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A Compact UWB Antenna with Bandwidth Improvement for Microwave Imaging Application

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Abstract— **In this paper, we suggest a new Ultra Wide Band (UWB) monopole antenna which can receive or transmit signals (omnidirectional) in all the directions for In-Body Microwave Imaging Application. The suggested antenna comprises of following materials a square radiating microstrip antenna and a Ground with two resonant components, a pair of I-shaped slots and another I-shaped slot placed in between the paired slots. The designed antenna fetches a wide unstable bandwidth of (5.3–10 GHz).The planned antenna has the merits of wider bandwidth, closely packed size, cheap, better omnidirectional radiation patterns, and acceptable time domain activities for using all together as a microwave imaging application.**

Index Terms—**Microwave imaging,ultra wideband(UWB) and wireless body Area Network(WBAN)**

I. INTRODUCTION

Ultra wide band (UWB) technologies are widely used in many industries and especially in the commercial applications. The UWB based WBAN which stands for wireless body area networks are broadly used for monitoring the health conditions and also for resisting attacks. The main component which is used in UWB systems are the antennas and it makes a difference in performance. WBAN systems are widely categorized into wearable and Implantable systems. Generally wearable systems are set on the human body and the implantable systems are inserted into the human body tissues. WBAN systems has lots of sensors Which are attached on the body of the humans in order to achieve the microwave imaging applications. Microwave imaging systems are used in variety of applications such as nondestructive testing and evaluation (NDT&E), hidden weapon identification at check points, monitoring the health, and through-the-wall imaging. Christo Ananth et al.[3] discussed about E-plane and H-plane patterns which forms the basis of Microwave Engineering principles. Though there are various advantages this method also has some disadvantages such as the rates which are detected might be false, missing of any relatively high information and converting the atoms into ionic radiations called ionizing radiation. The UWB signals cannot be converted into ions and hence can flow through the human tissues much effectively than other signals. In antennas wireless communication systems are needed. The design of closely packed antenna with wider bandwidth and better performance is sufficiently a great challenge. A partial view into the recently created Monopole antenna had many merits that make them as a superior choice in WBANS systems.

The microwave imaging system performs series of actions such as spreading of electromagnetic fields in the microwave area to create pictures. This provides an alternative tool for the microwave imaging systems in medical applications which helps in the identification of disease in our human body. It is basically a non-ionizing radiation and hence establishment of the squeezed body part is avoided. For example microwave imaging systems are used as a cancer judging tool. This advantages leads to safe and comfortable study of the body. It also plays an important role in identification of tumor cells. But one important point to be remembered is that all the imaging devices have high negative results and positive results as well. They can be carried from one place to another and hence rain stroke identification is possible.

The above mentioned information's about the imaging systems made many offers to the field of microwave medical imaging systems. It also contributed many contributions to the field of microwave imaging systems such as the development of Vivaldi antenna which can be operated as transducers, artificial phantoms. The invented antenna has better sensitivity when compared to other antenna's, high time domain characteristics, wider bandwidth, smaller in size and better gain for using it in the microwave imaging applications. The results obtained for the invented antenna is demonstrated by constructing number of antennas and measuring their performance, loss and radiation characteristics.

II. ANTENNA CONFIGURATION AND DESIGN

The figure below represents the top, bottom and the side views of the invented antenna. The design of the invented antenna starts up by picking out the dimensions for the invented antenna. The invented antenna is fixed on an FR4 microwave substrate with a size of 13X18mm^2, thickness of about 1.6mm, and relative dielectric constant of 4.3. The invented antenna comprises of a square shaped radiating patch and a ground plane which is fed by a microstrip line.

The invented antenna consists of a patch which is connected to microstrip feed-line with the width of W_f and the length of L_f. The width of the substrate is

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$$W_{sub} = \frac{c}{2f}\left[\sqrt{\left(\frac{2}{\varepsilon r+1}\right)}\right] \quad (1)$$

where "c" is the velocity of light in the free space. The effective dielectric constant for a microstrip antenna is

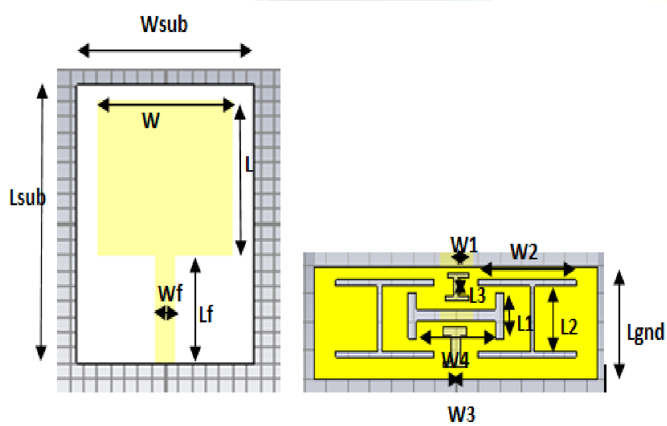
$$\varepsilon reff = \frac{\varepsilon r+1}{2} + \frac{\varepsilon r-1}{2}\{[1+12\frac{h}{w}]^{-\frac{1}{2}}\} \quad (2)$$

The extension of length is

$$\frac{\Delta L}{h} = 0.412\frac{(\varepsilon_{reff}+0.3)(\frac{w}{h}+0.264)}{(\varepsilon_{reff}-0.258)(\frac{w}{h}+0.8)} \quad (3)$$

The effective length of the microstrip antenna is

$$L_{sub} = \frac{c}{2f\sqrt{\varepsilon_{reff}}} - 2\Delta L \quad (4)$$



(a) Front view (b) back view

Fig.1. Geometry of proposed antenna

The best dimension for the invented antenna are mentioned in the tabular column.

Table 1: Optimal dimension of the proposed antenna

Parameter	mm	parameter	mm
Lsub	`18	W2	4
L1	2.5	Wf	1.5
Lgnd	3.9	Wsub	13
H	1.6	W3	0.4
T	0.035	W4	0.2
w	10	W1	0.2
Lf	7	L2	2.5

In this design, to create impedance matching which results in the bandwidth improvement, we have embedded two pairs of 'I' shaped slots in the top-bottom and both the sides of the ground plane and again an 'I' shaped slot placed in between the two pairs of 'I' shaped slots.

III. RESULTS AND DISCUSSIONS

The above invented antenna was simulated and optimized by CST software. This was used to calculate the return loss, impedance bandwidth and radiation pattern. Therefore the simulation result of return loss,VSWR,radiation efficiency is shown in figure 2,3 and 4.

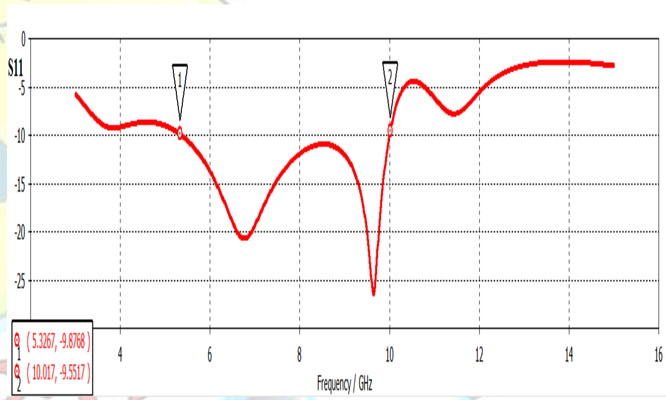


Fig.2. Simulated return loss of the proposed antenna

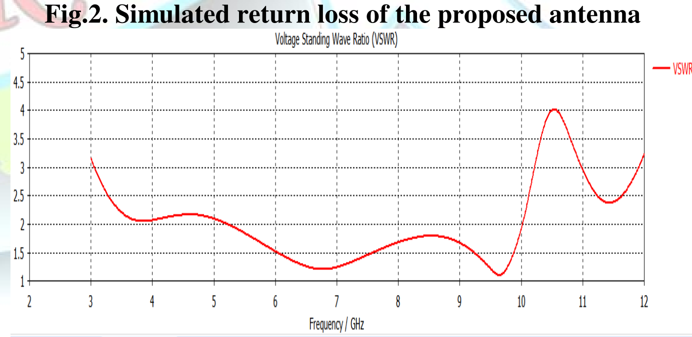


Fig.3.Simulated VSWR of the proposed antenna

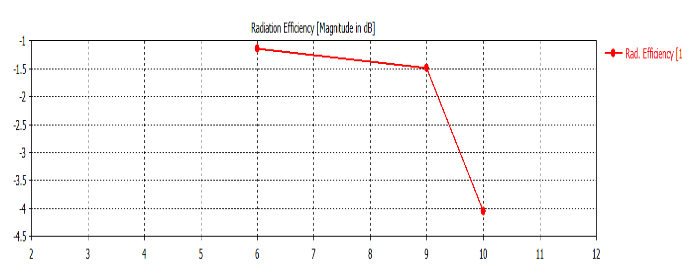


Fig.4.Simulated Radiation efficiency of the proposed antenna

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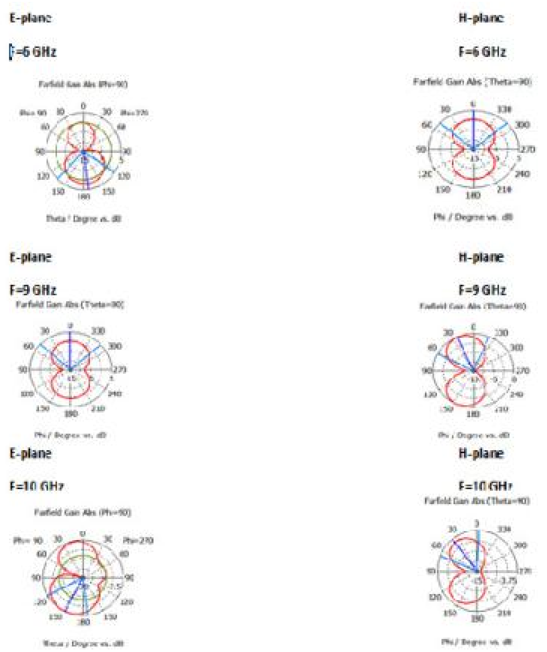
The radiation pattern of the proposed antenna describes the radiation properties on antenna as a function of space coordinate. Considering a linearly polarized antenna, the performance can be shown in terms of E plane and H plane patterns. The E-plane is shown as the plane containing the electric field vector and the directions of maximum radiation while the H-plane is shown as the plane containing the magnetic field vector and the direction of maximum radiation. The radiation pattern of the proposed antenna is shown in figure 5.



IV. CONCLUSION

In this paper, a monopole antenna with bandwidth improvement has been designed for UWB based cancer imaging applications, advanced mobile phone service and in wireless local area network applications. To improve the bandwidth enhancement, we use a two pairs of 'I' shaped slots and another 'I' shaped slot placed in between the two pairs of slots which are fixed in the ground plane, as a result wider bandwidth was produced. From the above results it has been concluded that the invented antenna has acceptable performance and can be used for wireless applications and also for treating cancers.

REFERENCES

[1] Balasubramanian, V. and A. Stranieri, "Performance evaluation of the dependable properties of a body area wireless sensor network," *International Conference on Optimization, Reliability, and Information Technology (ICROIT)*, 229–234, 2014.

[2] Lee, C., J. Kim, H. S. Lee, and J. Kim, "Physical layer designs for WBAN systems in IEEE 802.15.6 proposals," *9th International Symposium on Communications and Information Technology, ISCIT 2009*, 841–844, 2009.

[3] Christo Ananth, S.Esakki Rajavel, S.Allwin Devaraj, M.Suresh Chinnathampy. "RF and Microwave Engineering (Microwave Engineering)." (2014): 300.

[4] Otto, C. A., E. Jovanov, and A. Milenkovic, "A WBAN-based system for health monitoring at home," *3rd IEEE/EMBS International Summer School on Medical Devices and Biosensors*, 20–23, 2006.

[5] Shahzad, A., M. O'Halloran, E. Jones, and M. Glavin, "A preprocessing filter for multistatic microwave breast imaging for enhanced tumour detection," *Progress In Electromagnetics Research B*, Vol. 57, 115–126, 2014.

[6] James j., and P.S. Hall (Eds), Handbook of microstrip antenna, Peter Peregrinus, London, UK, 1989.

[7] Ramesh Garg, Prakash Bartia, Inder Bahl, Apisak Ittipiboon, *''Microstrip Antenna Design Handbook'', 2001,* pp 1□68, 253□316 Artech House Inc. Norwood, MA.

[8] Wentworth M. Stuart (2005), *''Fundamentals of Electromagnetic with Engineering Applications''*, pp 442□445, John Wiley & Sons, NJ, USA.

[9] J. D. Kraus, R. J. Marhefka, *"Antenna for all applications"* 3rd Ed., McGraw- Hill, 2002.

[10] Robert A. Sainati, CAD of Microstrip Antennas for Wireless Applications, Artech House Inc, Norwood, MA, 1996.