

Wearable Antenna with E Type Slot for Health Tracking

Neha¹, Dhananjay Singh¹, V.K. Pandey¹

¹Department of Electronics & Communication Engineering, Noida Institute of Engineering and Technology, Greater, Noida 201306, India.

Abstract: *The exploration work is done in the field of wellbeing observing framework. The plan, reenactment, improvement, and estimation done on the E-shape microstrip slot antenna for the ISM band of frequencies is introduced in this paper. This E-shape slot antenna is taken care of by a microstrip line feed. Its resonance frequency is learned at 2.6 GHz. This frequency lies in ISM band of remote applications. The design and simulation are done in High Frequency Structure Simulator (HFSS) software with RT Duroid substrate. As indicated by its genuine application, the material, shape, and the type, the microstrip antenna is planned. The size of the antenna is determined by the length, width articulations. Then, at that point, the antenna is mimicked for the radiation boundaries got through upgrading and matching to meet the necessities. The parameters of antenna, for example, Reflection coefficient, Gain, VSWR and Return misfortune are estimated.*

Keywords - E-shaped Slot, RT Duroid, microstrip patch antenna, simulation, Radiation Pattern.

Introduction

Medical care is a sacred basic liberty, and it is one of the most fundamental pieces of our everyday schedule and ought not be viewed as advantaged for the meager few. It is likewise influencing time, traffic, money, and work when one necessity to run medical clinic. The older populace is generally impacted in these circumstances. This persuades the need to distinguish one effective and minimal expense specialized arrangement which is wellbeing checking system. This is conceivable by utilizing a wearable antenna [1-2]. These technologies considered as the critical system for agreeable, great quality and minimal expense medical services. An antenna that is coordinated into clothing of the wearer is known as a wearable antenna. The difficulties behind planning an antenna for medical care observing framework are to be planar, light weight, non-harmful, adaptable, and minimal expense. There is an expanding development in the ability towards the patch antenna because of their high conservativeness, low profile and modest framework when contrasted with their relating greater antennas [3]. RT-Duroid [4] is utilized for planning the antenna with HFSS simulation to work in 2.6 GHz resonant frequency and their performance are analyzed and analyzed for wellbeing checking framework.

Literature survey

Microstrip patch antenna has many advantages. It is low cost, lighter in weight, low profile than the conventional antenna. Planar structure provides ease of fabrication [5]. The performance of microstrip antenna depends on its structure. The dimensions of the patch, on the substrate material as well as thickness and feed line are accountable for the resonant frequency of the microstrip patch antenna [6]. For designing Wearable antenna for remote healthcare monitoring, the fabrication of wearable antenna could be integrated with sensors for remote monitoring of patients [7]. These antennas can be interconnected by networks and active devices with printed microstrip line fed. A patch antenna comprises of a radiation part as colored on dielectrics substrate top side and bottom side as ground. The radiating patch and the microstrip feed lines are designed on the dielectric substrates. By surveying it is planned to design and implement E-shape microstrip Patch Antenna resonating at ISM Band of 2.6 GHz frequency.

Design and Analysis

It is necessary to choose a suitable substrate to meet the demands of antenna to be efficient. RT Duroid is taken as substrate as it gives better results [4]. The different parameters of microstrip patch antenna are

calculated from the basic equations given below.

Step 1: Calculation of the Width (W)

$$W = \frac{c}{2f_0 \sqrt{\frac{\epsilon_r + 1}{2}}}$$

where, C is presenting speed of the light in free space and f₀ is the operating frequency.

Step 2: To calculate effective dielectric constant

$$\epsilon_{eff} = \frac{\epsilon_r + 1}{2} + \frac{\epsilon_r - 1}{2} \left[1 + 12 \frac{h}{W} \right]^{-\frac{1}{2}}$$

Step 3: Calculation of the effective length

The length of the radiating patch determines the operating frequency, so it is an important factor to design the antenna. Length of the patch is calculated as:

$$L_{eff} = \frac{c}{2f_0 \sqrt{\epsilon_{eff}}}$$

Step 4: Calculation of the length extension

$$\Delta L = 0.412h \frac{(\epsilon_{eff} + 0.3) \left(\frac{W}{h} + 0.264 \right)}{(\epsilon_{eff} - 0.258) \left(\frac{W}{h} + 0.8 \right)}$$

Step 5: Calculation of the actual length of patch

$$L = L_{eff} - 2\Delta L$$

Step 6: Substrate Dimension

$$l_g = l + 6h \text{ and } w_g = w + 6h$$

The antenna is fed by Microstrip feed with 50-ohm characteristic impedance. The Antenna is simulated at 2.6 GHz frequency and the results were observed. In this paper, a rectangular microstrip patch antenna having resonant frequency at 2.6 GHz are designed on flexible substrate using HFSS software. In our work, a simple patch antenna with E-shaped slot is designed by taking different types of flexible substrates and various antenna parameters are analyzed and their properties are represented in the table.

Table 1. Parameters of antenna

S.No	Parameters	Dimension
1	Operating Frequency	2.6 GHz
2	Length of the Substrate	65.6 mm
3	Width of the Substrate	74.1 mm
4	Length of the patch	37.7 mm
5	Width of the patch	48.2 mm
6	Length of the feed line	19.6 mm

7	Width of slot	2.08 mm
---	---------------	---------

Fig 1: Proposed Antenna Design

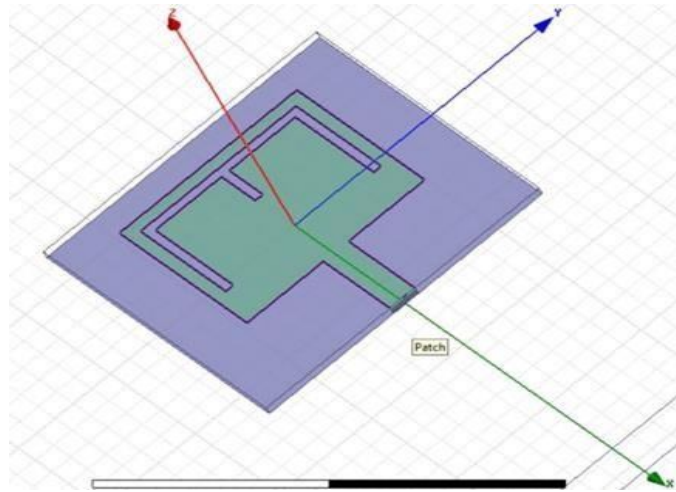


Fig 1: Proposed Antenna Design

The proposed rectangular microstrip patch antenna with E-shaped slot has been designed, simulated and optimized by HFSS software and the results are analyzed. RT-Duroid is selected as substrate. Gain and bandwidth have analyzed and discussed for antenna with RT Duroid substrate. The proposed flexible antennas are chosen to operate at 2.6 GHz operating frequency. Here the intention is to analyze the simulation- based results.



Fig 2: Frequency vs Magnitude

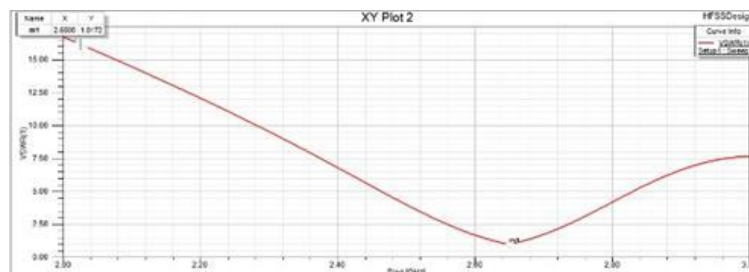


Fig 3: VSWR

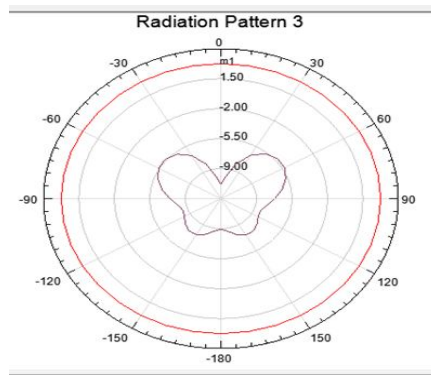


Fig 4: Radiation Pattern of RT Duroid

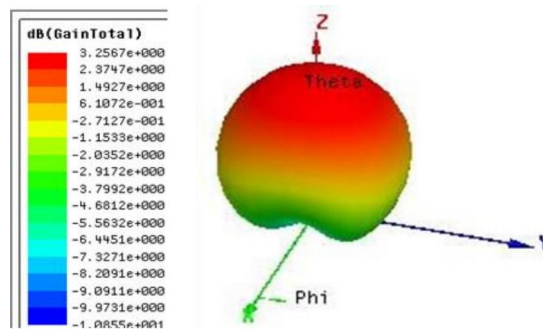


Fig 5: 3D Polar Plot of Antenna

Gain is the key performance factor that holds the directivity and efficiency of a transmitting antenna [6]. If we want to transmit the signal from one point to another, the directivity plays an important role in deciding the amount of power directed in a direction towards the receiving antenna [7]. The result of the designed antenna is shown in table below.

VSWR	1.0172
Gain	3.25 dB

Table 2: Results of the Designed Antenna

Conclusion

The proposed E-shape Slot Antenna for Health Care Monitoring is designed using high frequency structure simulator (HFSS). RT Duroid material is used as substrate for microstrip patch antenna. The E-shape microstrip antenna resonates at 2.6 GHz. The radiation pattern of the simulated antenna was perpendicular to the axis of the wearer, which implies that this antenna is feasible for wearable applications. Wearable antenna is best for wireless body area communications, and it has vast applications in health care monitoring and other biomedical applications.

Future Work

The future work can be done by improving the bandwidth and efficiency of antenna. The gain of the antenna can also be increased. Under wet conditions, performance of antenna deteriorates. So, we can design antenna using waterproof material.

Reference

- [1] Applications: a Survey,” International Journal of Computer Applications, vol. 2, no. 5, pp. 1595–1599, 2011.
- [2] C. A. Balanis, *Antenna Theory: Analysis and Design*. Hoboken, NJ John Wiley & Sons, 2012.
- [3] R. Salvado, C. Loss, R.G. Calves & P. Pinho, —Textile Materials for the Design of Wearable Antennas: A Survey”, *Sensor Journal*, Volume. 12, pp. 15841-15857, 2012.
- [4] Carla Hertleer, Hendrik Rogier, Luigi Vallozzi & Lieva van Langenhove, —A Textile Antenna for Off-Body Communication Integrated into Protective Clothing for Firefighters”, *IEEE Transactions on Antennas and Propagation*, Volume. 57, Issue 4, pp. 919-925, 2009.
- [5] Mak, “Reconfigurable multiband antenna styles for wireless communication devices,” *IEEE Transaction Antennas Propagation*, vol. 55, no. 7, pp. 1919-1928, Jul. 2007.
- [6] C. Deng, Y. Xie, and P.Li, “CPW-fed planate written monopole antenna with electric resistance information measure increased, *IEEE Antennas Wireless Propagation, Lett*, vol. 6. 8, pp. 1394–1397, 2009.
- [7] Capobianco, “A novel UWB bow-tie antenna style with high F/B quantitative relation and directionality,” in *Proc. 8. 38th Eur. Microw. Conf.*, Amsterdam, The Netherlands, 2008, pp. 393–396.
- [8] Saumya Priya Basu , Saumya Das , Sanjita Das, Manas K Das; 'Effect of Methanoic Extract of the Leaves of Calotropis Gigntea R.BR. On Leukocyte and Neutrophil Migration', Volume No.2, Issue No.1, 2013, PP.033-036, ISSN :2229-5828
- [9] Deepak Bhardwaj , S P Singh, VK Pandey; 'VHDL Implementation of Interleavers : Fundamental and Recent Developments for Wimax and Wlan', Volume No.2, Issue No.1, 2013, PP.037-043, ISSN :2229-5828
- [10] Malviya, Ragini; 'Study and Simulation of the Unified Power Flow Contr-oller(UPFC) In Power System', Volume No.2, Issue No.1, 2013, PP.045-050, ISSN :2229-5828
- [11] Rajesh Lavania, Manu Pratap Singh; 'Performance Analysis For Multilayer Feed Forward Neural Network With Grad-ient Descent with Momentum & Adaptive Back Prop-agation and Bfgs QuasiNew-ton Back Propagation for Hand Written Hindi Characters of Swars', Volume No.2, Issue No.1, 2013, PP.051-065, ISSN :2229-5828
- [12] Shweta Vishnoi , Rakesh Kumar, Sunder Pal & Beer Pal Singh; 'Study of Optical Character-ization of Pulse Laser Dep-osited Zno Thin Films', Volume No.2, Issue No.1, 2013, PP.067-070, ISSN :2229-5828
- [13] Vinay Kumar ,Lalit Kumar, Gagan Deep; 'Study on the Curing Kinetics of Epoxy Resins Using Diorga-notiin Dichlorides', Volume No.2, Issue No.1, 2013, PP.071-074, ISSN :2229-5828