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A Review Paper on Microstrip Patch Antenna used in WLAN Systems

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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 [1], comparative analysis of s- shaped Multiband microstrip patch Antenna [2], Dual-Band Antenna with Compact Radiator for 2.4/5.2/5.8 GHz WLAN Applications [3], A Slot-Monopole Antenna for Dual-Band WLAN Applications [4] and Compact Broadband Slotted Rectangular Microstrip Antenna [5]. The paper also discusses the technology used in order to bring the required changes in terms of improved performance characteristics.

1. 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 U. Chakraborty et al. designed a compact dual-band microstrip patch antenna [1] to support the IEEE 802.11system. Two rectangular slots L1 and L2 for quarter wavelength were inserted. Initially, two 10-dB impedance bands are separately generated by two different designs with same dimensional slotted ground-plane structures. Afterword, these two designs were combined to form the geometry of the dual-band antenna. The designed geometry is shown in fig.

1. Overall, the design technique used for the double-slotted dual-band antenna using two separate single-slotted RMSAs is successful for the application in IEEE 802.11a WLAN band (5.15–5.35 and 5.725–5.825 GHz).

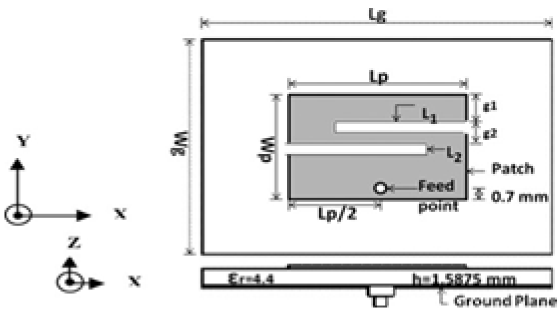

Fig 1. Proposed antenna geometry [1].

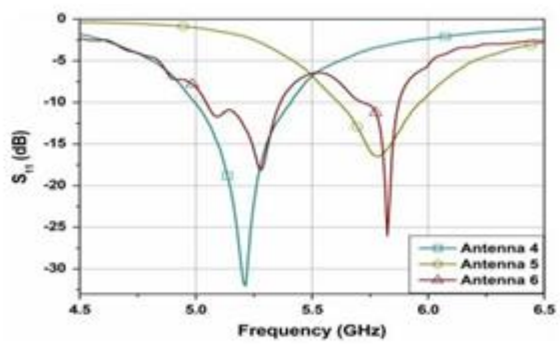

Fig 2. Return loss [1].

In [2] Jigar M. Patel et al. presented a comparative analysis in between common S- shaped multiband microstrip patch antenna, defected ground structure S-shaped microstrip patch antenna using Complementary split ring resonator and S-shaped microstrip patch antenna using metamaterial. This research comfirms that metamaterial generates more bands than the proposed simple S-shaped Microstrip Patch Antenna. The antenna can be used for L Band and S Band Applications. Further design can be modified to have multiband for other applications in C Band, X Band and other bands.

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The designed geometry and its return loss value are shown in fig.3 and fig 4 respectively.

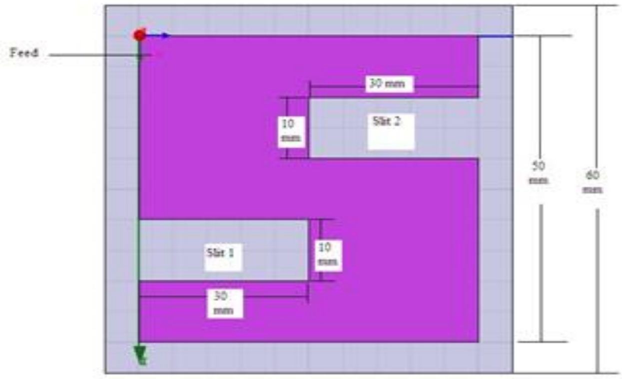

Fig 3. Actual proposed geometry [2].

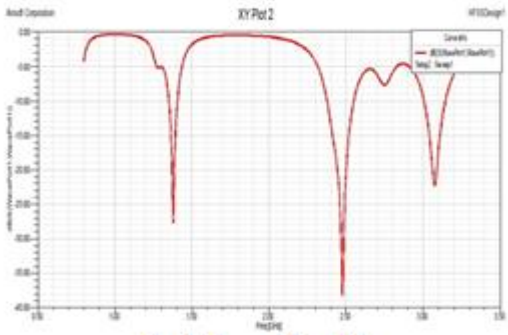

Fig 4. Return loss [2].

Xiao Lei Sun et al. 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.

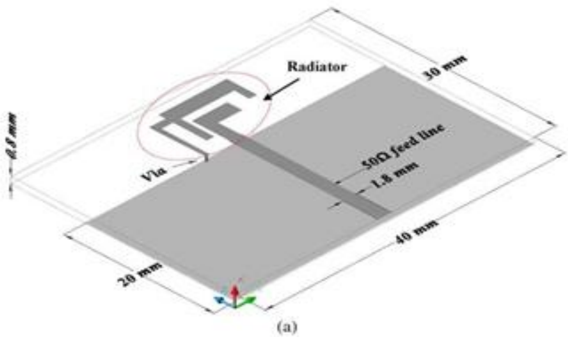

Fig 5. Proposed geometry [3].

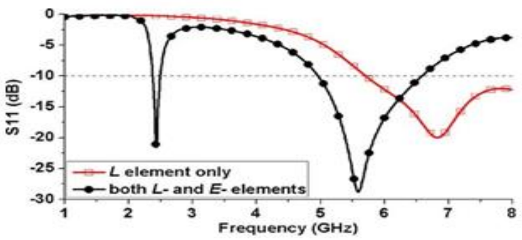

Fig 6. return loss [3]

Chih-Yu Huang and En-Zo Yu [4] 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.

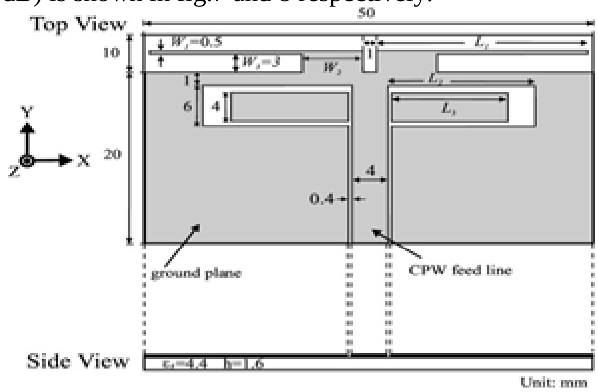

Fig 7. Proposed antenna design [4].

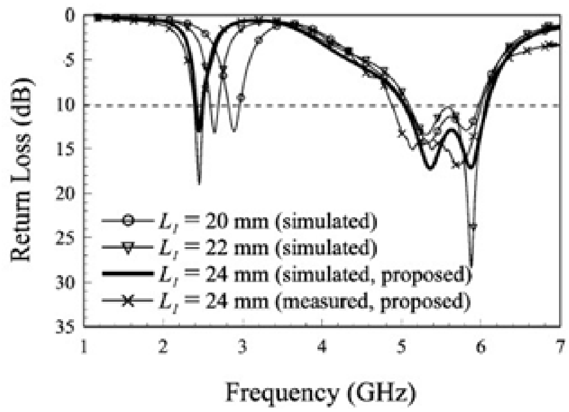

Fig 8. Return loss [4].

Amit A. Deshmukh and K. P. Ray proposed a new geometry (shown in fig.9) by integrating a half-U-slot and a rectangular slot inside the rectangular microstrip antenna on the foam substrate and rectangular microstrip antenna on air substrate in [5]. The proposed antenna design shows better bandwidth enhancement with gain of more than 7 dBi over the entire BW with the broadside radiation pattern. Fig.10. shows that simulated bandwidth is 28% and measured bandwidth is 26.74%.

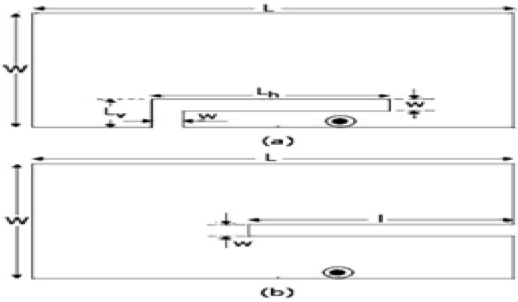

Fig.9. Proposed antenna design [5]

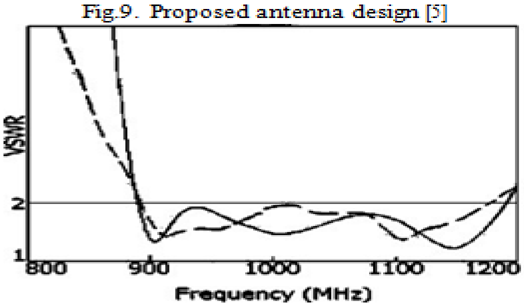

Fig 10. VSWR [5].

Table 1. Literature review.

Antenna	[1]		[2]	[3]	[4]	[5]
Year	2014		2013	2012	2011	2009
Author	U.Chakraborty et al.		Jigar M.Pat el et al.	Xiao Lei Sun et al.	Chih-Yu Huang and En-ZoYu	Amit A. Deshmuk h And K. P.Ray
Publicati on	IEEEAntenna and wave propogation letters		IJAR EEIE	IEEEAntenn a and wave propog ation	IEEEAntenn a and wave propog ation letters	IEEE Antenna and wave propogati on letters
Software	IE3DSoftware		Ansof tHFSS	CSTStudio	AnsoftHFSS	IE3DSoftware
Feeding method	Probe feed		Probe feed	Micro-strip line feed	Co-planar wavegu ide line feed	Probefeed
Maximu m return loss(Negativ	Ant4	32dB	38.18 dB	28.5 dB	29.5 dB	-
	Ant5	17dB				
	Ant6	26dB				
Usablefre-quency	5.15to5.35GHz &5.725 to 5.825GHz		1 to 5 GHz	5.15 to5.35GHz &5.725 to 5.825GHz	2.4GHz & 5.8GHz	890 MHz to 1190MHz
Band-width	Ant4	5.90%	6.88%	3.8% &1.7%	5.1% & 22.4%	14.5%
	Ant5	6.80%				
	Ant6	3.8%				
VSWR	Less than 2		Lessthan2	Less than 2	Less than 2	Less than2

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. Thisreview 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.

III. References

[1] U. Chakraborty et al. “Compact Dual-Band Microstrip Antenna for IEEE 802.11a WLAN Application” IEEE Antennas and Wireless Propogation Letters, VOL. 13, 2014, pp: 407-
410.

[2] Jigar M. Patel et al. “Comparative Analysis of S-Shaped Multiband Microstrip Patch Antenna” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 7, July
2013, pp: 3273-3280.

[3] Xiao Lei Sun et al. “Dual-Band Antenna with Compact Radiator for 2.4/5.2/5.8 GHz WLAN Applications” IEEE Antennas and Wireless Propogation, Vol. 60, issue 12, December 2012.

[4] Chih-Yu Huang and En-Zo Yu “A Slot- Monopole Antenna for Dual-Band WLAN Applications” IEEE Antennas and Wireless Propogation Letters, Vol. 10, 2011.

[5] Amit A. Deshmukh and K.P.Ray “Compact Broadband Slotted Rectangular Microstrip Antenna” IEEE Antennas and Wireless Propogation Letters, Vol.8, 2009.