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Rectangular Microstrip Patch Antenna Operating in ISM band for Medical Applications

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ABSTRACT: In this paper microstrip patch antenna is presented for biomedical applications. This antenna resonates at2.45GHz. The proposed microstrippatch antenna has rectangular structure withmicrostrip feed. Roger having dielectric constant 10.2 is used as substrate material. The structure is simulated using IE3D. Simulation result shows that it covers the frequency band2.38GHz to2.52GHz. Microstrip patch antenna is preferred as it is flexible in shape, conformal and miniaturization can be achieved to a great extent.

KEYWORDS: Antenna, ISM band, microstrip antenna, biomedical application

I. INTRODUCTION

Implantable medical devices are used to perform a wide variety of diagnostic and therapeutic function. With the help of biotelemetry and integrated implantable antenna full duplex communication is made possible between implantable antennas with on body receiver antennas for in-body communication system. Also wireless communication makes inroads into every aspect of human life. Designing an antenna for implanted application is difficult because of different electrical properties of human tissue. Also size of antenna at low frequency is a very crucial factor. Implantable medical devices can communicate wirelessly with an external device. Biomedical telemetry can be both real time and stored physical signals can also be communicated to the receiver. As per the recommendation of FCC, Industrial, Scientific and Medical (ISM) band is suitable for medical appliances. Microstrip patch antenna is preferred as it is a narrowband, wide-beam antenna. These are fabricated by etching the antenna element pattern in metal trace bonded to an insulating dielectric substrate, such as a printed circuit board, with a continuous metal layer bonded to the opposite side of the substrate which forms a ground plane. Ground plane acts as reflector for radiation or it prevents radiation towards human body.

Common microstrip antennas are designed in shapes like square, rectangular, circular and elliptical, but any continuous shape is possible. Some patch antennas do not use a dielectric substrate, instead they are made of a metal patch mounted above a ground plane using dielectric spacers; the resulting structure is less rugged but has a wider bandwidth.

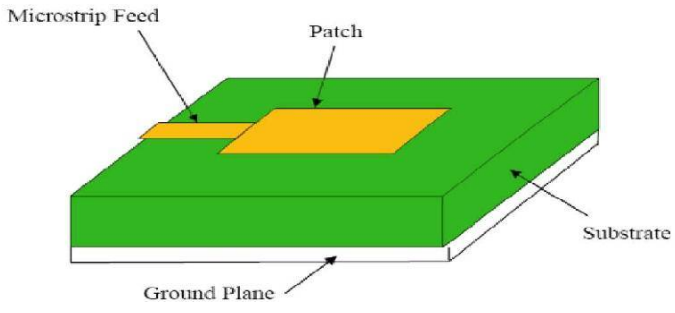

Fig 1.Microstrip patch antenna

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II. RELATED WORKS

The great interest of researchers in Wireless Body Area Networks (WBAN) and its applications have recently led to vast developments in wireless communication technologies. Wireless biotelemetry systems, such as implantable on-body and off-body medical antennas, have significantly enhancedthe exchange of physiological data from the body to external monitoring devices compared to the traditional inductive coils [1]. Their higher data rates and longer communication range have been excessively exploited in applications such as hyperthermia treatments, microwave breast imaging, implantable brain computer interfaces, and wireless telemedicine. Successful use of medical devices requires effective communication of the critical microwave signal to the monitoring device [2]. This includes taking into consideration the multipath fading due to the movement of the body as well as the high dielectric constant of the tissues surrounding the radiated signal [3]. In addition, the wearable device should be low profile, small size, and light weight in order to facilitate its use in the human body [4][5].

Nowadays, many proposed wearable antenna have beenintroduced due to the invention of broaden applications indifferent fields such as telemedicine applications, Satelliteapplications, and GPS, to mention a few. The wearableantenna has several requirements must be considered duringthe design such antenna small size, light weight and conformalto devices and body shape. For these requirements anddemands, many wearable antennas have been reported to getthe aforementioned issues. A flexible and compact AMCbased antenna for telemedicine applications is proposed forWireless Body Area Network (WBAN) and telemedicineapplications operating at 2.45 GHz [6]. A compact polyimidebasedantenna for flexible displays has been introduced [7]. Awearable circularly polarized antenna for personal satellitecommunication and navigation has been reported [8].

III. PROPOSED ANTENNA STRUCTURE AND SIMULATED RESULT

Medical devices can communicate wirelessly with an external device. Designing an antenna for medical devices is very critical. Size of antenna must be very small. Many research works is going on around the globe on the size reduction of the antenna at the ISM frequency band. Most of the available structures are complex (like spiral, helical, rectangular spiral, and fractal) and inherently very difficult to design and implement. Complex mathematical calculations are involved in analysing these structures. In this paper a microstrip rectangular patch antenna has been proposed. The structure has been simulated in IE3D. The substrate material used is Roger having dielectric constant of 10.2, with a substrate height of 1.6mm. In the proposed antenna ground plane used is 40x40mm^2 and the patch dimension is 24x24mm^2. The simulation result shows that the antenna covers ISM band of center frequency of 2.45GHz.

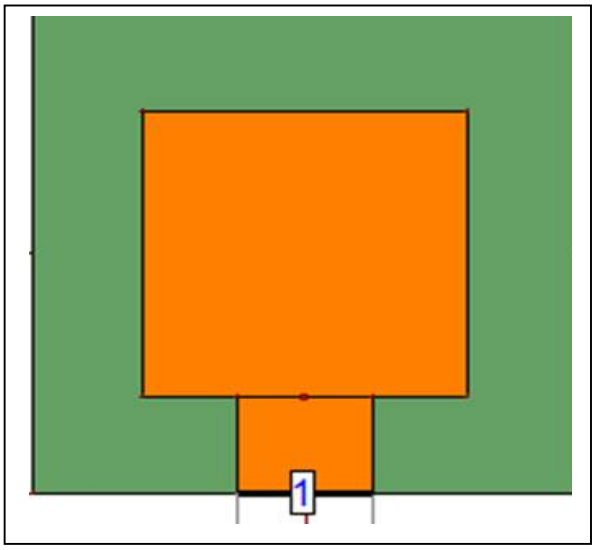

Fig1. Proposed Microstrip patch antenna

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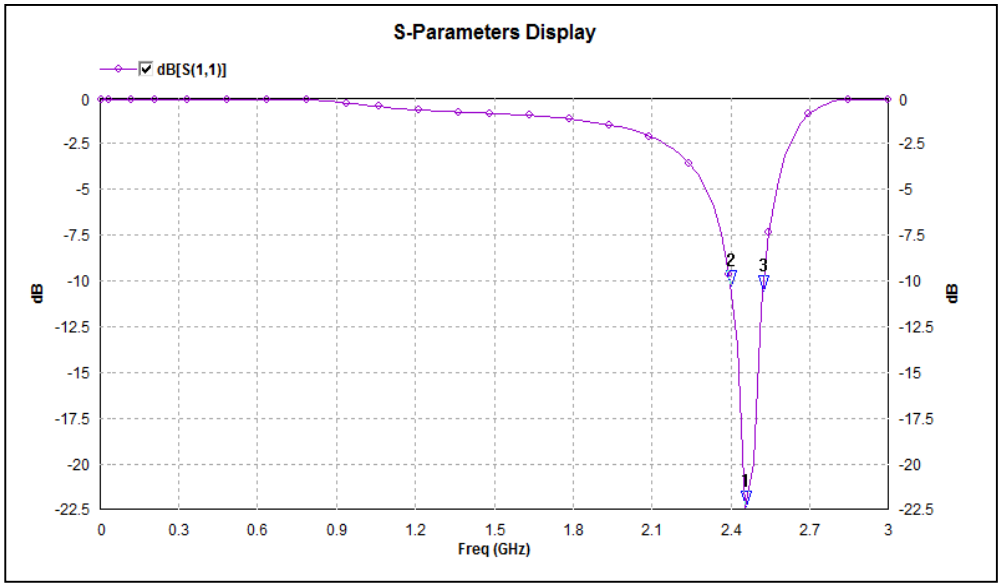

Fig2. The S parameter display

IV. CONCLUSION

Microstrip patch antenna is simple to design and implement due to its sensitivity at high gain but it is difficult to design it in ISM band. However, Microstrip patch antennas give high directivity, high gain and antenna efficiency. Thisantenna design can be very helpful in the communication system for many applications in fields such as biomedical example- pacemaker. The demand for narrowband antenna is increasing day by day. To meet with these increasing demands, more efficient antennas such as Microstrip patch antennas are required.

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