DESIGN OF WIDEBAND AND MULTIBAND ANTENNA USING DUAL PATCH FOR WIRELESS DEVICES

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Abstract

The microstrip antenna using dual patch is proposed for WLAN and WiMax application. The proposed Antenna comprising of Fr4 substrate with C shaped slot connected to simple feed network. Micro-strip line is used as a feeding source. The relative permittivity of Fr4 substrate is 4.44 respectively. By using position and dimensions of the slots the frequencies of dual band can be independently controlled. For the proposed antenna, the return loss is achieved -11.20dB.The micro-strip antennas are used for cognitive radio applications. The design are analysed and simulation using 'Ansoft HFSS' is employed to optimize the antenna properties, which shows the features of good radiation pattern, gain, small size structure operating in wide frequency band for which both return loss and directivity is examined.

Keywords-C-slot, micro strip antenna

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I. INTRODUCTION

Microstrip antennas are used for variety of wireless applications. A Reconfigurable wide band and multiband antenna for compact wireless devices [1]-[3].These antennas generally suffers from narrow bandwidth, so that cannot be used for wireless applications [4]-[6]. These antennas have demand for low profile structure [7].

To achieve the wide band operation various techniques are performed. In that technique the size of the antenna can be changed by varying the current path [8].Low profile antenna applications the dielectric layer must be compact and easy to fabricate [9]. Numerous advantages have been obtained by radiating the patch in microstrip lines [10]. Various works have been done to emphasize on achieving wide frequency band [11].By using microstrip antenna as feeding source the return loss has widest frequency bandwidth among the single feed microstrip antennas [12]. The suitable design of microstrip antenna is obtained by this phenomenon.

To reduce the antenna size has become more important, especially in payload situations, where multiple frequencies are common. Hence to develop the antenna with different frequency bands and serve different functionalities.[13]

To determine the optimal size and spacing, Finite-difference time-domain (FDTD) are employed on the microstrip line. [14] By using Pattern reconfigurable antennas, it avoids the systems from noisy environments and improves the security. The pattern reconfiguration feature is attained with phased antenna arrays, which may be too large and complex to satisfy the requirements of many applications [15].

To achieve multiple octave tune ability, micro strip antenna structures has been emphasized [16].The Radiation pattern reconfigurable antennas have been recently proposed. The antenna radiation pattern characteristics could be switched electrically, such as the far-field pattern shape or the main beam location, within the operational bandwidth. Unfortunately, the radiation patterns of these antennas have the disadvantage of narrow bandwidth. Thus, they are limited for serviceable applications [17].

For the wide band the position of slot can be adjusted [18].The antenna, comprising of rectangular patch element embedded with C-Shaped slot in the patch element. Prototypes of the obtained optimized antenna have been designed and constructed [19]. The return loss and directivity of dual patch by C-shaped slot, operating in WLAN. The parametric study is performed to understand the characteristics of the antenna [20].

II. ANTENNA MODEL

The Geometry of the double patch microstrip Antenna is shown in the Fig. 1. The proposed antenna was fabricated on FR4 with Relative permittivity of 4.44.

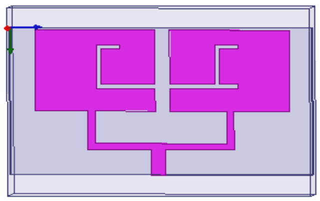

Fig 1 Dimensions of dual patch antenna

The basis of the antenna structure is chosen to be a rectangular patch element with substrate dimensions of width 35.6mm and length 64mm. It consists of two patch elements with simple feed network on one side of the substrate and ground on another side of the substrate. The length of patch determines the resonant frequency. Two patch elements are placed on the dimensions of length 19.6mm, width 25.3mm and height of 1.5mm. These results give wider bandwidth. The C shaped slot is used..

The ground length width and patch are calculated by using transmission line model. The length is obtained by a very popular approximation relation from below equation

$$\Delta L = 0.412\frac{(\varepsilon_{reff} + 0.3)\left(\frac{W}{h} + 0.264\right)}{(\varepsilon_{reff} - 0.258)\left(\frac{W}{h} + 8\right)}$$

The relative dielectric constant of the substrate is given as

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{h}{W}\right]^{\frac{1}{2}}$$

The effective length of patch is given by

$$L = L_{eff} - 2\Delta L$$

The formula for patch width is given by

$$W = \frac{\lambda_0}{2}\sqrt{\frac{r + 1}{2}}$$

The length is given by the formula

$$L = \frac{1}{2f_r\sqrt{\varepsilon_{eff}\mu_0\varepsilon_0}}$$

The Dimensions of the antenna are shown in Table 1

Table 1 DIMENSIONS OF THE ANTENNA

Parameter	**Value(in mm)**
PL	**19.6**
PW	**25.3**
SL	**35.6**
SW	**64**
SH	**1.5**
GL	**35.6**
GW	**64**

FL	**1**
FW	**4**

III. SIMULATION RESULTS

The proposed antenna was fabricated on Fr4 with Relative permittivity of 4.44.

It can cover the 5.15–5.35GHz WLAN band and 3.4–3.69 GHz WiMAX band of wireless communication system. The radiation pattern obtained is shown in Fig 2.

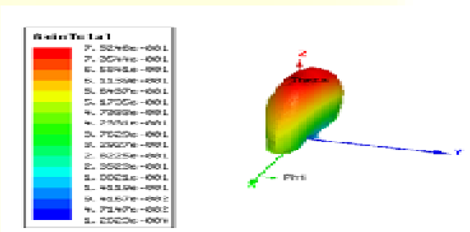

Fig 2 3-D Radiation pattern

Fig 3 shows the current distribution of the microstrip Antenna, The surface current propagates towards the edges and produce radiating current distribution on the patch which leads to increasing the radiating microstrip antenna.

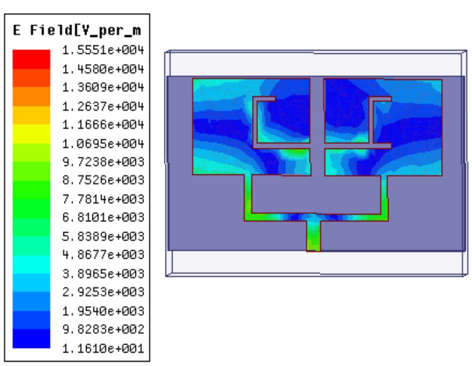

Fig 3 E field distribution

The simulation results of the return loss of the optimized structure to produce the wide frequency band.

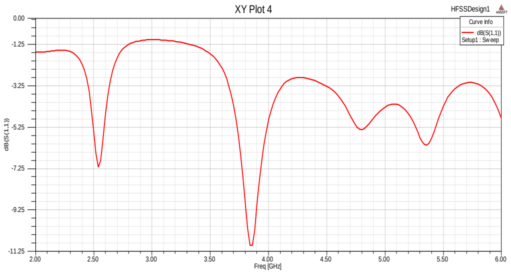

Fig 4 Return loss of the dual patch antenna

The Return loss or reflection loss is the reflection of signal power from the insertion of a device in a transmission line. The measured value is -11.20dB at 3.6 GHz.

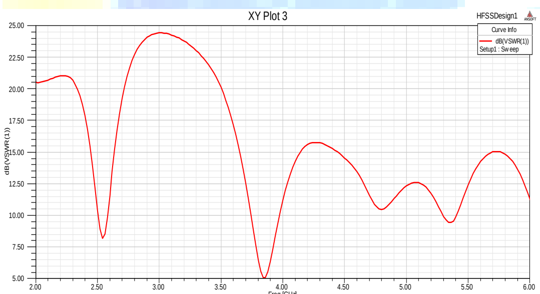

Fig 5 . Radiation Emission

Fig 5 VSWR for dual patch antenna

VSWR is also called as Voltage Standing Wave Ratio. The most common case for measuring and examining VSWR is when installing and tuning transmitting antennas. VSWR is a function of the reflection coefficient, which describes the power reflected from the antenna.

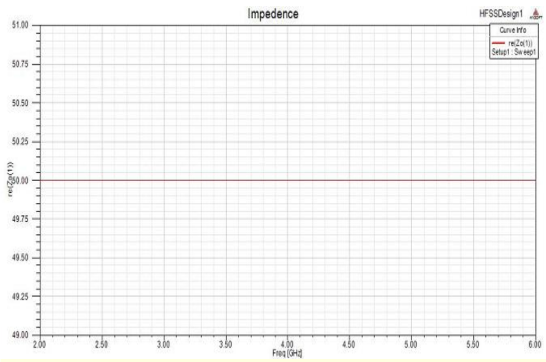

Fig 6 impedance plot

The impedance is perfectly to 50Ω for the frequency range 2 to 6 Ghz.

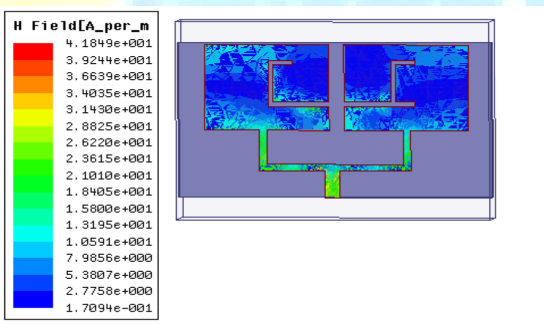

Fig 7 H field distribution

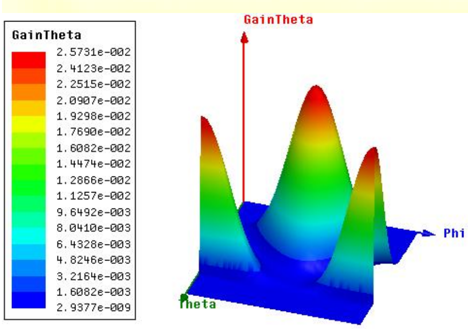

Fig 8 Gain theta

The simulation result for the return loss for the frequency range is 3.6GHz. It satisfies the dual-band frequency. Dual band used in cognitive applications including the co and x-polarization. Dual –band frequencies are used in civil, military, and government institutions for weather monitoring, air traffic control, maritime vessel traffic control , defense tracking , and vehicle speed detection for law enforcement .

The shorter wavelengths of the Dual- band allow for the high resolution imagery from high – resolution imaging radars for the target identification and discrimination. The band width of the Return loss is < -10dB. The simulation and experimental results are completely achieved in the operating frequency band.

IV. CONCLUSION

In this paper, it is possible to design the microstrip antenna with more parameters to adjust the antenna characteristics such as directivity and return loss. The microstrip patch antenna that provides a excellent coverage at a reduced size.The purpose of this work is successfully completed as studied and designed. The Simulated result of return loss of microstrip antenna yields the dual-band. The radiation pattern is Omni directional pattern for all of operation bandwidth. The simulation gives satisfactory results for the requirements to fabricate prototype which can be used.

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