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Design of Multiband Antenna of F Shaped, L Shaped and T Shaped Strip for WLAN / Bluetooth/WiMAX/HyperLAN Applications.

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Abstract: **A novel planar monopole antenna for multiband operation is presented.The proposed antenna consists of front to front F shaped, T shaped and L shaped patch with microstrip line with probe feeding technique. A novel multiband antenna with front to front F shaped strip , T shaped strips and L shaped strips for WLAN / Bluetooth / WiMAX /HYPERLAN Applications. The proposed antenna is composed of T shaped strip,L shaped strips and F shaped strip resonates to 5.5GHz,2.4GHz and 3.5GHz covering WLAN,Bluetooth, WiMAX and HYPERLAN.The antenna occupies an overall dimension of 40×12mm^2.The simulations results show good antenna performance in all frequency bands such as reasonable gain and omnidirectional radiation pattern.**

Keywords: Multiband, L-strips, F-strip, T-strip WiMAX, WLAN and Bluetooth

I. INTRODUCTION

Due to rapidly and widely growth in wireless communication technology for wireless local area network(WLAN) standards in the 2.4GHz(2400–2480 MHz), 5.2GHz(5150-5350MHz), 5.8GHz(5725-5825MHz) and Bluetooth(2400-2483.5 MHz).The popularity of multiband mobile sets and smart phones is also increasing fastly all over world.The high speed mobile communication and Internet requires the development of microwave systems such as WLANs, Bluetooth and WiMAX along with high speed delivery data at affordable price. A multiple of antenna designs such as Compact Multiband Monopole e Antenna for GPS/WLAN/WiMAX Application [1], Microstripline dual band printed monopole antenna [2],Compact and small planar monopole antenna with symmetrical L and U shaped slots [3],Compact Tapered Fed Dual Band Monopole antenna[4],Planar F shaped monopole antenna with dual band circular polarization[5],Compact Dual Band Planar Monopole Antenna[6]Design of dual band planar monopole antenna [7],Compact dual-band Monopole Antenna[8]Multiband planar Branched monopole antenna[9],Planar Monopole Multiband Antenna with U and L shaped slots [10],Planar Monopole Multiband Antenna with U- and L-shaped slots[11],A Narrow size Planar Monopole Multiband Antenna with Double L shaped slots[12] have been presented for WLAN,WiMAX,HYPERLAN and Bluetooth applications.The different planar monopole antennas have sufficient gained but their advantages such as easy fabrication, compact size, multiple band, low size, low weight and easy fabrication etc. The aim of this work is to design and developed microstrip based monopole antenna at an affordable price, which can work WLAN, WiMAX, HYPERLAN and Bluetooth applications. It may be mentioned here that work involves a detailed parametric analysis, which would help the future designers in selecting any physical parameter of the antenna depending upon the requirements. Here, a low profile microstrip planar monopole antenna is presented which covers WLAN,WiMAX, HYPERLAN and Bluetooth frequency bands. The proposed antenna is low profile such as easy fabrication, compact size, multiple band, low size, low weight and easy fabrication etc. The antenna consists of T shaped strip, L and F shaped strips that combine effect get proper reflection coefficient with resonance frequency.

II. ANTENNA DESIGN AND SIMULATION APPROACH

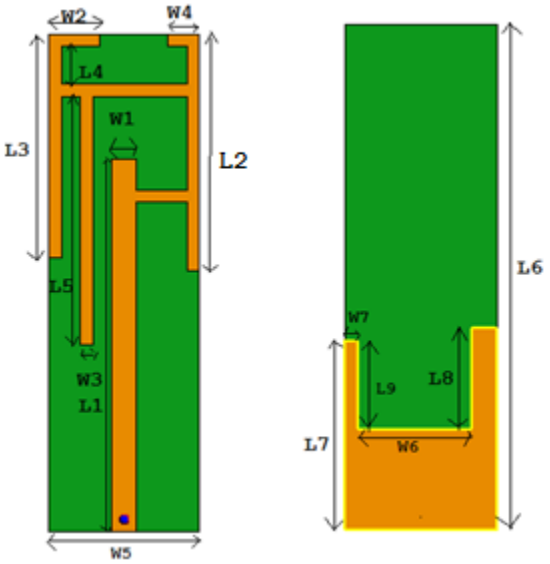

Figure 1 Geometry of the proposed antenna

Figure 1 shows the actual geometrical structure of the antenna along with its various design parameters. The is built on an low cost FR4 substrate with relative dielectric constant 4.4, loss of tangent 0.002 and height 1.6mm.The overall size of antenna is 40x12mm^2.The ground plane size is modified for improve impedance matching.

Table I ANTENNA PARAMETERS (UNITS IN MM)

Design Parameter	Dimensions
L1	30
L2	19
L3	18
L4	3
L5	20
L6	40
L7	15
L8	8
L9	7
W1	2
W2	4
W3	1
W4	2.5
W5	12
W6	9
W7	1

It can be seen from figure 1 that radiating patch and feed point is located at the point on the patch, where the input impedance is 50Ω for resonant frequency. Hence little trial and error method is used to locate the feed point. The combine effect of T shaped strip, L shaped strips and F shaped strip is obtained2.4GHz(2400–2480 MHz),5.2GHz(5150-5350MHz) , 5.8GHz(5725-5825MHz)and Bluetooth(2400-2483.5MHz).

III. SIMULATION RESULTS

All simulations of the proposed antenna are achieved using the CADFEKO software. The simulated return loss is presented in figure 3.The T shaped strip, L shaped strips and F shaped strip are responsible for generating different resonant frequencies. It can be seen that the antenna has three different frequency bands operation. The lower frequency band is from 2.37 to 2.68GHz with bandwidth of 410MHz covering Bluetooth and WLAN. The second frequency band is from 3.29 to 3.82 GHz with bandwidth of 530MHz covering WiMAX. The third frequency band is from 5.17 to 6.29 GHz with bandwidth of 1012 MHz covering HYPER LAN1 and HYPERLAN2.

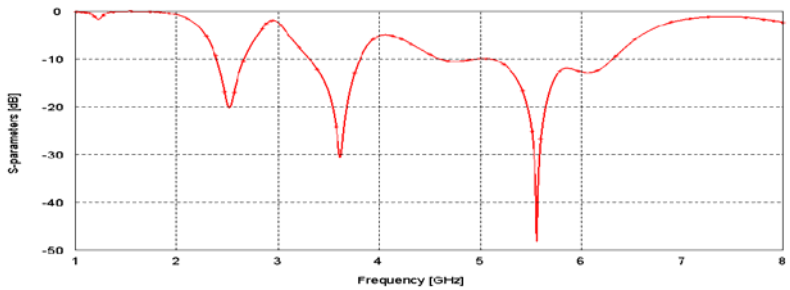

Figure 2.Return Loss characteristics of the proposed antenna

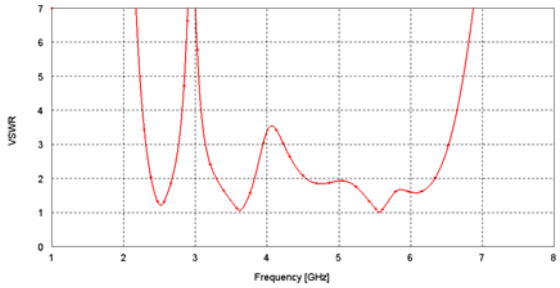

Figure 3.VSWR for the proposed antenna

However there is an 11% change in reflected power when the VSWR changes from 1 to 2 so it is radiated more than 90% power.

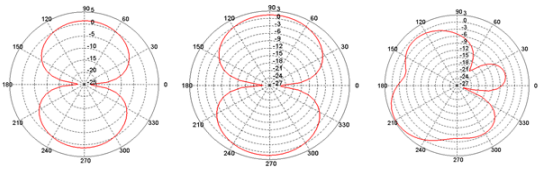

Figure 4.Polar Radiation patterns of antenna at (a)2.47GHz (b)3.52GHz (c)5.45GHz

Its E-far field polar plot is given in Figure 4. The basic patchcovered now is linearly polarized since the electric field only it varies in the one direction. Thispolarization can be either vertical or horizontal depending on the orientation of the patch.The three dimensional radiation patterns of the antenna and gain at different frequencies are shown in Figure 5 and table II respectively. The exhibits omnidirectional radiation pattern and has a reasonable gain at different frequencies.

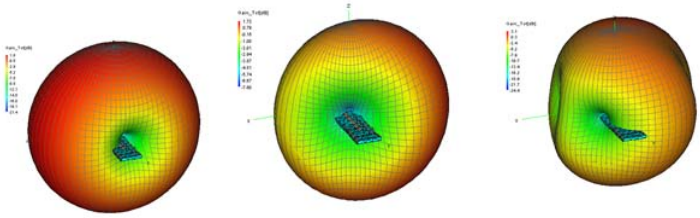

Figure 4.3D Radiation patterns of antenna at (a)2.47GHz (b)3.52GHz (c)5.45GHz

Frequency GHz	2.47	3.52	5.42
Gain (dB)	1.8	1.72	3.1

IV. CONCLUSIONS

In this paper design and analysis of T shaped strip, L shaped strips and F shaped strip has been presented.The design antennas can be used for various applications such as WLAN, Bluetooth, WiMAX and HYPERLAN.Its provides good omnidirectional radiation characteristics and reasonable gain**.**

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