ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 3, March 2017

Design and Analysis of Implanted Low Profile Antenna for Bio-Medical Applications

P.Jyothi[1], K.Prasanna Kumar[2], P.Devi[3], R.Srikavya[4], T.Anil[5],

B.Tech Student, Department of Electronics and Communication Engineering, LIET, JNTUK, India

Associate Professor, Department of Electronics and Communication Engineering, LIET, JNTUK, India

Assistant Professor, Department of Electronics and Communication Engineering, LIET, JNTUK, India

B.Tech Student, Department of Electronics and Communication Engineering, LIET, JNTUK, India

B.Tech Student, Department of Electronics and Communication Engineering, LIET, JNTUK, India

ABSTRACT: Implantable devices have been introduced with great interest as communication tools. These implantable devices are implanted into the human or pet body. The vital information (such as Temperature, Blood pressure, Cardiac beat, Cancer identification, Thyroid, Sugar levels etc.) can be transmitted from implantable devices to the external equipment by use of a wireless communication link. Therefore, the research on the antenna for implantable devices (implanted antennas) is very important. In this paper, a micro strip patch antenna is proposed which is suitable for bio-medical applications. The main goal of this paper is to design a micro strip patch antenna which is suitable at 6 GHz for remote health monitoring system. In remote health monitoring system the patient has no need to consult the doctor face to face and the condition of the patient can be monitored and can also diagnose the level of the disease. Generally the health monitoring system is mainly useful in remote areas. This low profile antenna has dimensions of 41.5mm*29mm. when printed on a Rogers ultralam 1217 substrate of dielectric constant 2.17 and height 1.6 mm. Simulated return loss and pattern results obtained through software package of HFSS provided and results are obtained.

KEYWORDS: Micro strip patch antenna, Return loss, VSWR, Bandwidth, Bio-medical Applications, Remote health monitoring system, Implanted devices.

I. INTRODUCTION

The generation of antenna has facilitated increasing interest in new applications for wearable communications and unwearable communications, with such body-centric networks becoming important in medical, military, and commercial sectors, Bio-telemetry, Hyperthermia. For example, continuous wireless remote monitoring and logging of vital signs is useful for supervising the health status of patients suffering from chronic diseases or providing early indication for impending heart attacks and terrorist identification in military application. Such remote health care solutions have the potential to compensate for limited health care resources and costly equipment. Likewise, specialist professions such as fire service, police, and military are keen on integrating a network of small mobile terminals into clothing or body-centric for monitoring and short range communications between team members in an attempt to increase survivability, awareness, and performance.

Many of these emerging applications are focused on integration of radiofrequency (RF) transceiver modes with signal processing and sensor Circuitry for small, low power wireless sensor nodes, with user, and ideally conformal to the body surface, yet they must maintain high performance in terms of efficiency and reliability, cost.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 3, March 2017

In the 1990s, the role and possibility of implanted device systems were suggested for implementation of future telecommunications. The examples of the applications for humans are measurement of temperature, blood pressure, and continuous monitoring of cardiac beat and the medical records or body information, such as allergies, can be saved in the implantable devices. Thus, these devices are useful for the decision of a diagnosis and treatment method of a patient. Some other applications are finding lost pets, controlling farm animals for safety and quality management, quantity measurement. It is suggested that the implantable devices transmit the recorded information by using a reading device and the personalinformation can be received outside the body by use of a data exchange between the implantable device and the computer network. Obviously, these implanted devices must be wirelesswhen used to communicate with the exterior, because they are implanted into the human or animal body (domestic animals and wild animals). Therefore, it is appreciated that the antenna of an implanted device system has a particularly important role as the part of transmitting and receiving power in the human body and animals.

Now a days, antenna technology is not only used in the field of communication but also playing a key role in different areas like military and commercial areas in addition to biomedical applications. Antennas are widely using in medical applications like hyperthermia, cancer treatment, tumor detection, head and neck cancer treatment, remote health monitoring, speech sensing, self-monitoring, digestive monitoring etc. As in remote health monitoring system the antenna should be implanted on patient's body so that it should be small as much as possible. A micro strip patch antenna is better for this system as it can be designed in small size and also easy to fabricate besides having the advantages like low cost high radiation efficiency.

II. RELATED WORK

At earlier stages a real-time patient monitoring system prototypes have been designed to obtain various physical parameters. But there were several constraints like securityof the patient, Interference due to mass deployment. Also added to these were design constraints like battery power consumption and sensor calibration to different working conditions and controllers. Secondly Biotelemetry (or Medical Telemetry) involves the application of telemetry in the medical field to remotely monitor various vital signs of ambulatory patients. Biotelemetry is the remote detection and measurement of a condition, activity or function relating to physical activities. But this goes with cost of deploying a high-end equipment at every remote centers which makes it little tedious to proceed. Thirdly there were high-end systems in Military to remotely monitor the soldier's physical parameters. The Army Knowledge Online critical care Tele-consultation system is a web based service used to perform consultation on patients being treated in the field. Med Web provides a web based Tele-Radiology service which allows clinicians to transmit X-ray, CT MRI and Ultrasound datasets from patient in the field to be analyzed by radiologists around the world. Fourthly the "long-distance home health care service" has become one of the key emerging businesses in Taiwan. A mobile health management system is presented which is the first one integrating a wearable ring-type pulse monitoring sensor with a smart phone. All physiological measurements are transmitted to the smart phone through Bluetooth. In some projects, handwritten medical documents are scanned and uploaded to the database as images to bridge the gap of typing and computer literacy in remote workers. In some cases optical character recognition technology has been tried to scan and index specific sections of the image based on their character based section-headings. However, the survey could not find any examples of adoption of character recognition technology equipped with medical vocabulary to digitize the handwritten content input from the images. The Health wear service is based on the Wealthy prototype system. A new design has been made to increase comfort in wearing of the system during daily patient activities. The cloth is connected to a patient portable electronic unit (PPU) that acquires and elaborates the signals from the sensors. The PPU transmits the signal to a central processing site through the use of GPRS wireless technology. This service is applied to three distinct clinical contexts: rehabilitation of cardiac patients, following an acute event; early discharge program in chronic respiration patients; promotion of physical activity in ambulatory stable cardio-respiratory patients. The design approaches for generating stealthy probes and describe various possible mechanisms that can be used for such a design. These approaches are evaluated according to the design criteria and we identify what may be feasible solutions for stealthy probing in battlefield ad-hoc wireless networks.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 3, March 2017

III. ANTENNA GEOMETRY

The proposed antenna shown in Fig.1Consists of two sleeves with different lengths to each other. The antenna is fabricated on the Rogers ultralam 1217 substrate with dielectric constant of 2.17 and loss tangent of 0.0009. The substrate thickness is 1.6 mm, the overall dimensions of the substrate is 41.50*29*1.6 mm^3. The length of the first arm is 20mm and width is 5mm. The length of second arm is 6mm and width is 5mm all dimensions are mentioned in Table 1. The ground size is 29*29mm^2. The fabricated design of the proposed antenna is as shown in Fig 2.

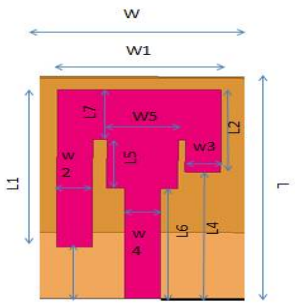

Fig. 1. Proposed antenna design

IV. PERFORMANCE AND CHARACTERISTICS

All the simulations in this work are obtained with the help of HFSS Software. The measured value for return loss is -44 dB at 6GHz. The return loss in -44dB with respect to frequency in GHz for the proposed antenna proves that it can be used for biomedical applications at 6GHz. Unlike calculating the return loss for two sleeves differently, here the return loss is calculated for entire micro strip patch antenna. In order to get the efficient return loss, the substrate ROGERS ULTRALAM 1217 (tm) was used in this antenna design as it had dielectric constant of 2.17 with a tangent loss of 0.009. The major modification done in this antenna design was by maintained the widths of two sleevesof the antenna were constantin order to increasethe return loss. The impedance graph in Fig.5.depicts that obtained characteristics impedance for proposed antenna is 50Ω. The voltage standing wave ratio (VSWR) for the proposed antenna is 1.

The radiation patterns are shown in Fig.7which shows the XZ pattern for ø = 0º, XY pattern if ɵ = 90º and E absolute gives the magnitude in dB for both polarizations, Ephi and Etheta are the azimuthal and elevation component of radiation pattern respectively.

Table 1:
Parameters and their value

Parameters	values in mm
W	29
W1	23
W2	5
W3	5
W4	5
W5	10
L	41.50
L1	29.30
L2	15.30
L3	10.05
L4	24.05
L5	15.05
L6	15
L7	9.30

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 3, March 2017

V.RESULTS AND ITS DISCUSSION

This section is about referring from calculation andparametric study from simulation. This antenna has been analyzed by simulation and then will compare with an actualmeasured antenna result from experiments. The characteristic has been compared in this work is the return loss, resonance frequency, bandwidth, gain and radiation pattern of the antenna,3D polar plots and 3D Rectangular plots,Impedance,VSWR.

FREQUENCY VERSUS RETURN LOSS

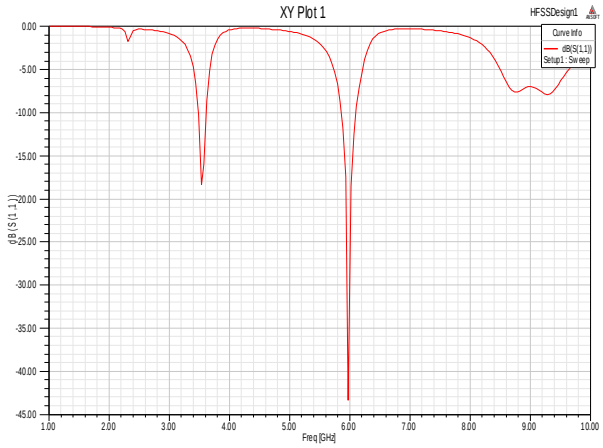

Fig. 2. Graph of Return loss versus Frequency.

Fig 2. Shows graph between return loss and frequency. In this figure we have return loss -44dB at operating frequency 6 GHz.

FREQUENCY VERSUS VSWR

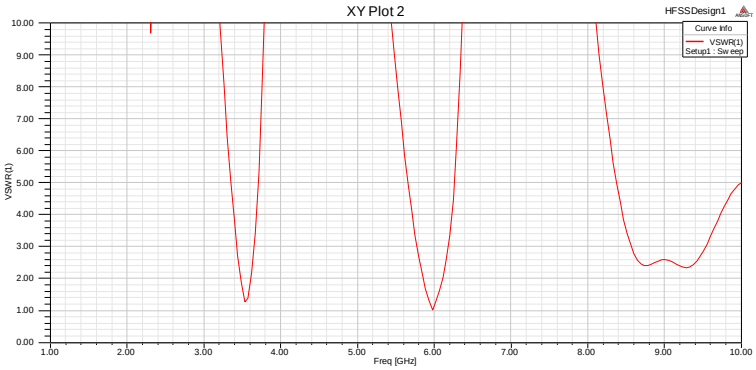

Fig. 3. Frequency versus VSWR.

This figure no.3 shows that frequency versus VSWR. For proposed antenna , we got VSWR 1 operating frequency at 6 GHz in high frequency simulation software (HFSS).

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 3, March 2017

FREQUENCY VERSUS IMPEDANCE

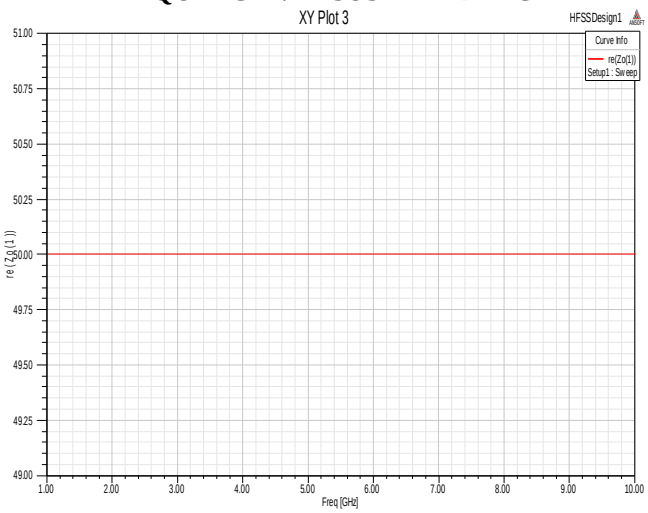

Fig.4 Frequency versus impedance graph

This figure shows that frequency versus impedance. For proposed antenna, we got impedance 50Ω operating frequency at 6 GHz in high frequency simulation software (HFSS).

RADIATION PATTERN

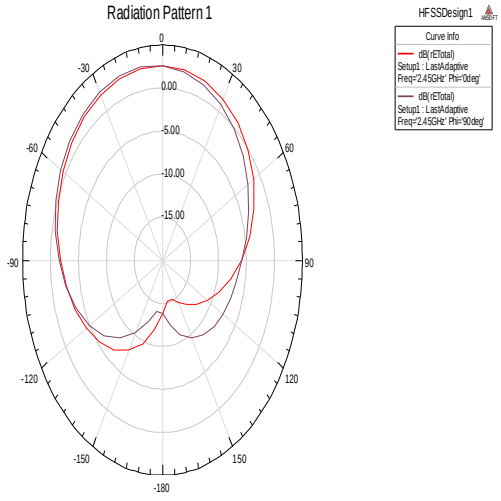

Fig.5 Radiation pattern for 0º and 180º

This figure shows that frequency versus impedance. For proposed antenna , we got impedance 50Ω operating frequency at 6 GHz in high frequency simulation software (HFSS).

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 3, March 2017

3D GAIN PLOT

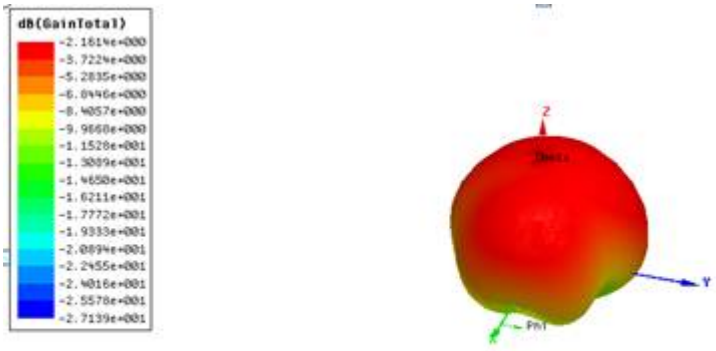

Fig.6. 3D gain plot

This figure shows that Polar plot. For proposed antenna operating frequency at 6 GHz in high frequency simulation software (HFSS).

ANIMATED FIGURE

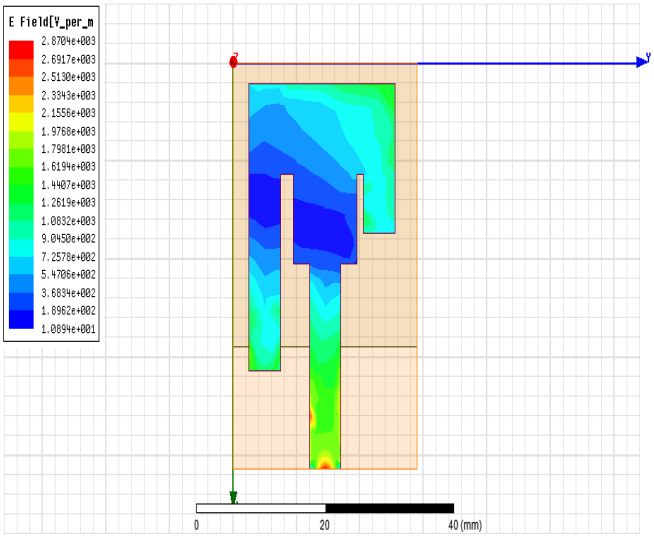

Fig.7. Animated design

This figure shows the Animated design which represents current direction of a simulated design.

VII. CONCLUSION

This implanted low profile antenna is used for biomedical applications. This proposed antenna having dimensions 41.5*29*1.6mm^3.It is suitable for several applications like blood pressure monitoring , glucose monitoring, temperature ,hyperthermia , cancer treatment, tumour detection, head and neck cancer treatment, remote health monitoring, speech sensing, self-monitoring, digestive monitoring etc. The presented proposed antenna having good radiation characteristics with a return loss of -44dB at operating frequency 6 GHz.The value obtained for VSWR and impedance

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 3, March 2017

is 1 and 50Ω respectively. Its compactness, good frequency versus losses response, radiation pattern will definitely help this designed antenna to be applicable for bio-medical applications.

REFERENCES

[1] Beach,R .D. Kuster, F.v and Moussy,F., "Sub miniature implantable potentio statand modified commercial telemetry device for remote glucose monitoring" .IEEETrans.Instrum.Meas.48,1239–1245.
[2] Conway,G.A.,Scanlon,W.G, "Antennas for over body surface communication at 2.45GHz".IEEETrans.AntennasPropag.57,844–855.
[3] Duan,Z.,Guo,Y.X.,Xue,R.F.,Je,M.,Kwong,D.L.,2012."Differentially fed dual band implantable antenna for biomedical applications".IEEETrans.AntennasPropag.60,5587–5595.
[4] Haga,N.,Saito,K.,Takahashi,M.,Ito,K.,2009."Characteristics of cavity slot antenna for body area networks" . IEEETrans.AntennasPropag.57,837–843.
[5] Hao,Y.,Alomainy,A.,Hall,P.S.,Nechayev,Y.I.,Parini,C.G.,Constantinou,C.C.,2005. "Antennas and propagation for body centric wireless communications".IEEE/ACESInternationalConferenceonWirelessCommunicationsandAppliedComputationalElectromagnetics,586–589.
[6] Karacolak,T.,Hood,A.Z.,Topsakal,E.,2008."Design of a dual band implantable antenna and development of skin mimickinggels for continuous glucose monitoring".IEEETrans.Microw.TheoryTech.56,10011006.
[7] Malika,T.,Abdennaceur,K.,Rahma,A.,Frederic,A.,2014. "Miniaturized on body patch antenna for 430MHz wirelesss digestive monitoring system".IEEEWorkshoponBiometricMeasurementsandSystemsforSecurityandMedicalApplications(BIOMS)Proceedings,57–60.
[8] Xia,Wei,Saito,K.,Takahashi,M.,Ito,K.,2009. "Performances of animal planted cavity slot antenna embedded in the human arm".IEEETrans.AntennasPropag.57,894–899.
[9] Asimakis,N.P.,Karanasiou,S.I.,Uzunoglu,N.K.,2009. "Conformal L-notch patch antennas for human brain monitoring using the SAM head mode"l.InternationalConferenceonElectromagneticsinAdvancedApplicationsICEAA,214–217.
[10] Balanis,C.A.,2005.AntennaTheoryAnalysisandDesign,3rded.JohnWiley.
[11] Gabriel,S.,Lau,R.W.,Gabriel,C.,1996. "The dielectric properties of biological tissues" :III.Parametric models for the dielectric spectrum of tissues.Phys.Med.Biol.41,2271–229
[12] Lee,C.M.,Yo,T.C.,Huand,F.J.,Luo,C.H.,2009. "Bandwidth enhancement of planar inverted F antenna for implantable biotelemetry".Microw.Opt.Technol.Lett.51,749–752.