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Design of Reconfigurable Monopole Antenna in Med Radio Band

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Abstract- This work carries the design of an antenna specially meant for implant devices. This antenna operates at the Med Radio band (401-406MHz).An antenna miniaturization is accomplished by spiraling. The antenna to be designed for the implant devices has the dimensions of 29mm*11.52mm*0.6mm(200.44mm3).Fabrication of the designed antenna is on the FR4 substrate(εr=4.4). Antenna Design and Simulation is being implemented in ADS.

Keywords-Implantable Antenna; Medical Device Radio Communications(MedRadio band); Pattern Reconfigurable; miniature antenna; Advanced Design System (ADS)

I. INTRODUCTION

There are many such clinical usages where dependency on the implant devices increases in order to promote patient's independence. An important role to healthcare services is being provided by the implantable devices for the purpose of both recognition and remedy[1]. This paper focuses on the software simulation of the monopole antenna. Implantable antenna design attracts high scientific interest to deal with the challenges of miniaturization, biocompatibility, impedance matching, reliable data exchange and patient safety. A damaged biological structure or to enhance the existing structure an implant device is used. The design of an X-band frequency reconfigurable patch antenna has been demonstrated [6], etc. The main component is the antenna for an RF-linked implant device, which needs to meet the size limit requirements[2]. Information regarding the situation of the patient is being provided to the server unit by the in-body antenna. Inorder to exhibit the property of reconfigurable the antenna must be undergo some changes in its elements like switching, implementation of pin diodes and hence avoidance of radiation at unwanted directions results. For better communication this monopole anteena needs to operate at the MedRadio band (401-406 MHz) [8] [5]. In [7] Simulations based on the Finite Element (FE) and Finite Difference Time Domain (FDTD) methods are carried out within different stages of the antenna design and analysis procedures to suit specific needs. In this paper The proposed antenna involves the below measurements:

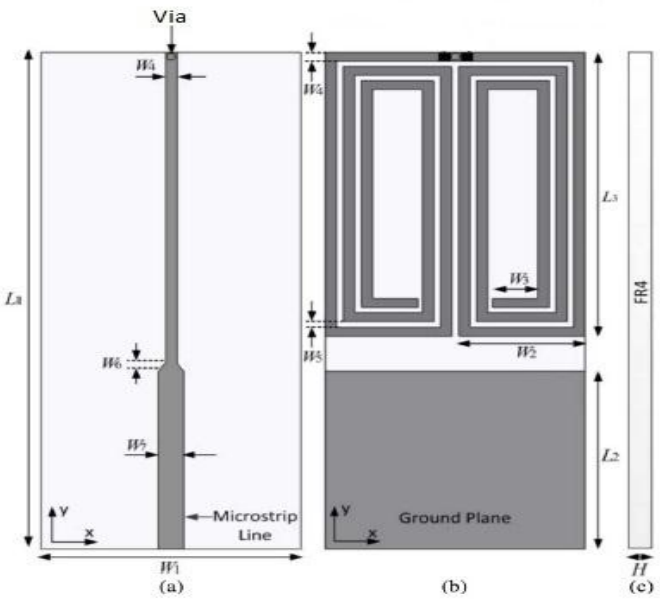

Fig. 1. Three views of the proposed antenna: (a) top view;(b) bottom view; (c) side view.

L1 =29mm, W1=11.52mm, H= 0.6mm.The antenna is designed and developed purely in Advanced Design Systems (ADS) environment. It is built by using the FR4 substrate with a specific relative dielectric constant of εr=4.4 and thickness h of about 0.6mm. The antenna dimensions are all taken in millimeters as shown in Fig 1. Section II deals with the Antenna Design in this paper. Section III consists of the measurement results. Conclusions and future works are being presented in Section IV and V.

II. Design Procedure of the Miniaturized Monopole Antenna

Monopole is an antenna with just the radiating element where the ground of the transmitter is connected to an electrical ground which serves as an Image ground to the radiating element. Thus the name mono pole.In communication systems the most important things to look for are the cost and low power of the device used. A Via is being introduced which shorts the feedline and spirals of the antenna. Fig 3 shows the layout design of the proposed monopole antenna. The spirals and the lowest part of the antenna are combined by means of a via and microstrip feedline. In a radio antenna, the feed line is the cable or other transmission line that connects the antenna with the radio transmitter or receiver. In a transmitting antenna, it feeds the radio frequency (RF) current from the transmitter to the antenna, where it is radiated as radio waves. The loop width of the spirals is 0.3mm. Inorder to match the impedance of 50Ω, a feedline of 1.13mm is choosen .A port as shown in Fig 3 is connected to one end of the microstrip feedline.The Proposed monopole antenna undergoes simulation inorder to resonate at the Medical Device Radio Communications band. The designed monopole antenna for the implants has the dimensions of 29mm*11.52mm*0.6mm (200.44mm3). It is fabricated on FR4 (Flame Retardant) substrate.The dimensions of the proposed antenna are listed in Table I.

TABLE I-Detailed Dimensions of the Proposed Antenna

Parameter	Value(mm)	Parameter	Value(mm)
H	0.6	W3	2
L1	29	W4	0.3
L2	10	W5	0.2
L3	16	W6	0.5
W1	11.52	W7	1.13
W2	5.6		

FR4 substrate and proposed Monopole Antenna Designed in ADS is shown as follows:

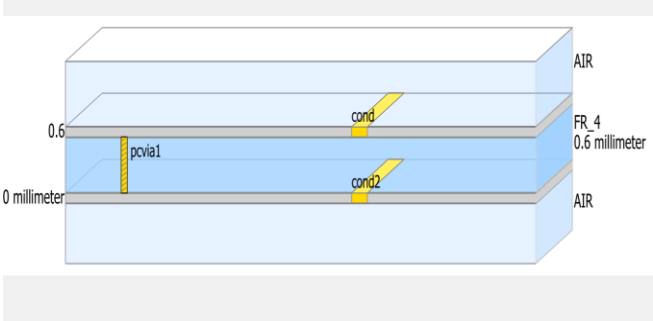

Fig. 2 Design of stack up of the proposed antenna in ADS software.

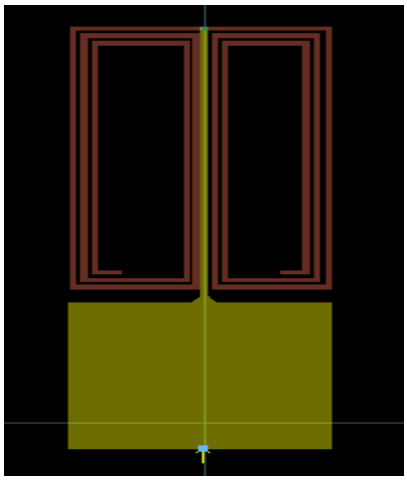

Fig. 3 Proposed Monopole Antenna Designed in ADS

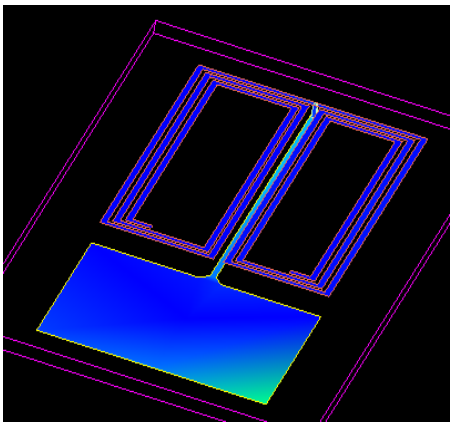

Fig. 4 3-D view of the Proposed Monopole Antenna Designed

III. Measurement and Results

The return loss of proposed monopole antenna is shown in fig. 5. This monopole antenna has the return loss of -4.849 dB at the frequency of 403 MHz. Fig 6 and 7 represents the current distribution and radiation pattern output for monopole antenna without pin diodes.

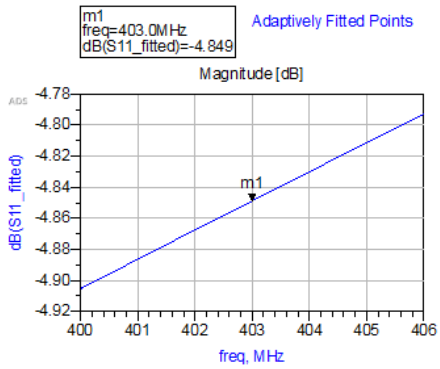

Fig. 5 Return Loss of the proposed monopole Antenna Designed in ADS

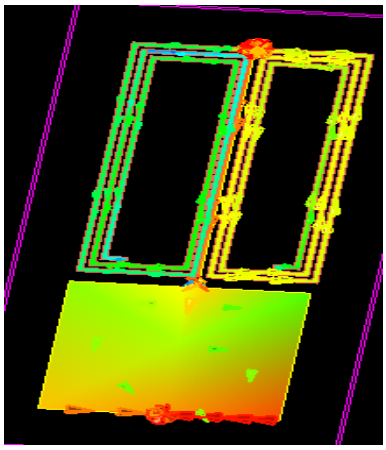

Fig. 6 Current Distribution of the Proposed Monopole Antenna Designed in ADS

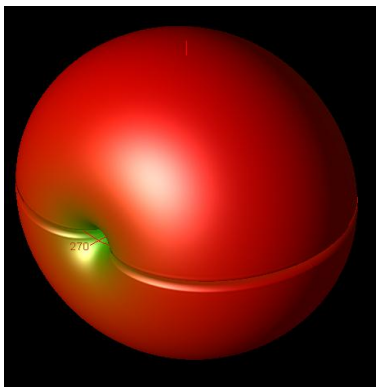

Fig.7 3-D Radiation Pattern of the monopole

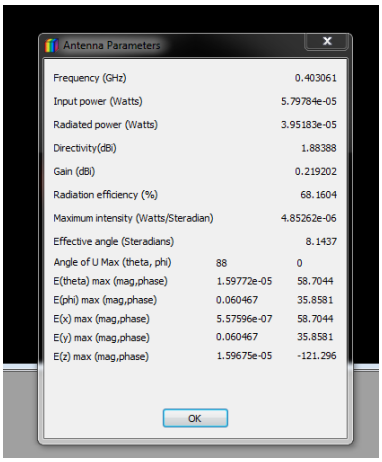

Fig. 8. Antenna Parameters in ADS Simulator.

IV. CONCLUSION

The Simulation of a monopole antenna for the Implant Devices is being Done. This paper concludes only the design of a monopole Antenna and its simulation results. The Antenna Parameters determines the behavior of Antenna.The gain of the antenna is low and hence inorder to improve its gain the copper besides the via are being removed and placed by pindiodes.This will lead to change in the beam direction and hence the radiation in unwanted direction is being minimized.

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