International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 3 Issue: 3 1070 - 1073

A Tri-Band Heart Shaped Microstrip Patch Antenna

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Abstract:- In this paper a tri-band heart shaped Microstrip patch antenna is presented for Bluetooth and C-band applications. The proposed antenna has symmetrical properties and has been designed by etching heart shaped structure on FR-4 substrate with coaxially fed input. It radiates for Bluetooth, WLAN and WIMAX Frequency bands. The gain at 2.4 GHz, 5.4 GHz, and 7.6 GHz respectively is obtained. The proposed antenna can be widely used for Bluetooth, WLAN applications.

Keywords: *Microstrip Antenna, Return Loss, Radiation Pattern, VSWR Measurement.*

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I. INTRODUCTION:

Wireless Local Area Networks (WLAN) are widely used worldwide. The IEEE 802.11b and 802.11g standards utilize the 2.4 GHz ISM band. Mostly, low dielectric constant and thicker material is used for the designing of patch antenna. The patch has different shapes like circular, rectangular, ring and elliptical respectively. Another metallic plate is mounted at the bottom of dielectric which is known as ground plane. Ground plane provides sufficient reflections to the fringing fields which occurred due to the change in length of patch antenna. Microstrip patch antenna is popular for low profile applications at frequencies above 100 MHz. The bandwidth of the Microstrip patch antenna are preferred for radar tracking applications due to their low profile nature and cost effective [1].

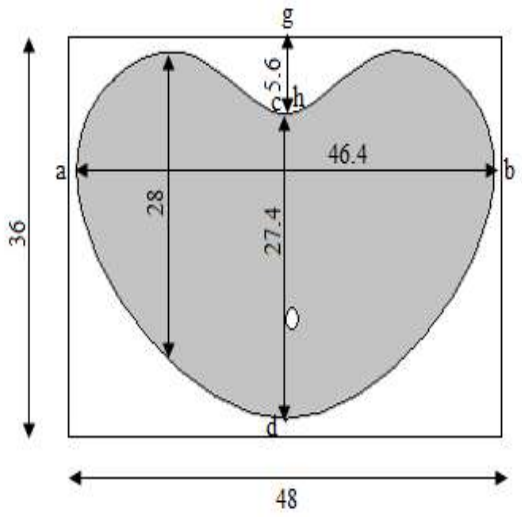
In recent years the demand of Tri-band [2] and multiband antennas is increased, as these antennas can integrate more than one communication standards in a single compact system. In this paper , a Tri-Band Heart Shaped patch antenna for wireless communications is designed to resonate at 2.4 GHz, 5.4 GHz and 7.6 GHz frequencies.

The IEEE 802.11 b and 802.11 g standards utilizes 2.4 GHz ISM band [3].Bluetooth devices and other appliances that use this same band [4]. The 802.11a standard uses the 2.4 GHz band which supports high-speed WLAN [5].

5.4 GHz wireless antennas are perfect to use at IEEE 802.16 and 802.20 standards. These standards are used for Wi-Fi Systems, Radio Local Area Networks (RLAN), Fixed Wireless Access Systems (FWA), WiMAX Technology [6]. A comprehensive parametric study has been carried out to understand the effects of various dimensional parameters and to optimize the performance of the final design.

II. ANTENNA DESIGN:

The geometry of the proposed antenna is shown in Figure 1. The patch antennas are fabricated with various shapes and the most widely designed antennas are E shaped patch antenna [7], H shaped patch antenna [8] and U slotted patch antennas [9], etc... The Microstrip patch antenna consists of three layers patch, substrate and ground. Here, the substrate used for the design of the proposed antenna is FR4_epoxy of thickness 2 mm. The antenna is provided with a coaxial probe feed of radius 0.7 mm at the length of 9.4 mm from the bottom tip of the heart shaped patch. The dimensions of the substrate are taken as 48 x 36 x 2 mm^3 and size of the ground plane is 48 x 36 mm^2.



(a)

 ISSN: 2321-8169
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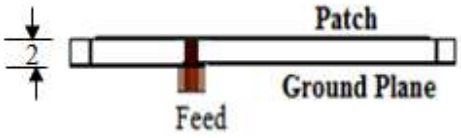


(b)

Figure 1: Geometry of the proposed antenna
(a) Top View (b) Side View

The patch above the substrate is formed by considering 4 poly lines. These arcs are united to form a heart shape. The developed antenna resonates at 2.4GHz, 5.4GHz and 7.6 GHz.

III. RESULTS:

The simulation results for the proposed antenna are shown in the figure below. The return loss is shown in Figure 2. The antenna resonates at frequencies 2.4 GHz, 5.4 GHz and 7.6 GHz with a return loss of 20.43 db, 16.22 db and 17.2 db. The bandwidth obtained at these frequencies are 8.10%, 5.61% and 14.53%. Also, the calculated VSWR values are found to be 1.65, 2.70 and 2.39 as shown in Figure 3. The radiation patterns of the proposed antenna are shown in Figure 4.

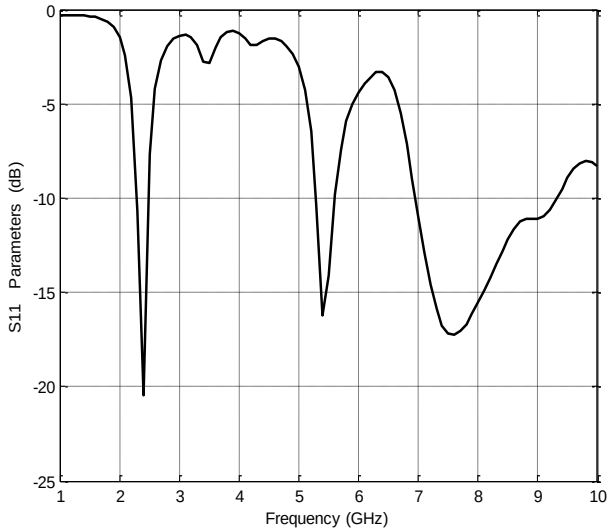


Figure 2: Return loss of the proposed antenna

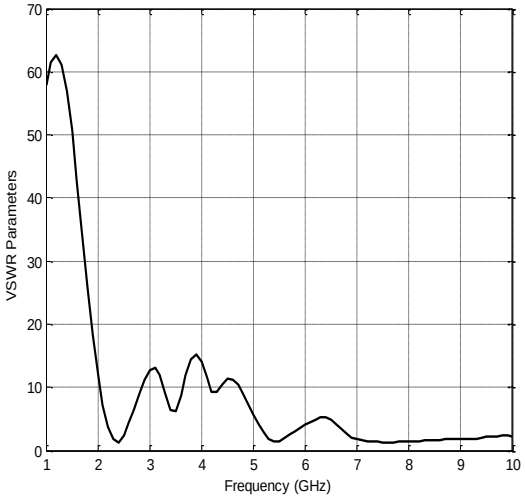
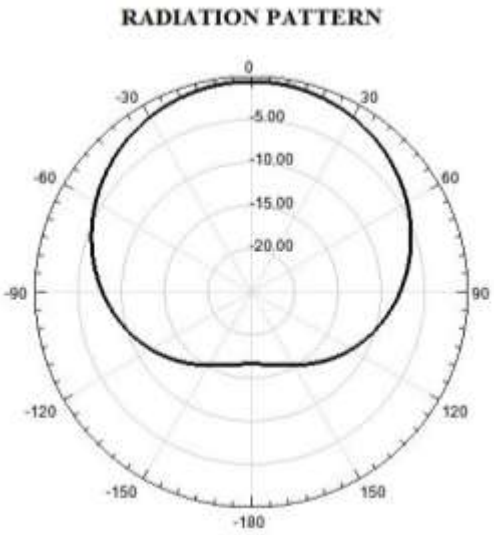
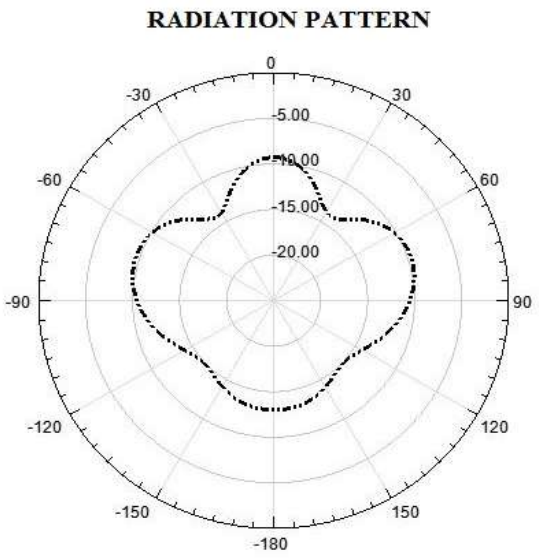


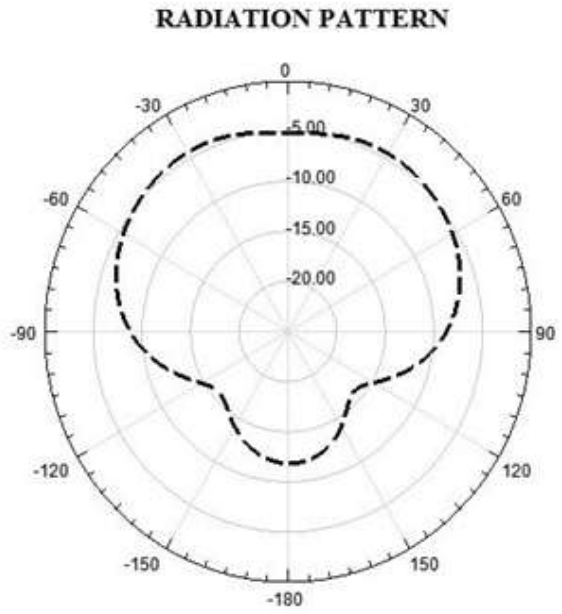
Figure 3: VSWR plot of the proposed antenna



(a)



(b)



(c)

Figure 4: Radiation pattern of the proposed antenna (a) At 2.4 GHz (b) At 5.4 GHz (c) At 7.6 GHz

IV. CONCLUSION:

In this paper, a tri-band heart shaped Microstrip patch antenna for wireless communications is designed to cover 2.4 GHz, 5.4 GHz and 7.6 GHz frequency band. A comprehensive parametric study has been carried out to understand the effects of various dimensional parameters and to optimize the performance of the final design. The proposed antenna can be widely used for Bluetooth, WLAN and WiMAX applications.

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 ISSN: 2321-8169
1070 - 1073

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