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A Dual band Human Shaped Microstrip Patch Antenna for 2.4 GHz and 5.4 GHz Applications

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Abstract: The article presents a structure of human shape microstrip patch antenna operating at dual frequencies. In this paper a rectangular patch of human shape cutting is proposed. The human shape antenna is designed for wireless applications, which works at 2.4 GHz and 5.4 GHz frequencies. This proposed antenna can be widely used for Wi-Fi (IEEE 802.11 standard), BLUETOOTH, WLAN, WiMAX (IEEE 802.16 and 802.20 standards. Radio Local Area Networks (RLAN), Fixed Wireless Access Systems (FWA) and NLOS applications.

Keywords*:* Human shape microstrip patch antenna, Air substrate, Return loss, VSWR, Radiation pattern, Wireless applications.

I. INTRODUCTION

The microstrip patch antenna is one of the most preferred antennas due to its compact shape, light weight, less complexity, easy to implement and conformability. The microstrip patch antennas radiate primarily because of the fringing fields between the patch edge and the ground plane [1]. In recent years the demand for the design of dual band, tri-band [2] or multiband antennas is increased, as these antennas can integrate more than one communication standards in a single compact system.

Fast development of technology of wireless access to Internet and requirements of standards imposed on WLAN, WiMAX [3] and other technologies of wireless networks entourage demand for equipment which is not only reliable and functional but also is characterised by small size. As antenna is essential element of each wireless system it also has to be miniaturized as well as enable work in more than one frequency strip. This article presents Human shape microstrip antenna which operate at two frequencies 2.4 GHz and 5.4 GHz [4].

The IEEE 802.11b and 802.11g standards utilizes 2.4 GHz ISM band [5]. The frequency band is license-free, hence the WLAN equipment will suffer interference from microwave ovens, card less phone, Bluetooth devices and other appliances that use this same band [6]. The 802.11a standard uses the 2.4 GHz band which supports high-speed WLAN [7].

5.4 GHz wireless antennas are perfect to use 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 and NLOS applications [8].

II. ANTENNA DESIGN

The structure of the proposed antenna is shown in Figure 1. The dimensions of the geometry are given in the Table 1. For better performance, the thick dielectric substrate having a low dielectric constant is required for providing a better efficiency, larger bandwidth and better radiation. Hence, the substrate selected for the design of the proposed antenna is air of thickness 3.2 mm and with low permittivity (Єr = 1.0006). The dimensions of the substrate are taken as 120×100×3.2 mm^3. The dimensions of the rectangular patch are taken as 100×80 mm^2. In that rectangular patch Human shape cutting is proposed.

Table 1: Dimensions of the proposed antenna.

Parameter	**A**	**B**	**C**	**D**	**S**
Units(mm)	80	100	11	20	5
Parameter	**H**	**H1**	**H2**	**H3**	**H4**
Units(mm)	5	27	21	27	27
Parameter	**L1**	**L2**	**L3**	**L4**	**M**
Units(mm)	25.5	30	25.5	25	68
Parameter	**M1**	**M2**	**M3**	**R1**	**R2**
Units(mm)	10	40	8	14	8

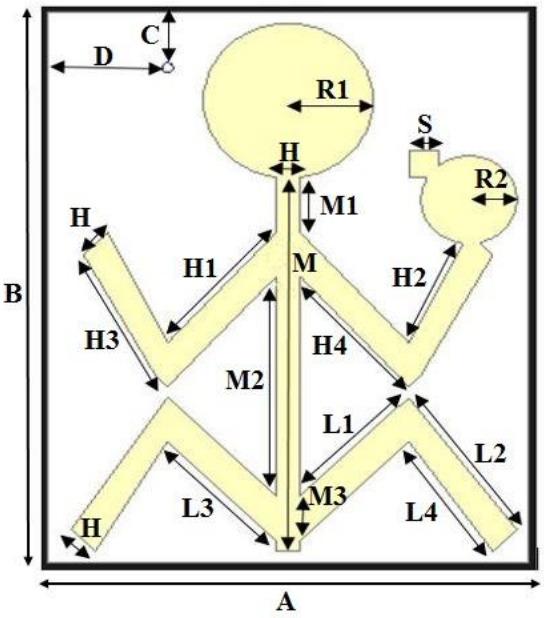

Figure 1: Human shaped microstrip patch.

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Microstrip patch antenna can be fed by variety of methods. These methods are contacting and non-contacting. The four most popular feeding technique used are microstrip feed, co-axial probe feed, aperture coupled and proximity coupled feeding. Here the whole system is fed by a coaxial probe having a radius of 2 mm at position (-40,-20,0). The outer conductor of the co-axial cable is connected to the ground plane and the centre conductor is extended up to the patch. The co-axial probe feed of the Human shape microstrip patch antenna is shown in the Figure 2.

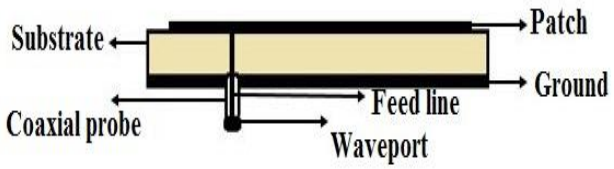

Figure 2: Coaxial feed of the proposed antenna.

III. RESULTS & DISCUSSION

The simulation results for the proposed antenna are shown in the figures below. The S11-parameters are shown in the Figure 3. The antenna resonates at frequencies 2.4 GHz and 5.4 GHz with a return loss of 26.55 dB and 38.58 dB respectively. The bandwidth obtained at these frequencies are 3.92% and 6.49% respectively. Also, the calculated VSWR values at the two resonant frequencies are found to be 1.1 and 1.13 as shown in Figure 4. The antenna radiates normal to its patch surface, so the radiation pattern for $\varnothing = 90^0$ is important for measurement. The radiation pattern is shown in Figure 5 for $\varnothing = 90^0$ at 2.4 GHz and 5.4 GHz.

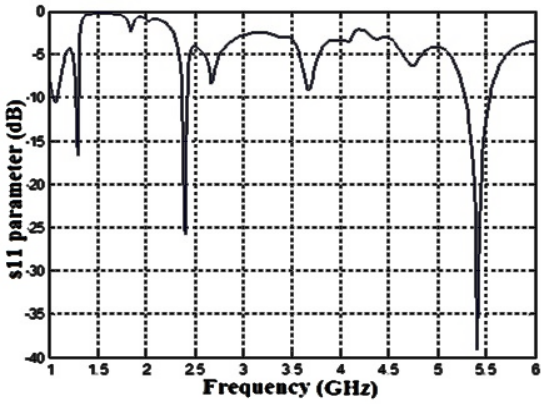

Figure 3: S11 parameters of the proposed antenna.

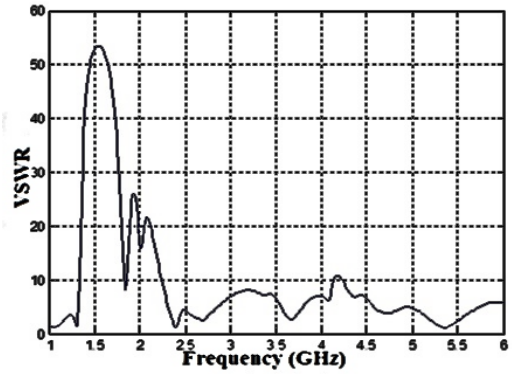

Figure 4: VSWR plot of the proposed antenna.

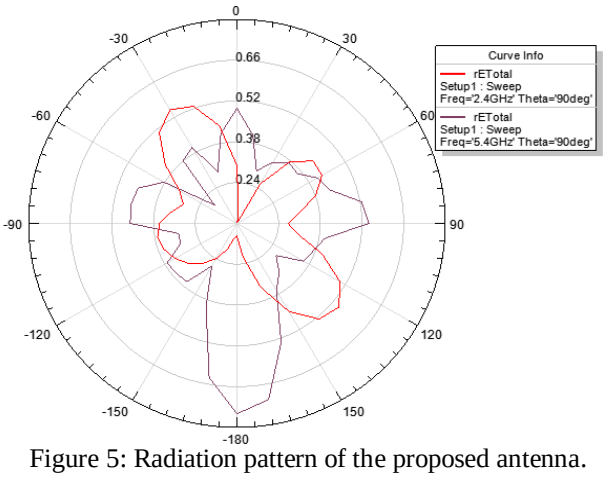

Figure 5: Radiation pattern of the proposed antenna.

IV. CONCLUSION

A Human shape microstrip patch antenna working at the frequency bands 2.4 GHz and 5.4 GHz is proposed. These frequencies are applicable for Wi-Fi (IEEE 802.11 standard) and WiMAX (IEEE 802.20 standard) applications. Return losses of an antenna are 26.55 dB and 38.58 dB at frequencies of 2.4 GHz and 5.4 GHz respectively. The antenna characteristics and radiation pattern are applicable for many wireless applications.

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