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A Review Paper on Microstrip Patch Antenna Used in Wlan Systems

Poonam Rajput, Prateek Wankhade

Abstract: ***A compact microstrip patch antenna became a very useful in communication systems. Properties like compactness, light weight, high bandwidth make it a good candidate of communication system. This paper reviews the performance analysis of Compact Dual-Band Microstrip Antenna for IEEE 802.11a WLAN Application (2014), comparative analysis of s-shaped Multiband microstrip patch Antenna (2013), Dual-Band Antenna with Compact Radiator for 2.4/5.2/5.8 GHz WLAN Applications (2012), A Slot-Monopole Antenna for Dual-Band WLAN Applications (2011) and Compact Broadband Slotted Rectangular Microstrip Antenna (2009). The paper also discusses the technology used in order to bring the required changes in terms of improved performance characteristics.***

Index Terms: WLAN (Wireless local area network), Dual band, Transmission line, Microstrip antenna, Monopole antenna, Dual band antenna, RMSA, Water Patch, L-probe.

I. INTRODUCTION

A compact microstrip patch antennas became very useful, primarily for space craft and aircraft purpose. Today they are applicable in almost every communication systems such as radar systems, missile technology, mobile communication, GPS service for land vehicles, maritime vessels to find out their exact position etc. The reason is being its advantages such as light weight, low profile, simple and inexpensive, planner structure using advanced printed circuit technology, mechanically stable when mounted on rigid body, compatible with MMIC designs. In this paper we have reviewed some papers about microstrip patch antenna and will see the performance of parameter on the basis of comparative analysis of bandwidth enhancement and return loss value of different papers. Extensive research work is being carried out in the field of Microstrip patch antennas. The development in the context of microstrip patch antenna is our focus area. The following review focused on the comparative study of five different research works; in a recent study Keisuke Noguchi et al. presented a new circuit model for E-shaped patch antennas (ESPA shown in fig. 1) using the multi-conductor transmission line mode theory (the modal theory) in [1]. Radiation and transmission line modes generated on the

ESPA are described and an equivalent circuit is derived from the modal theory. The equivalent circuit described in detail to achieve wideband and multiband characteristics. For wideband ESPAs, the theoretical maximum bandwidth is derived under VSWR criterion. Dual-band ESPA is also discussed theoretically and the return loss vs frequency characteristic is shown in Fig.1. Fig.1 shows dual band characteristics with the maximum return loss value of -21.4 dB and -24.9 dB at 1.73GHz and 2.40 GHz respectively. Impedance bandwidth value of 4.5 % and 10.5 % is obtained at 0.8445 GHz and 1.825 GHz respectively.

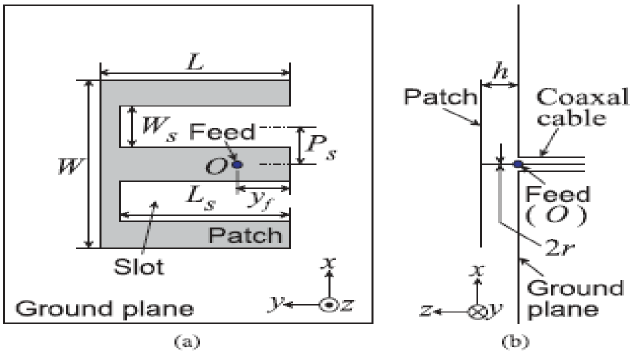

Fig.1. Proposed Antenna Geometry (a) Top View (b) Side View [1]

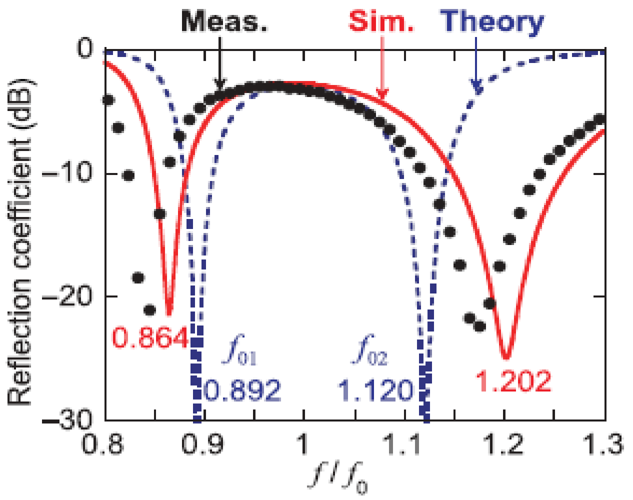

Fig.2. Return Loss VS Frequency Characteristics of Dual Band ESPA [1]

In [2] Yujian li and Kwai-man luk designed a novel water dense dielectric patch antenna (DDPA) fed by an L-shaped probe. The operation of the proposed water DDPA is similar to the conventional metallic patch antenna. An L-shaped probe is used excitation of the water DDPA (shown in fig 3). Wide bandwidth can be achieved for the designed antenna by choosing a thick supporting substrate between the water patch and the ground plane. A prototype is fabricated to correctness of the design. An impedance bandwidth of 8%, maximum return loss of -22.45 dB (with water dielectric patch), maximum gain of 7.3 dBi, radiation

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Poonam Rajput, PG Scholar, Department of Electronics and Communication, Oriental College of Technology, Bhopal (M.P). India. E-mail: poonam.rajputec@gmail.com

Prateek Wankhade, Associate Professor, Department of Electronics and Communication, Oriental College of Technology, Bhopal (M.P). India. E-mail: prateek.wankhade@gmail.com

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efficiency up to 70%, and symmetrically unidirectional patterns with low back-lobe and low cross polarization levels are obtained. The proposed water DDPA can be conveniently integrated with the solar cells to realize a dual-function design.

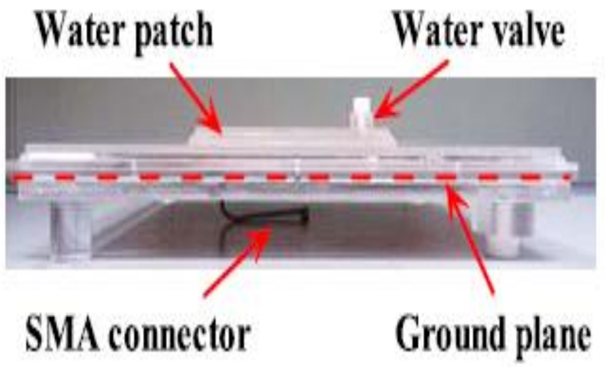

Fig.3. Designed Water DDPA [2]

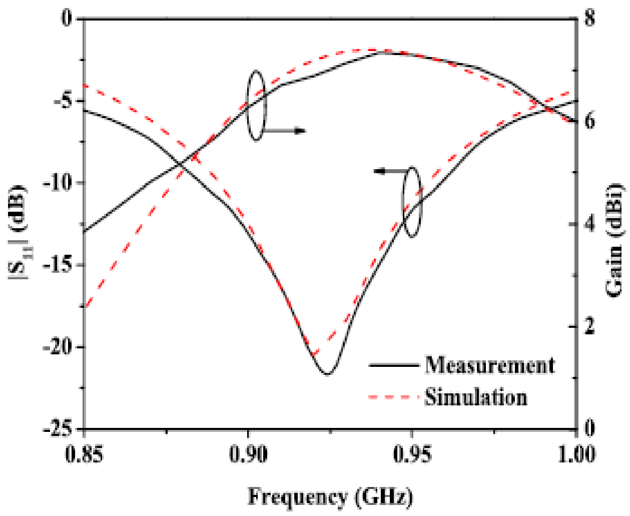

Fig.4. Return loss VS Frequency [2]

Xiao Lei Sun et al. [3] designed and studied A dual-band monopole antenna with a very compact area of only for 2.4/5.2/5.8-GHz wireless local area network applications in [3]. The antenna consists of an L – shaped and E - shaped elements having resonances at about 2.44 and 5.5 GHz respectively. The two frequency bands can be tuned separately. Fig.5 and 6 shows the geometry and return loss value.

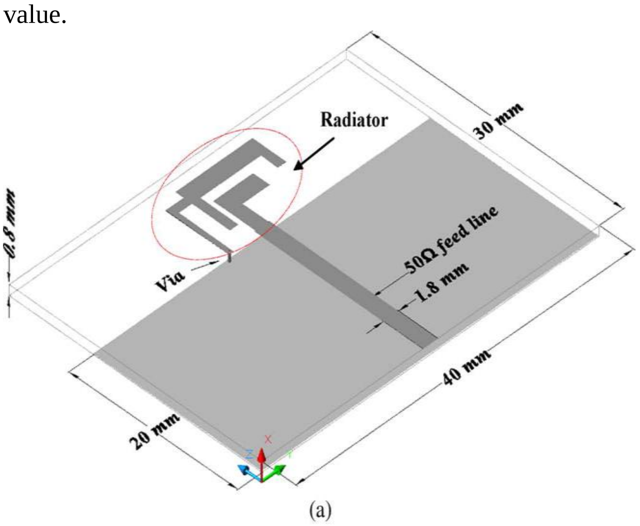

Fig.5. Proposed Geometry [3]

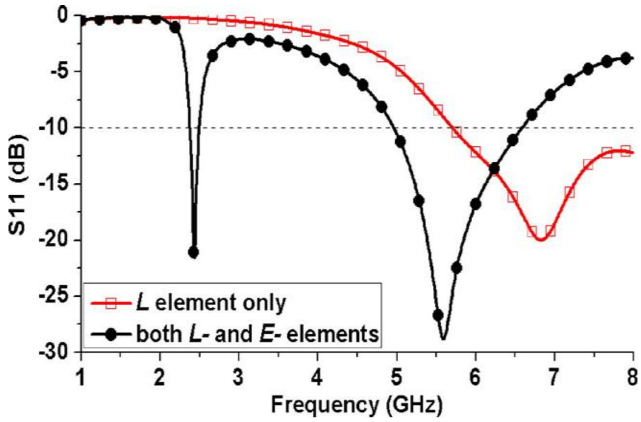

Fig.6. Return Loss [3]

In [4] Chih-Yu Huang and En-Zo Yu proposed a coplanar waveguide fed dual-band slot-monopole antenna suitable for WLAN operation. The proposed antenna provides two separate impedance bandwidths of 124 MHz (about 5.1% cantered at 2.45 GHz) and 1124 MHz (about 22.4% centered at 5.5 GHz), Both the bandwidths are large enough for the required bandwidth of the 2.4- and 5.2/5.8-GHz WLAN bands. Antenna design and return loss curve (i.e; -29dB) is shown in fig.7 and 8 respectively.

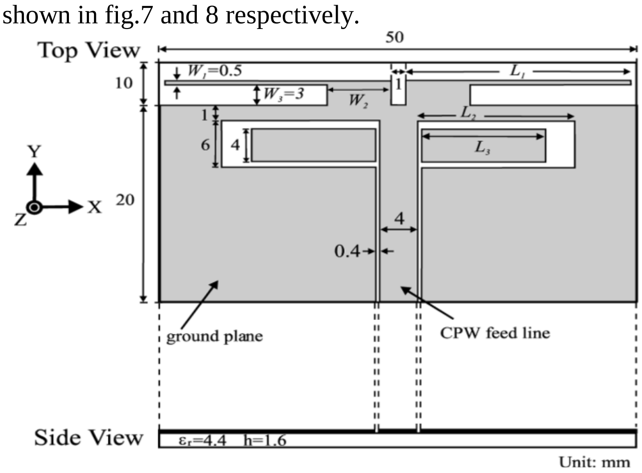

Fig.7. Proposed Antenna Design [4]

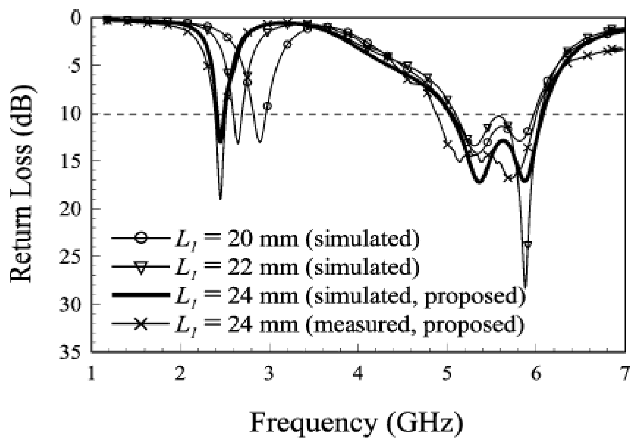

Fig.8. Return loss [4]

Amit A. Deshmukh and K. P. Ray [5] proposed a new geometry (shown in fig.9) by integrating a half-U-slot and a rectangular slot inside the rectangular microstrip antenna in [5]. The proposed antenna design shows better bandwidth enhancement (shown in fig.10) with gain of more than 7 dBi

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over the entire BW with the broadside radiation pattern.

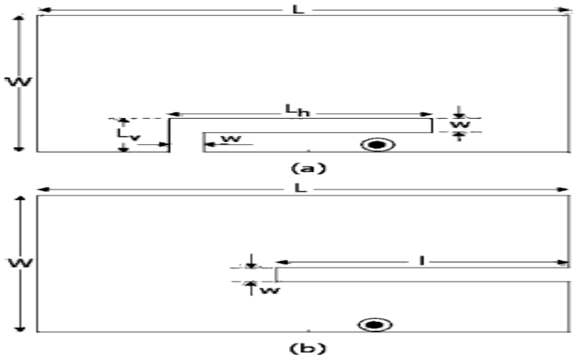

Fig.9. Proposed Antenna Design [5]

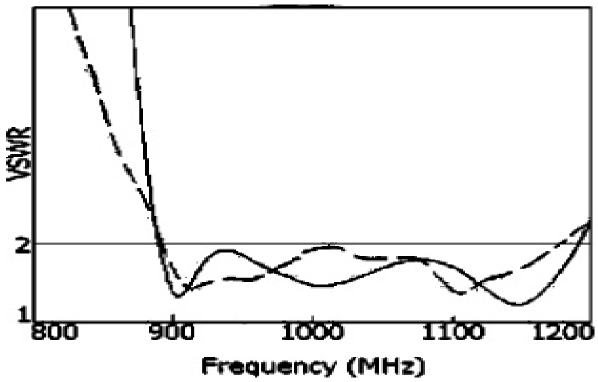

Fig.10. VSWR [5]

Table.1. Literature Review

parameters	[1]	[2]	[3]	[4]	[5]
Year	2016	2015	2012	2011	2009
Author	Keisuke Noguchi et al.	Yujian li and Kwai-man luk	Xiao Lei Sun et al.	Chih-Yu Huang and En-Zo Yu	Amit A. Deshmukh And K. P. Ray
Publication	IEEE transactions on Antennas propogation	IEEE Access	IEEE Antenna and wave propogation	IEEE Antenna and wave propogation letters	IEEE Antenna and wave propogation letters
Software	IE3D Software	Ansoft HFSS	CST Studio	Ansoft HFSS	IE3D Software
Feeding method	Probe feed	L shaped Probe feed	Micro-strip line feed	Co-planar waveguide line feed	Probe feed
Maximum return loss	-24.9 dB	-22.45dB	-28.5 dB	-29 dB	-
Usable fre-quency	1.120 to 1.245 GHz and 0.825 to 0.864 GHz	0.89 to 0.95 GHz	5.15 to 5.35 GHz & 5.725 to 5.825 GHz	2.4 GHz & 5.8 GHz	890 MHz to 1190 MHz
Band-width	10.5 %	8 %	3.8% & 1.7%	5.1% & 22.4%	14.5%
VSWR	Less than 2	Less than 2	Less than 2	Less than 2	Less than 2

II. CONCLUSION

This review provides an insight in determining the performance characteristics of microstrip patch antenna. The impedance bandwidth can be enhanced by implementing slot to patch. This review also gives the effects of several feeding techniques. It was also inferred that by introducing slot of different shapes (U-shape, half U-shape and L-shape), we can avoid interference near their corresponding band notch frequencies. Single band characteristics can be converted into multiband characteristics by implementing more than one slot inside the patch. This review paper also helps in exploring the filter characteristics.

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Poonam Rajput received her B.Tech. Degree in electronics & communication from Rajiv Gandhi Proudyogiki Vishwavidhyalaya, Bhopal, (M.P.), and pursuing her M.Tech in electronics and communiation from Oriental College of Technology, RGPV, Bhopal (M.P.), India.

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Prateek Wankhade received his B.Tech. Degree from Rajiv Gandhi Proudyogiki Vishwavidhyalaya, Bhopal, (M.P.), M.Tech Degree in Digital Communication from Rajiv Gandhi Proudyogiki Vishwavidhyalaya, Bhopal, (M.P.). He is an Associate Professor in the Department of Electronics and Communication Engineering, Oriental College of Technology, Bhopal, (M.P.), India.

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