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DESIGN OF MONOPOLE PATCH ANTENNA FORWi-MAX, WLAN, ISM AND C-BAND APPLICATIONS USING STRIP LINE FEEDING

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ABSTRACT:

Multiband in Ultra-wide band microstrip patch antennas is proposed. The antennas are suitable for operating frequency of 3.5GHz and 7.5GHz in Wi-max and ISM band it is shown that return loss of the antennas at 3.5GHz and 7.5GHz is better than10dB. The VSWR obtained is less than 7.5 the patch antenna is found to have the compact size and more bandwidth. The return loss value of first band is -20.0 dB and for second band are -19.0dB. With radiation efficiency 94% and antenna efficiency 80% calculated using ADS simulation software. The measured results are also calculated with vector network analyser.

KEYWORDS:WLAN,ISM,Wi-Max,Ultra-wide band,Patch antenna.

1. INTRODUCTION:

FCC(Federal communications commission) allocated the block of radio spectrum from 3.1 GHz to 10.6GHz for UWB operations. UWB system providesmore than 500 Mbps data transmission within the area of 10metres. The present communications desire condensed size, less cost printed antennas with wideband and ultra-wideband characteristics.There are two types of UWB antennas, that is, directional and Omni-directional antennas.The size of directional antennasis large with high gain andfield of view is narrow. The size of Omni-directional antennas are small and has less gain with widespread field of view since it radiates in all directions.

The main advantage of UWB antennas are low cost, large channel capacity and it is immune to multipath interference. Among the many challenges in UWB antenna design, the major challenge is to achieve wide impedance bandwidth. The UWB antenna is required to be operated over the entire range of 3.1 GHz – 10.6 GHz. The USB antennas are designed to transmit and receive short pulses. The radiation pattern analysis of wide bandwidth is required for efficient operation of the antenna.

In literature many planar shapes, such as square, circular, triangular and elliptical shapes are analysed and reported. The circular ring type antenna is difficult to design compared to monopole based planar antennas, which is due tothe effect of ground pane.The bandwidth of the microstrip patch antenna can be enhanced by modifying the ground plane. Many research work is performed to improve the design of circular antennas.

In [6] the authors proposed a double-ridged horn antenna applied to UWB for human being detection. The frequency in which the antenna works is 0.86 - 2.37GHz with antenna gain is 9.6 -12 dB. The reflection coefficient is less than -10dB. In [7], the authors proposed the design and simulation of a modified double-ridged antenna. This main objective of this work is to the design an ultra-wideband Double Ridged Horn antenna with VSWR less than 2, which operats at 5.3 GHz - 6.3 GHz, 11.02 GHz - 11.8 GHz, 16.5 GHz - 18 GHz, 22.8 GHz - 23.7 GHz and 28 GHz - 29.14GHz frequency ranges which is appropriate as a feed element in reflectors of the RADAR systems. The authors of [10] designed a dipole antenna which is a compact UWB antenna fed by strip line. The antenna is a log-periodic dipole antenna with 18 elements.

2. OBJECTIVE:

The main objective of this work is to design and simulate a compact microstrip patch antenna using Advanced Design System (ADS) simulation software and the characteristics of antenna is analysed. The simulated antenna is fabricated with FR-4 substrate material and thickness of 1.6mm. The fabricated antenna is tested using Network Analyser and the simulated results and fabricated results are compared.

3. ANTENNA CONFIGURATION AND DESIGN:

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The length and width of patch antenna is calculated from equations. The first step is of dimension 2.5*1 mm^2 and second step is 4 mm on Y-axis and 1 mm on X-axis. The ground plane is placed. The slot present at patch is 3*7.9 mm^2. The ground plane is modified to enhance the bandwidth of the antenna. The whole structure of the patch antenna is shown in figure 1 and the dimensions of proposed antenna are shown in table 1.

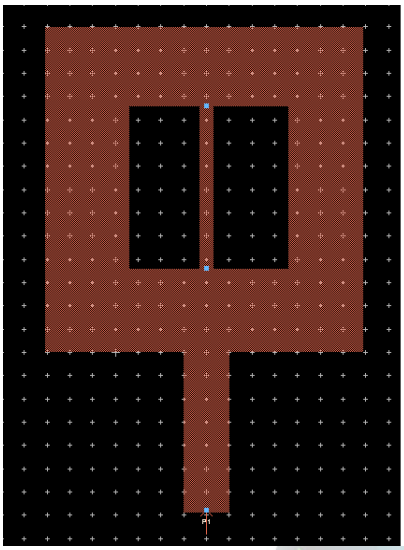

Fig.1 Geometry of Rectangular patch antenna

TABLE I

ANTENNA DESIGNING PARAM ETERS (mm)

W SUB	L SUB	Wg	L g	Wf	Lf	Wp	L p	Ws	Ls
30	35	30	35	3.4	14	13	13	3	7.9

The proposed antenna designed on a FR4 substrate with dielectric constant €r= 4.4 and height of the substrate is h= 1.4 mm. The substrate has length L=30 mm and width W=35 mm. The substrate is mounted on the ground.

4. SIMULATION RESULTS:

This antenna is suitable for operating frequency of 3.5 GHz and 7.5 GHz in WLAN, Wi-MAX and ISM band of frequencies. It is shown that return loss of the antennas at 3.5 GHz and 7.5 GHz is better than -10 dB. The VSWR obtained is less than 1.5 the patch antenna is found to have the compact size and 88.48% maximum fractional bandwidth. The return loss value of first band is 20 dB and the second band are 19.0 dB.

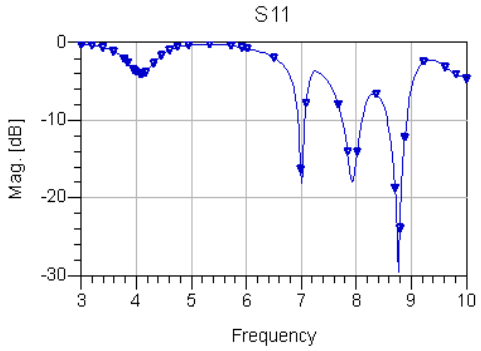

Fig.2. magnitude

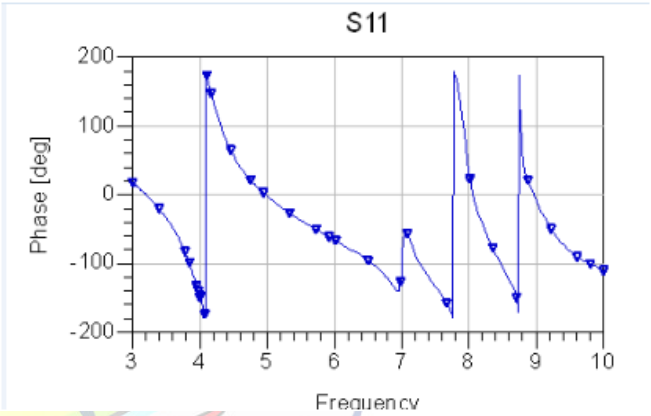

Fig.2.1 phase

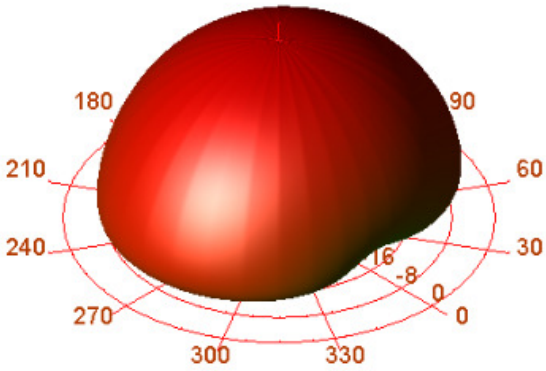

Fig.2.3 Radiation pattern

5. FABRICATION RESULTS:

The antenna structure is fabricated on FR-4 substrate using photolithograohy technique. The fabricated antenna is tested using vector network analyzer.The top view and measurement set up is shown in figure 4.

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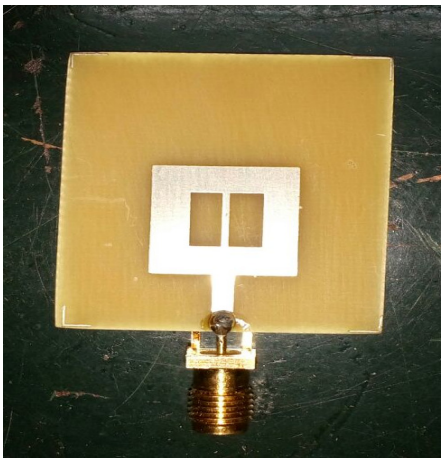

(a)

(b)

Fig.4 Photograph of the designed antenna
(a)Front view (b)Back view

CONCLUSION:

The gain and directivity of the designed antenna is 5.5071 dB and 6.33 dB respectively. By adding suitable slits and slots in the patch and ground, improvement in the bandwidth is achieved. By variation of the ground plane and patch size, a significant impedance bandwidth has been realized.

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