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Circularly Polarized Reconfigurable Micro Strip Patch Antenna for Medical Implants.

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ABSTRACT

A novel frequency reconfigurable micro strip patch antenna has been presented for 1.9 GHz, 2.4 GHZ and 5.5 GHz. The frequency reconfiguration is obtained by using layers of mercury and liquid crystal polymer (LCP) on conventional patch antenna. The proposed structure was modeled and simulated using CST Microwave Studio. The simulated return loss for both the configurations is less at the radiating frequencies. The antenna also offers peak high gain on both the frequencies. Thus, the proposed frequency reconfigurable antenna operating on 1.9GHZ, 2.4GHZ and5 .5 GHz promises a great potential for medical applications.
Keywords: Liquid Crystal Polymer (LCP), Medical Implant Com- mutilations Service (MICS), Specific Absorption Rate (SAR).

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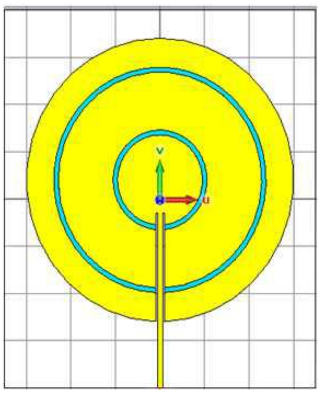
INTRODUCTION

The design of antennas for communication with implants inside the human body has received considerable attention from the research community. The design of these antennas is quite challenging, as there is a limit on the amount on power that can be transmitted and also on the size of these devices. Antennas have long been used in many medical applications including, microwave imaging, medical implants, hyperthermia treatments, and wireless wellness monitoring. Reducing the size and complexity of the antennas used in these applications has been the primary objective of recent antenna research. The planar and small form factor design of micro strip antennas has attracted growing medical applications. [1] Considered a simple dipole antenna at the receiver with a nominal directional gain. Since there is no limitation on the size of the external equipment, we can make use of a large antenna with a very high gain along the direction of transmission. [2] Flexible micro strip antenna that can be placed in contact with the human skin. A specific application of the antenna in microwave breast imaging is considered.[3] an implantable micro strip antenna design is introduced to cover the Medical Implant Com- medications Service (MICS, 402-405 MHz) band for biomedical telemetry systems.[4] explains about the Wireless body-centric sensing systems have an important role in the fields of biomedicine, personal healthcare, safety, and security. Body-centric radio-frequency identification (RFID) technology provides a wireless and maintenance- free communication link between the human body and the surroundings through wearable and implanted antennas.[5] explains the body-worn antennas and medical sensors based on embroidered conductive polymer fibers (e-fibers) on textiles. This technology 13 offers attractive mechanical and RF performance when compared to traditionally flat and rigid antennas and circuits.[6] Specific Absorption Rate (SAR) is analyzed using a numerical human body model (HUGO) to assess the feasibility of the proposed design are significantly improved compared to conventional monopole and dipole antennas.[7] explains Biomedical industry is in continuous growth in the last few years. Low profile compact antennas are 15 crucial in the development of wearable human biomedical systems. The polarization of the proposed antenna may be linear or dual polarized. Design considerations, computational results and measured results on the human body of several compact wideband microstrip antennas with high efficiency at434MHz ±5%.

EXPERIMENTAL

Reconfiguration in the radiating frequency of micro strip patch antenna is carried out by using different layers of mercury and liquid crystal polymer (LCP) on conventional micro strip patch antenna. The frequency reconfiguration operation is performed by using layers of LCP and mercury. In this way, inner patch becomes the radiating patch and antenna starts radiating at 5.5 GHz frequency. For shifting the radiating frequency of antenna, the gapes filled with layers of LCP and mercury. In this way, the diameter of radiating patch extends from which corresponds to 2.4 GHz frequency and the antenna starts radiating on this frequency

DESIGN



SPECIFICATION:

- ➢ SUBSTRTE MATERIAL : ROGERS RT
- ➢ GROUND PLATE : COPPER
- ➢ PATCH MATERIAL : COPPER
- ➢ SUBSTRATE DIMENSTION :84X80mm
- ➢ INNER PATCH :9.8mm
- ➢ MIDDLE PATCH :23.1mm
- ➢ OUTER PATCH : 30mm
- ➢ FEED LINE WIDTH :1.17mm
- ➢ PATCH THICKNESS :0.035mm
- ➢ SUBSTRATE THICKNESS :0.5mm
- ➢ LCP THICKNESS :0.035mm
- ➢ MERCURY THICKNESS :0.1mm

Figure 1: Micro strip Patch Antenna

RESULTS AND DISCUSSION

The performance of the antenna is studied from results obtained from software simulation.

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Table 1: Performance of the Antenna

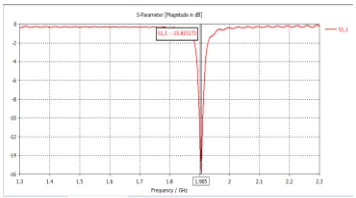
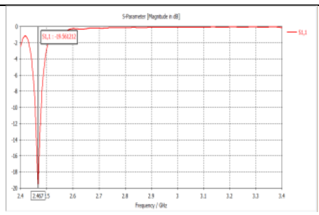
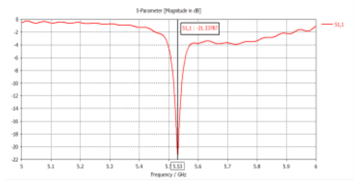
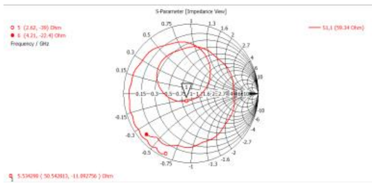
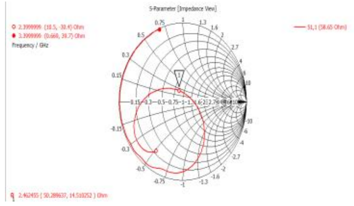
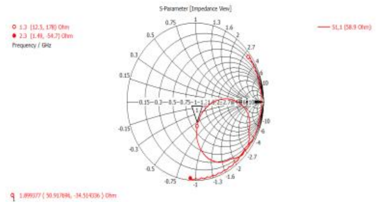
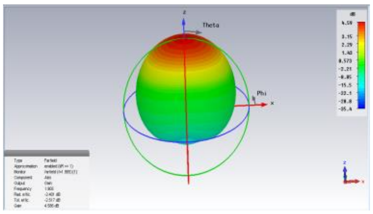
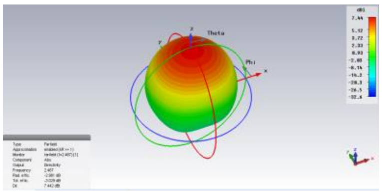
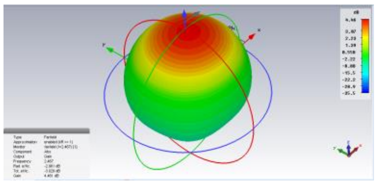
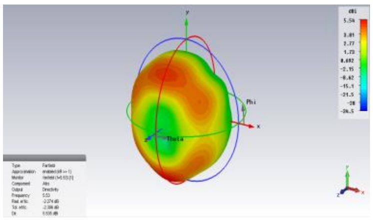
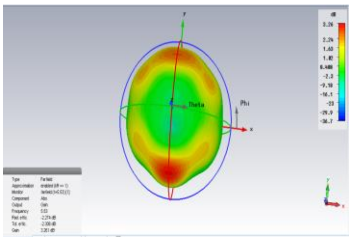
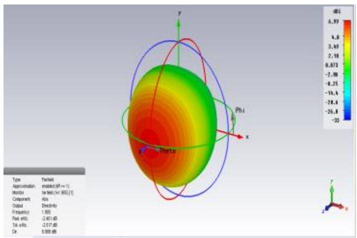
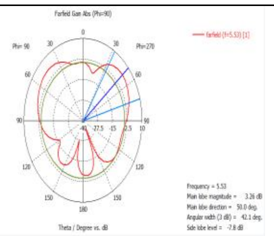
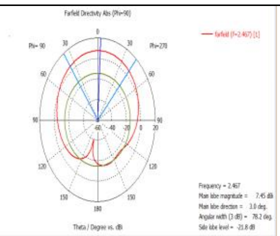
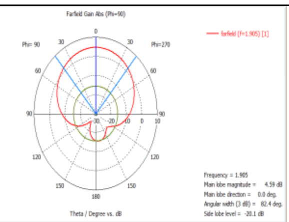
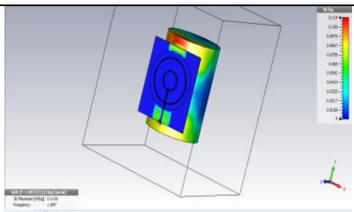
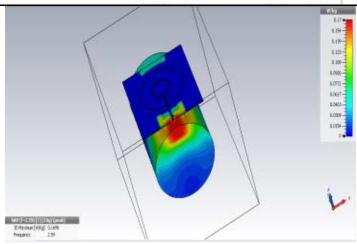
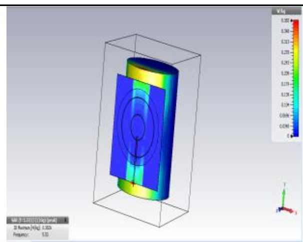
Frequency/ Parameter	Results at 1.9 GHZ	Results at 2.4 GHZ	Results at 5.5 GHZ
S_{11} Parameter			
Impedance Match			
Gain			
Directivity			
Radiation pattern			
SAR at 10g			

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Table 2: Effects of Various Frequency Level

Frequency Range	Return loss S_{11}	Impedance matching	Directivity	Gain	SAR(SPECIFIC ABSORPTION RATE)
1.9 GHZ	-15.81	50.91-j34.2555Ω	6.988 dBi	4.586 dB	0.1192 [W/Kg] at 10g
2.4 GHZ	-19.56 dB	50.28-j14.7957Ω	7.442 dBi	4.46 dB	0.1698 [W/Kg] at 10g
5.5 GHZ	-21.337	50.54-j11.7957Ω	5.535 dBi	3.261dB	0.3826 [W/Kg] at 10g

RESULTS

A compact, frequency reconfigurable, low cost, efficient, micro strip patch antenna has been designed and analyzed. In a nutshell, this paper concludes that the resonant frequency of patch antennas can be reconfigured by using layers of LCP. The frequency reconfiguration procedure has been analyzed and explained. These results show that the frequency reconfigurable antenna has better performance with excellent resonant frequencies and with good return loss values. The antenna also offers peak high gain on both the frequencies. Thus, the proposed frequency reconfigurable antenna operating on 1.9 GHz , 2.4 GHz and 5 GHz promises a great potential for medical applications.

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