International Conference on Emerging Trends in Engineering, Science and Management
Sphoorthy Engineering College, Hyderabad, India (ESM-17)
17th and 18th March 2017 , www.conferenceworld.in ISBN: 978-93-86171-32-0

HEXAGONAL MICROSTRIP PATCH ANTENNA FOR BIO-MEDICAL APPLICATIONS

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ABSTRACT

In this paper we present a Hexagonal Microstrip Patch Antenna for Bio-Medical Applications. The proposed antenna designed by FR4 substrate using 4.4 dielectric constant with overall dimension of the antenna is 80X60X1.74mm3.The proposed antenna resonate at different frequencies 2.25GHz, 5.5GHz, 6.5GHz,8.2GHz, and 9.5GHz and its isolation -22.5dB, -12.5dB, -17dB, -16.5dB, -11.5dB with overall bandwidth 680MHz. The antenna results shows that it is well suited for biomedical and wirelessapplications.

Keywords: Micro strip Patch antenna, ISM band, Bio-Medical application.

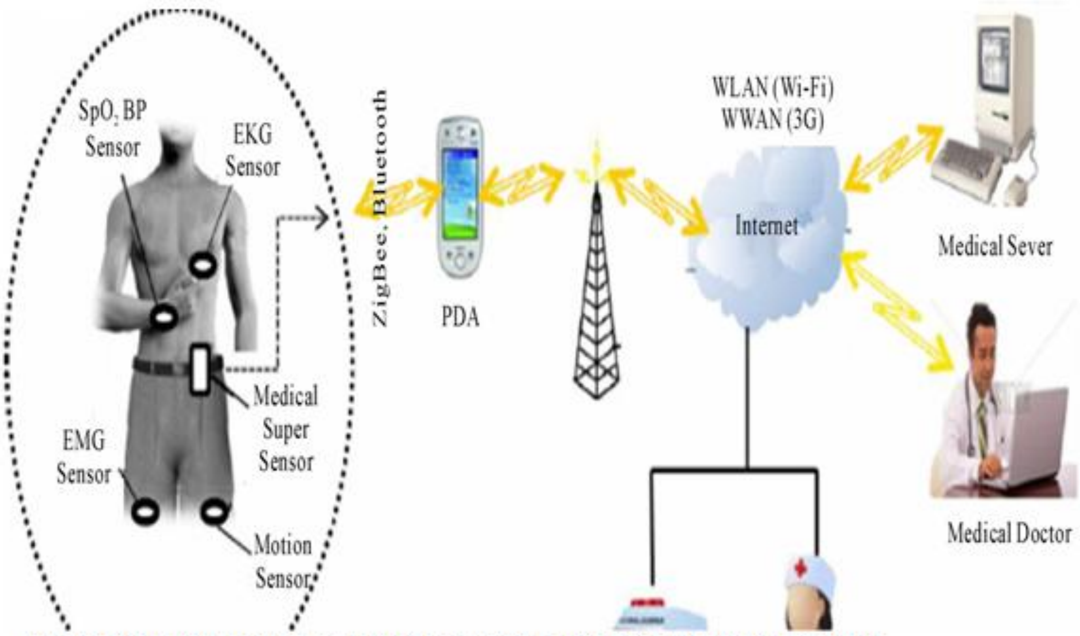
I. INTRODUCTION

Nowadays, there is an increasing need for diagnostic and therapeutic functions which are provided by Implantable Medical Devices (IMDs). With the help of integrated implantable antenna the bidirectional telemetry operation is done between exterior monitoring equipment and implantable medical device in a wireless manner. The implantable antenna comprises an advantage of creating such technology very attractive since it possesses the capability to be handled remotely. It is essential to study the biological property of the human tissues while implementing the implantable antennas within a human body because the human tissues lead a crucial role. This implantable antenna is fitted at the chest simply under the collar bone.

By varying the frequency, the conductivity and relative permittivity of the human tissues also vary. In implantable antenna design, the patch designs are much important because of its shape and flexibility [1]. Through the MICS band and the ISM band, the communication is accomplished at the frequency between 402.0 MHz to 405.0 MHz and 2.1 GHz to 2.48 GHz respectively [2]. The cables are removed because of the wireless links. Thus the operations are simplified by the way cost-effective communication is achieved [6]. The experimental and numerical studies of implantable patch antennas are much interesting which attract particular scientific interest [8].

In past few years due to the advancement in technology compact communication devices are produced which comprise compact antennas. The power is transmitted through the antennas which have less focus. For constant wireless applications the design of low profile antenna is essential. The microstrip patch antennas are employed for a wide range of applications such as biomedical applications, communication systems and satellite applications and it is also required to transfer power.

The coplanar waveguide (CPW) feed is used in the proposed system because this CPW feed can minimize the back radiation and respond at the range of high frequency. The total size of the antenna is about 10 ∗ 10 mm with 1 mm thickness. Design and analysis of a hexagon shape antenna are proposed with human phantom models such as muscle, fat and skin along with its relative dielectric permittivity, electrical conductivity and mass density and some of the parameters such as gain, return loss, radiation pattern and VSWR are measured [9]. The measured return loss is −29 dB at the frequency of 2.25GHz. The size of the muscle, fat and skin is 8 mm, 4 mm and 4 mm respectively.



Architecture of wearable sensors for remote healthcare monitoring system

ANTENNA DESIGN*:Figure-1 shows the geometry of the proposedantenna, the substrate of antenna is* RO3730 of thedielectric constant 3 and height 1.534, the antenna side is21.8 mm

Figure-1.The antenna used to compare the results of theproposed antenna is a rectangular patch microstrip antennaof 39 mm X34.5 mm mounted on the dielectric substrateof 80 mm X 60 mm X1.534 mm. In order to simulate theeffect of the human body presence on the antennaperformances a human tissue model is modeled as themulti-layers as shown in Figure-2, its layers dimensions are 120 mm X130 mm with 1mm height for the Skin ofthe constitutive parameters of (εr = 38.0066 and σ =1.464S/m), 2 mm for fat of the constitutive parameters of (Er =5.280 and σ =.104 S/m), and 30 mm for muscle of theconstitutive parameters of (εr =54.417 and σ =1.882 S/m).The antenna mounted above the model to show the effectof the human body antenna performances.

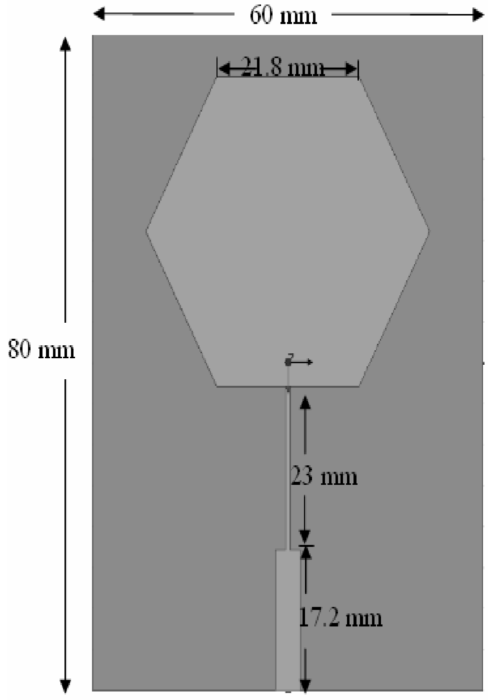


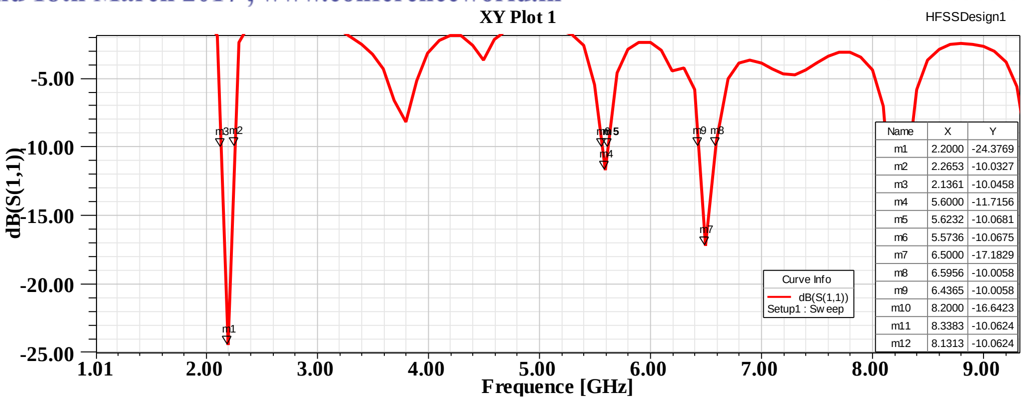
Figure-2. Human tissue model.

SIMULATING RESULTS

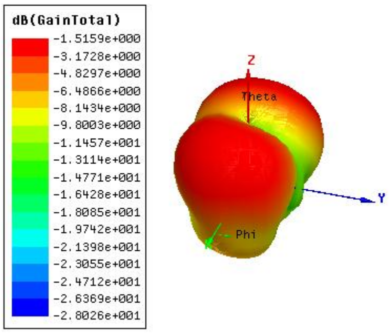
In order to validate our design of the proposed antenna ofFigure-1 High frequency structure simulationHFSS based on the FiniteAntenna geometry Element Method FEM and HFSS integral equation are used, Figure-3 shows the return loss, Sparameters, of the proposed antenna compared with therectangular patch antenna operated in the same ISM band at frequency of 2.25 GHz.To study the effect of the human body tissues onthe antenna performance, the antenna but on the tissuemodel, shows the simulated results for the S parameter and, while for the radiation patternparameters for tow antennas under study.In the antennathe return losses and theradiation pattern of the rectangular microstrip patchantenna.The antenna performances are listed in the Table-1. As shown from previous Figures and the Table-1, theproposed antenna performances are enhanced inbandwidth and maximum total gain with no change in theresonant frequency. Figure-8 shows the three dimensionradiation pattern of rectangular patch and the proposedantenna in air and on the human body model.

S-PARAMETERS*:S-parameters describe the input-output relationship between ports (or terminals) in an electrical system. For instance, if we have 2 ports (intelligently called Port 1 and Port 2), then S12 represents the power transferred from Port 2 to Port 1. S21 represents the power transferred from Port 1 to Port 2. In general, SNM represents the power transferred from Port M to Port N in a multi-port network.*

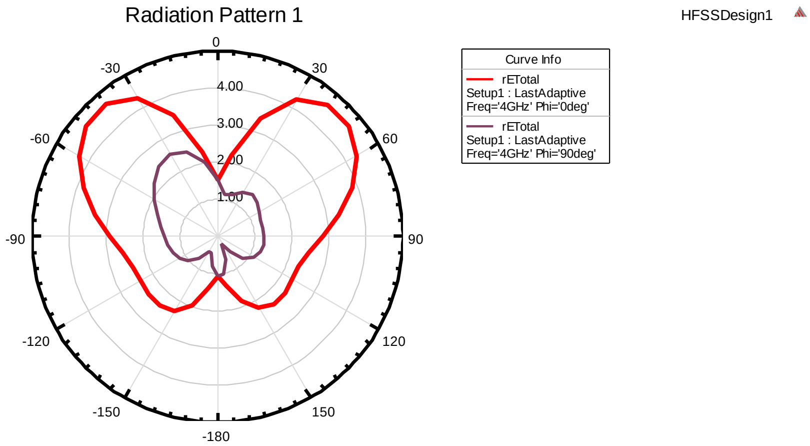
A port can be loosely defined as any place where we can deliver voltage and current. So, if we have a communication system with two radios (radio 1 and radio 2), then the radio terminals (which deliver power to the two antennas) would be the two ports. S11 then would be the reflected power radio 1 is trying to deliver to antenna 1. S22 would be the reflected power radio 2 is attempting to deliver to antenna 2. And S12 is the power from radio 2 that is delivered through antenna 1 to radio 1. Note that in general S-parameters are a function of frequency (i.e. vary with frequency).



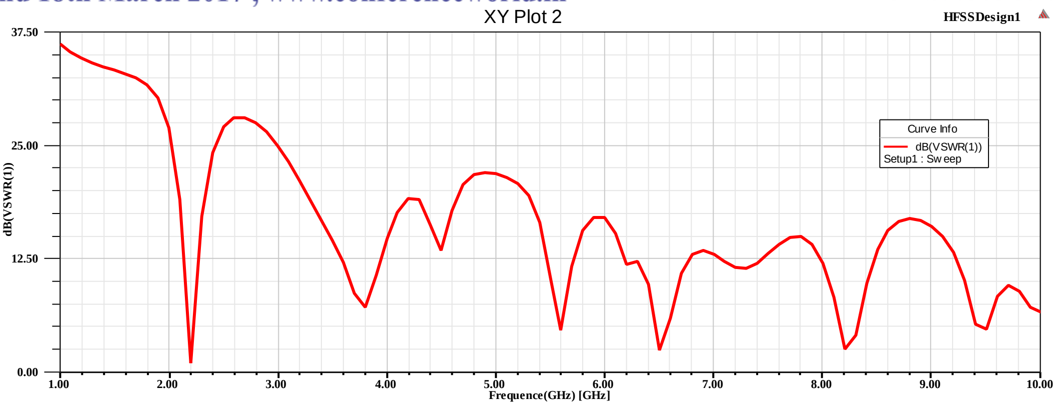
3D-POLER FIELD:

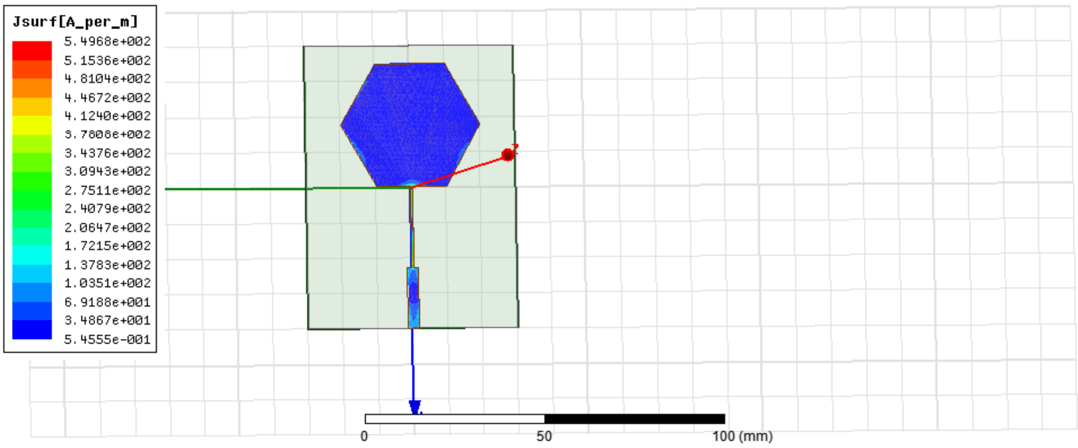


RADIATION PATTERN:A radiation pattern defines the variation of the power radiated by an antenna as a function of the direction away from the antenna. This power variation as a function of the arrival angle is observed in the antenna's far field.



VSWR:*For a radio (transmitter or receiver) to deliver power to an antennathe impedance of the radio and transmission line must be well matched to the antenna impedance. The parameter VSWR is a measure that numerically describes how well the antenna is impedance matched to the radio or transmission line it is connected to. VSWR stands for Voltage Standing Wave Ratio, and is also referred to as Standing Wave Ratio (SWR). VSWR is a function of the reflection coefficient, which describes the power reflected from the antenna.*





CONCLUSIONS

A new antenna has been design and simulates touse in the ISM band at the center frequency of 2.25 GHz.New antenna has no significant effects in its performanceswhen the human body is present compared with therectangular patch microstrip antenna.

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