COMPACT IMPLANTABLE ANTENNA USING CPW FEED FOR ISM BAND APPLICATIONS

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Abstract

An implantable CPW fed monopole antenna can be implemented in to human tissue is proposed for ISM band biomedical applications. The proposed antenna is made compatible for implantation by embedding it in an RT duroid substrate (Ω_r=10.2 and thickness=0.65 mm) and also FR4 material (Ω_r=4.6 and thickness=1.6 mm). The proposed antenna used for the ISM band of 2.45 GHz. The radiation parameters, such as return loss, E-Plane, H-Plane, are measured and analysed, using the CST software. The proposed antenna has advantages comparing other implanted antennas, like low profile, miniaturization, lower return loss, and better impedance matching.

Keywords: *Biomedical applications, implanted antenna, ISM band, Method of moments, Coplanar waveguide feed*

Introduction

The implantable antenna are presently used for the communication from the human body to the external environment than an external anenna. Since the implantable antenna gives developments in the patient's care and quality of life. This motivates researchers showing keen interest in the study of implantable antennas. Examples of such developments are in the field of biomedical engineering in glucose monitoring, pacemaker communication, insulin pumps, endoscopy, retinal prosthesis and blood pressure monitoring [1].

Old age patients want a check-up their blood pressure and glucose level at a hospital. The proposed system may be useful in such a way that patient be seated in their house and their health status data can be transmitted to the doctor who will be in remote place [2]. As shown in Fig. 1 [1] the patient can be monitored in remote place. Medical implant devices have to be magnetically coupled to external equipment.

Therefore, to design an implanted antenna, it is necessary to place the implant within the medium in which it will be expected to operate. In this paper, an implantable antenna is proposed for ISM (Industrial Scientific Medical) applications. The proposed antenna is found to be compact in size, and to have a reasonable return loss of -10 dB, to cover the ISM band. Furthermore, the return loss property of the antenna is greater than -10dB.

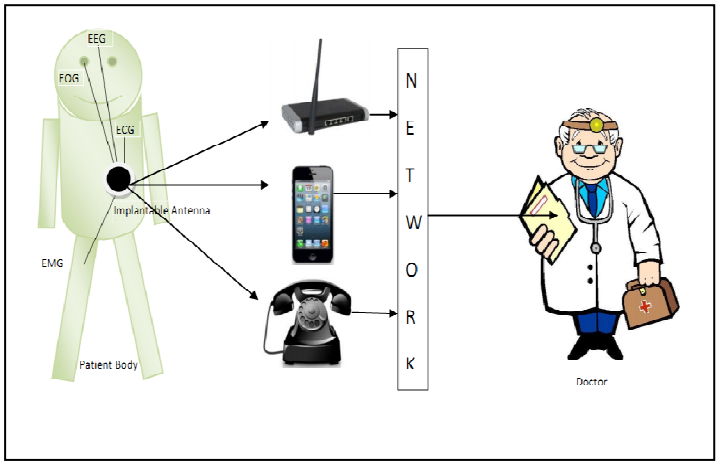

Fig 1 Hospital applications [1]

Some implanted antennas were analysed for ISM band applications [3]. We simulate this antenna, which can be effectively be used at the 2.45 GHz Industrial Scientific Medical (ISM) band.

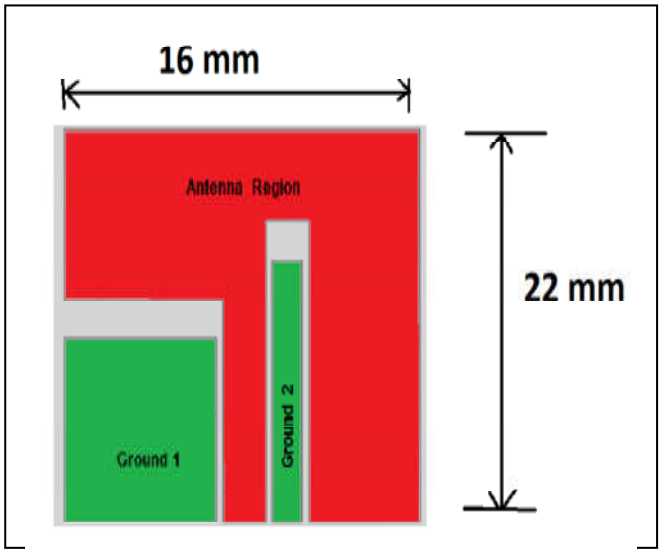

Fig. 2 Geometrical view of the Proposed Antenna (all Dimensions are in mm).

The use of larger implantable units restricts the distance of transmission of the signal. This is due to the fact that our body fluids and skin greatly attenuate the signal, and hence it is required to be compact in size, which has an adverse effect on transmission power and coverage. Such problems can be avoided by the usage of repeater units. The radiation characteristics of a tissue implantable antenna mounted over a human body is simulated, using CST software. The organization of this paper is as follows. In Section 2, the design dimension details of the proposed

antenna are explained. Sec tion 3 presents the working principle of the implantable CPW fed antenna. This section also provides proof that the proposed antenna is highly suitable for ISM band medical applications, with its simulation results. This is followed by the conclusion in Section 4.

Experiments

The layouts of the monopole antenna configurations studied in this paper are shown in Fig. 2, as well as their theoretical models. In the theoretical part, the fundamental design equations are derived from the Schwartz-Christofell transformation in Ref. [4]. Figure 2 shows the examined geometrical configuration of the implantable CPW fed monopole antenna for ISM band bio- medical applications. The antenna was constructed on RT duroid and FR4 substrate, with thickness of 0.65 mm and dielectric constant ε_r of 9.8, and 1.6mm with dielectric constant of ε_r of 4.6. The proposed antenna simulation model setup is shown in Fig. 3.

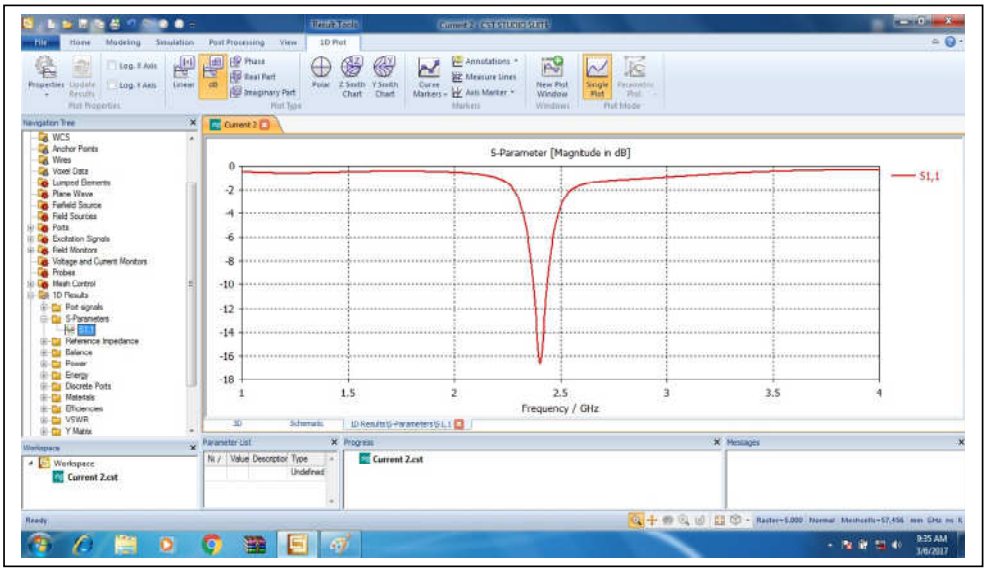

Fig. 3 Simulated Return loss in dB

Results and Discussion

The return loss result is shown in figure 3 and it clearly says that the bandwidth and operating frequency are upto the expected level i.e., return loss less than -10dB. In figure 4 the radiation pattern of the directivity is used and the red color shows the high radiation and green colour shows the average radiation.

Conclusions

In this paper, an implantable CPW-fed monopole antenna for ISM band biomedical applications is presented, with a compact size of (16 mm × 22 mm × 0.65 mm), and solutions are suggested regarding the design, numerical simulations, and experimental investigations of an implantable CPW-fed monopole antenna

for biomedical telemetry. The size of the antenna is reduced from the reference paper design dimension. Due to the better dielectric constant of RT duroid substrates, the implantable antenna exhibits miniaturization, lower return loss, good VSWR, and better impedance matching and high gain, compared to the other implanted antennas. Therefore, the proposed antenna is a suitable candidate for the ISM band frequency of 2.45 GHz, in the field of Biomedical Engineering.

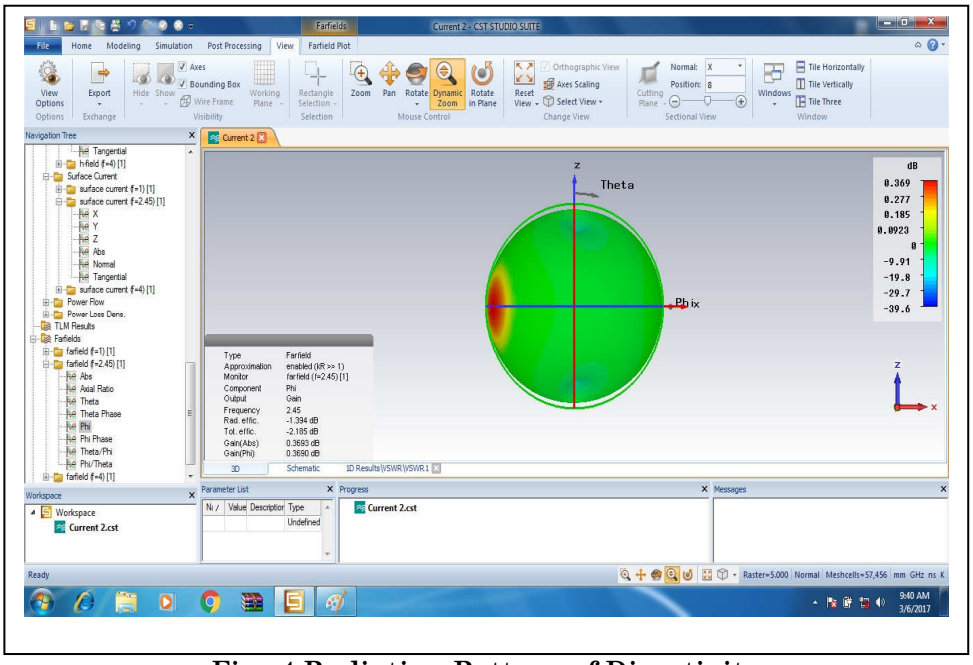

Fig. .4 Radiation Pattern of Directivity

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