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MulitBand Planar Monopole Antenna for WLAN/WiMAX/HIPERLAN

Pravin Tajane[1], P. L. Zade[2]

Lecturer, Dept. of ET, SDMP, Nagpur, India

Professor, Dept. of ET, YCCE, Nagpur, India

ABSTRACT: Modern wireless communication systems are greater demands for antenna designs. Planar monopole antenna is used to achieve multiband with broad bandwidth. Planar monopole antenna with its attractive characteristics satisfies the requirements of low weight, low cost, simple structure and regular omnidirectional radiation pattern.A planar monopole antenna for multiband and wideband operations is proposed. The proposed antenna consists of rectangular radiating patch with L-and symmetrically C shaped slots rectangular ground plane.The symmetrically C shaped on the patch is introduced to different band. The planar antenna operates in three frequency bands 2.4 GHz (2.26-2.61GHz) WLAN ,3.5GHz(3.14GHz-4.49GHz) WiMAX and 5.2 GHz (5.01-6.37 GHz)HIPERLAN bands.

KEYWORDS*:* Monopole antennas, multiband antennas, Wireless local area network (WLAN), worldwide interoperability for microwave access (WiMAX),High performance radio LAN (HYPERLAN)

I. INTRODUCTION

Modern wireless communication systems are greater demands for antenna designs. Recently demand for two or more frequencies has increased because of integrating more than one communication standard in a single system. It is difficult to set the dual or multiband antennas into such devices that require limited space. But modem antennas in the future require not only dual or multi band antennas but also compact size, simple structure and easily integrate with RF circuits. To meet these requirements, various types of antenna design have been reported [1] -[10].For achieving these requirements is quite difficult. Planar monopole antenna with its attractive characteristics satisfies the requirements of low weight, low cost, simple structure and regular omnidirectional radiation pattern. Multiband planar monopole antennas have widespread applications [2].

This paper proposed a planar antenna with U and C-shaped slots for WLAN and WiMAX applications. The proposed antenna consists of a rectangular radiation patch and ground plane. By cutting symmetrically C-shaped slot on the rectangular radiation patch, the antenna achieved triple-band characteristics easily. For improving the impedance match to expand bandwidth, a pair of U-shaped slots are embedded into the rectangular patch. The simulated results have shown that the proposed antenna has covered three bandwidths (2.26-2.61GHz), (3.14GHz-4.49GHz), and (5.01-6.37 GHz) for WLAN, WiMAX and HIPERLAN applications respectively. Furthermore, the good omnidirectional radiation characteristic is obtained owing to its symmetric structure. Details of the antenna design and simulated results are presented in the following sections [8].

II. ANTENNA DESIGN

Fig.1 shows the configuration of the proposed antenna. The antenna is fabricated on an inexpensive FR4 substrate with relative permittivity of 4.4, loss of tangent of 0.002, thickness of 1.6mm and fed by a microstrip-line with 50Ω impedance. The total size of the antenna is 26mm×40mm×1.6mm. The radiating element of the fabricated antenna consists of the rectangular patch on the top side of the substrate with the dimension of 26mm×27.5mm.The finite ground has the dimension of 26mm×12.5mm, which is printed on the bottom side of the substrate. [3]

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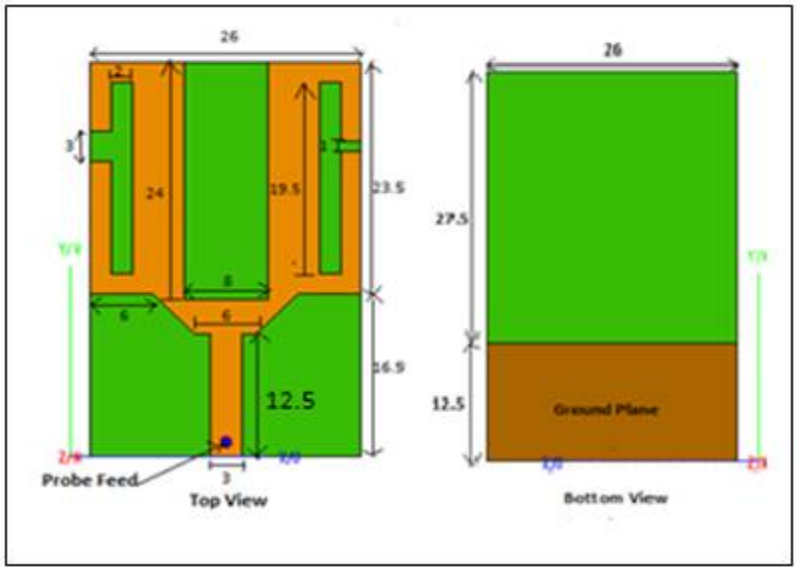

Figure 1 Configuration of proposed antenna
(Unit :mm)

The input reflection coefficient (S_{11}) of the presented antenna is shown in fig.2.As seen , the design in the absence of C and U shape only the presence of rectangular patch with partial ground plane shows no band. On the other hand by addition of C shape on the patch side proposed antenna provides a single band. Again by adding U shape slot on patch side presented antenna provides three band but not get exact band operation. By changing the length of C shape presented antenna provides three band (2.25-2.54GHz) WLAN, (3.15-4.46GHz) WiMAX and (5.07-6.37GHz)HYPERLAN.[9]

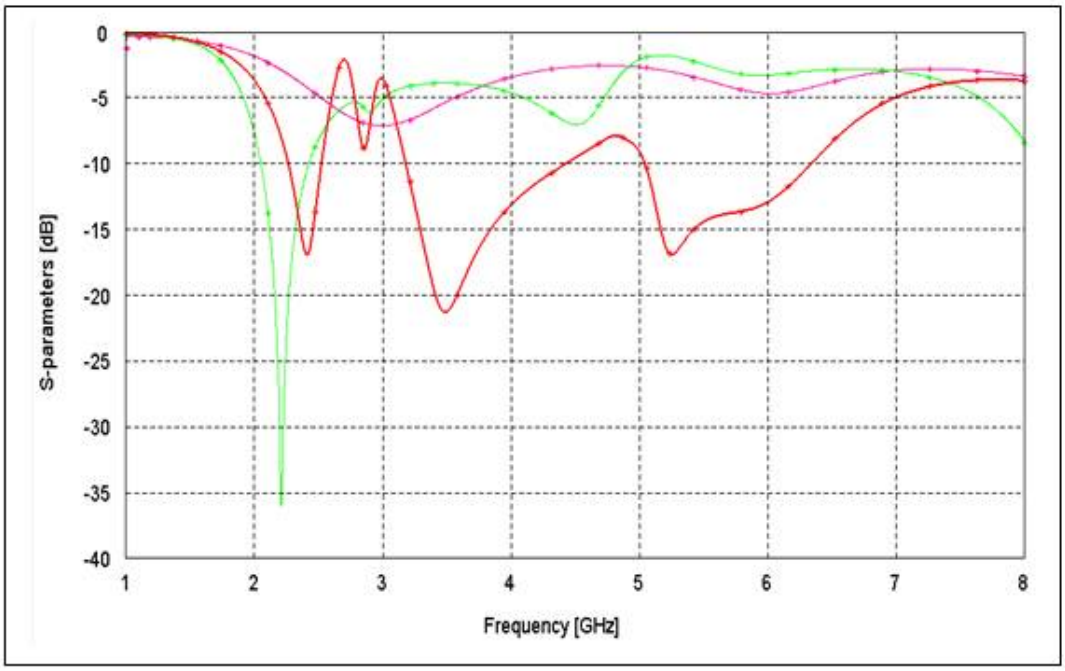

Figure 2. S_{11} characteristics of the proposed design

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The comparative VSWR characteristics of the presented antenna with and without C and U Shape slots are also shown in fig.3. The parameter VSWR 2:1 to indicate the range where the VSWR is between 1 and 2 so it is used for the whole band application.[6]

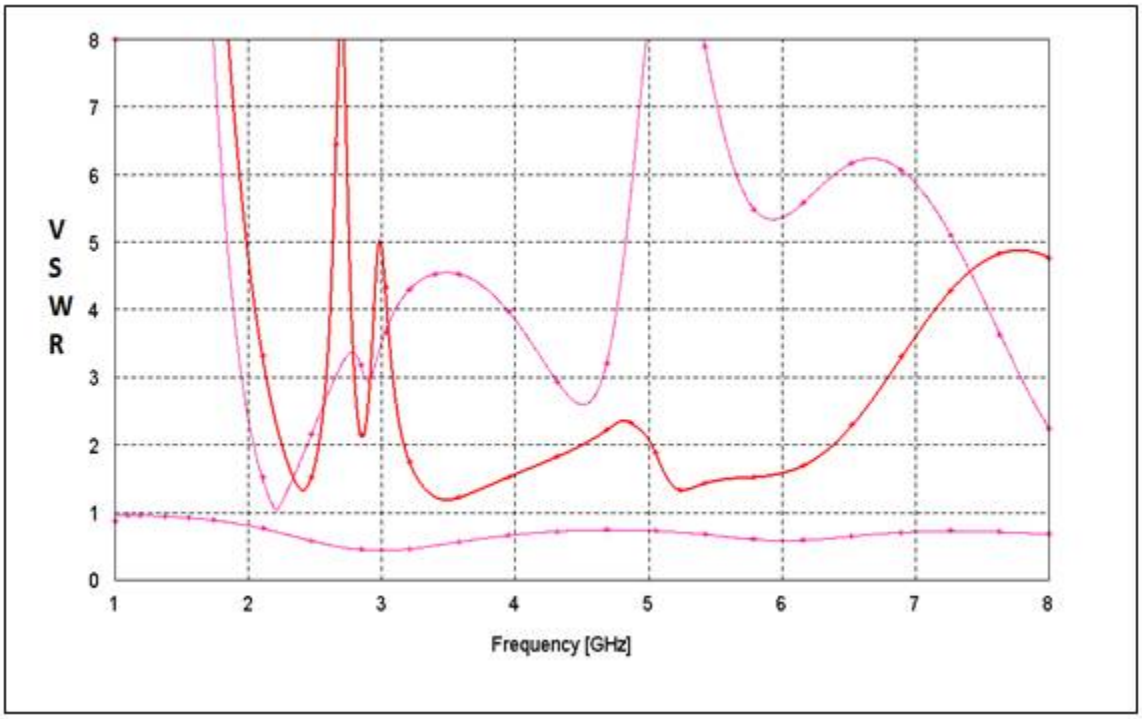
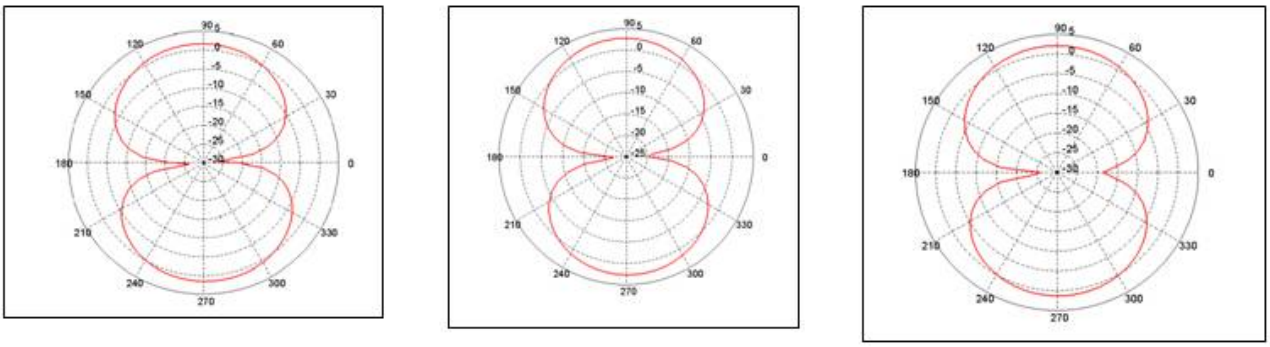


Figure 3. The VSWR performance of the proposed design

Fig. 4 shows the computed the radiation patterns at 2.5 GHz, 3.5GHz and 5.2GHz.As seen ,at the respective frequencies, the design has a multiband radiation pattern with directivity of about of about 4.5 dBi . Also the cross polarization levels are negligible, and the computed radiation efficiency of the antenna is about 90% over the bands of interest.



2.4GHz 3.5GHz 5.2GHz

Figure 4. The radiation patterns of the proposed antenna

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From the above figure 4 shows that the radiation pattern is useful for WLAN,WiMAX and HYPERLAN application .

Table : Variation of Gain with frequency

Frequency (GHz)	S_{11}(dB)	VSWR	Bandwidth (MHz)	Gain(dB)
2.4	-17.09	1.49	290	2.7
3.5	-21.38	1.02	1310	3.23
5.2	-17.15	1.26	1300	2.5

From the above table it is cleared that reflection coefficient(S_{11}) is minimum the gain of 3.5 GHz resonance frequency is high.For the remaining resonance frequency gain is low apart from 3.5 GHz frequencies.

III.CONCLUSION

In this paper C and U shape slot antenna for WLAN, WiMAX and HYPERLAN applications has been presented. By employing three different types of resonant structures U slot ,a pair of symmetrical C shape slots and a monopole radiator the antenna can obtain good triband operation performance while maintaining small size and agreement with the simulated results. The presented antenna features compact size, good triband operating bandwidth and stable radiation patterns, indicating it can be a good candidate for WLAN, WiMAX and HYPERLAN applications. [11]

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