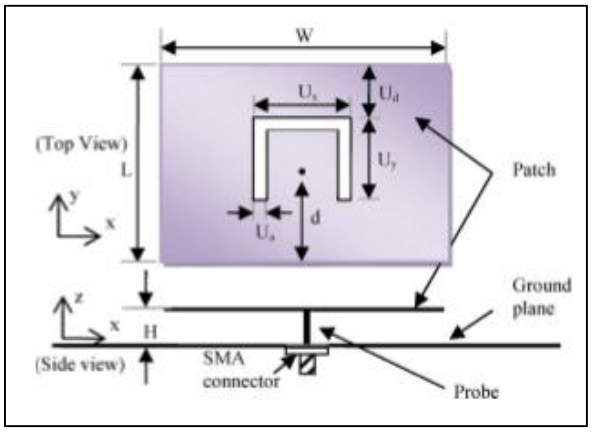

Fig. 2.2 Dual-and multiband U-slot patch antennas

C. Slotted Rectangular Microstrip Antenna for Bandwidth Enhancement[4]

Jia-Yi Sze et. al, in this the dual slots and a new adapted U-shaped slot in a microstrip patch antenna for bandwidth enhancement of proposed antennas is proposed. The essential sizes of the right-angle shape and custom-made U-shaped slot for bandwidth enhancement with good radiation characteristics have been determined practically. In this the calculated bandwidth is of about 2.4 times larger than of a other unslotted rectangular microstrip antenna.[4]

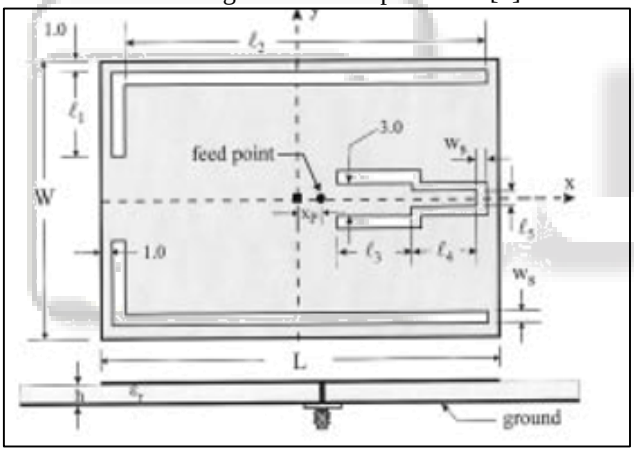

Fig. 2.3: Slotted Rectangular Microstrip Antenna for Bandwidth Enhancement

Mukesh Ku Khandelwal, SantanuDwari, Kanaujia BK, Sachin Kumar @(AEU 2014) [5] designed and analysed a new novel patch antenna (MPA) for Ku band applications by using the concept of defect ground structure. Defect ground structure was considered for impedance bandwidth enhancement. Defect ground structure is notably preferred to suppress the Cross Polarization level to a larger extent. Microstrip patch antenna was designed with a circular slot is integrated in the ground plane with operating frequency 10 GHz. 50 Ω Microstrip line is used to feed the proposed structure. The open ended Microstrip line is to be considered as a tuning stub for the proposed structure. This tuning stub is used to control the return loss level of proposed structure by controlling the reflection coefficient. Ansoft HFSS v.12 software is used to analyse the structure whish is based on finite element method (FEM).

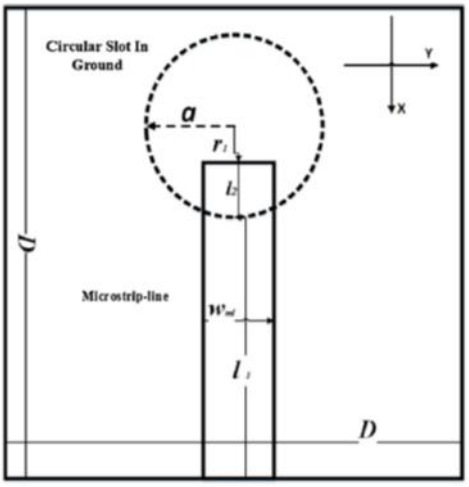

Fig. 2.4: Design of proposed structure [4]

In this paper [5] we investigated that an enhanced impedance bandwidth of 56%was achieved with lower and higher frequencies 9.8 GHz to 17.55 GHz respectively. Two resonances at frequencies 10.8 GHz and 16.35 GHz were achieved, which covers Ku band as well as partially X band. The return loss levels achieved at these two resonance frequencies were -30 dB and -23 dB respectively as shown figure (2.2).

The VSWR was less than 2. The concept of Defect ground structure was used to suppress the cross polarization level. The cross polarization suppression for the designed antenna was less than -35 dB in H-plane and less than -25 dB in E-plane for the entire operating band. Cross polarisation suppression leads to the minimum isolation between Co-polar and Cross polarization level was about 20 dBi H-plane and 15 dB in E-plane.Due to above characteristics the proposed structure is used for "Ku" band and "X" band applications.

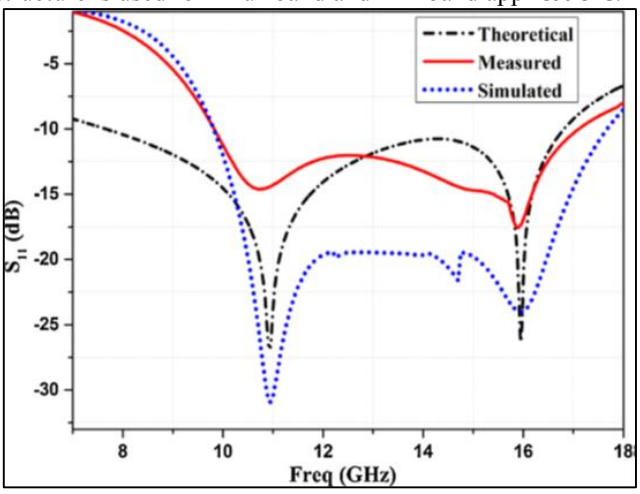

Fig. 2.5: Simulated and measured S11 variation vs. Frequency of the antenna

Author	Publication/year	methodology	Fr (GHz)	B/W (operating frequency range)	Gain	Retun Loss
	IEEE/ 2016	Characteristics Mode study of Empirical Design	4 GHZ	31%	5 dBi	-22 dB

Mahrukh Khan and Deb Chatterjee		Techniques for Probe-Fed, U-slot Microstrip Antennas.				
Kaushik Mandal,etal	IEEE/ 2013	U shaped patch antennas, modified ground planes, PTFE substrate	5.4	86.79%(4.5 GHz – 11.4 GHz)	4.1 dBi	-10 dB
Kai Fong Lee,etal	IEEE/ 2008	U slot patch antenna, L probe feeding, multiband operation	5.5 , 6.2	7.6%,5.5%, 8.9%(measured)(4.80-5.18,5.63-5.95,6.25-6.83)	8 dBi	-18 dBi
Jia YI Sze,etal	IEEE/ 2000	Modified slotted U shape patch,	1.8	4.3-4.6%	2.2-2.7 dBi	-10 dBi

Table 2.1L Literature Survey

III. CONCLUSION

In this review, discussed various papers and various techniques using different substrate and simulation technique and from the survey we have concluded that impedance bandwidth achieved nearly 66% which is very less. The achieved gain is also less so by using some technique like stub matching, impedance matching and by a via hole we will improve the bandwidth of proposed microstrip patch antenna.

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