International Journal of Engineering Applied Sciences and Technology, 2016
Vol. 1, Issue 8, ISSN No. 2455-2143, Pages 62-64
Published Online June - July 2016 in IJEAST (http://www.ijeast.com)

DESIGNING OF MICROSTRIP ANTENNA FOR BIOMEDICAL APPLICATION

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Abstract – Microstrip Patch antennas currently are receiving significant scientific researcher's interest for integration into the implantable medical devices and radio-frequency (RF)-enabled biotelemetry, because of their high flexibility in design, conformability, shape and size. Various techniques have been used so far to design such antennas for different type of diseases. This paper is an output of a detailed survey of various available techniques. The objective of this paper is to propose an antenna which can be used in treating disease like tumors and hyperthermia.

Keywords – IMD, Biomedical telemetry, MPA, Biomedical Applications.

I. INTRODUCTION

Technology modifies each day by a large group of thinkers and researchers of engineering expeditiously. Every aspect of life is greatly affected by it. Human live is getting easier everyday due to new advancements done by the people of science. Especially, when the main interest of a research topic is human life, the topic becomes relatively popular. When engineering is projected on biology and human life, the result becomes medical electronics, which might be one of the popular subjects of research due to its main interest: Human body.

Especially in the area of cancer imaging, scientists work of numerous proposals about the imaging problem and keep discovering new features about solving one of the most deadly diseases in the world.

Hyperthermia is a way to treat cancer tissues with enhancing the temperature of a part of the body within the range 42-45 °C. This technique has been shown to be an effective treatment for some cancers in combination with radiotherapy and chemotherapy. For treatment of tumours which are located close to the surface of the body, the electromagnetic field energy is applied through external antennas (applicators) [1], [2], [3].

Instead of treating any disease, prevention is far better option. Millions of people worldwide depend upon implantable medical devices to support and improve the quality of their lives. RF-linked implantable medical devices are already in use for a wide variety of applications, including temperature monitors [4], pacemakers and cardioverter defi brillators [5], functional electrical stimulators (FES) [6], blood-glucose sensors [7], and cochlear [8] and retinal [9] implants. As technology continues to evolve, new implantable medical devices are being developed, and their use is expected to rapidly increase from an already large base.

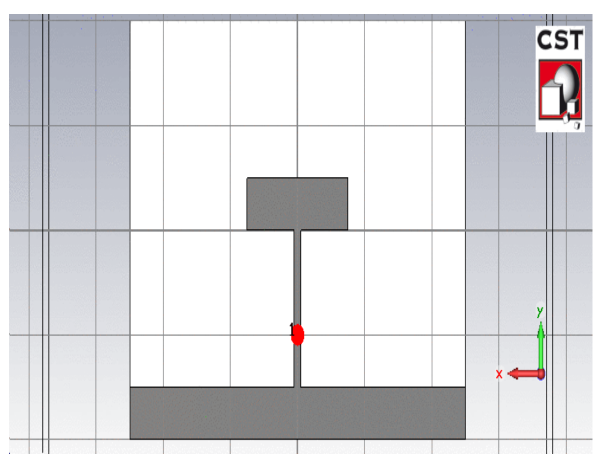
Until recently, no globally accepted frequency band had been dedicated to biotelemetry for implantable medical devices. The situation changed with the ITU-R Recommendation SA.1346 [10], which outlined the use of the 402.0- 405.0 MHz frequency band for Medical Implant Communications Systems (MICS).

However, focus is on the MICS band, because of its advantages of being available worldwide and being feasible with low-power and low-cost circuits, reliably supporting high-data-rate transmissions, falling within a relatively low-noise portion of the spectrum, lending itself to small antenna designs, and acceptably propagating through human tissue.

II. METHODOLOGY

It has been found in previous research that the best frequency range for treating cancer and hyperthermia related critical diseases is 0.4 to 1.5 GHz. whereas the MICS has the range of 0.402 to 0.405GHz and breast cancer has the range of frequency for treatment is 1 to 1.5GHz. So the proposed antenna is designed on 1 GHz frequency.

The front side of the antenna has a feed line with changing width which is connected to the main radiating strip.



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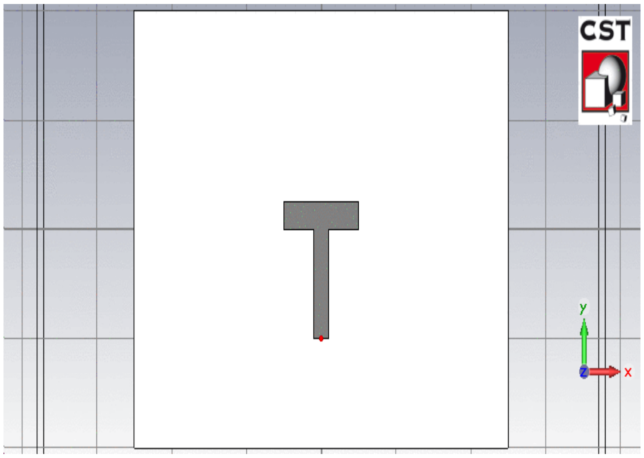

Figure l. Back and front side of the proposed antenna, inspired by meandered antenna.

This proposed design is inspire by yagi uda antenna proposed by Adela [11], and this proposed antenna will be radiating in as required 1 GHz frequency. The proposed antenna having its PCB structure of 50X50 mm and having a T shaped radiating structure whereas an extended T shaped ground structure. The ground is also can be represented as parallel plates like the one we have in yagi uda antenna, but here in this structure a narrow strip was used to connect these both plates. This strip was used so that a sudden change in width can enhance the radiation from the antenna plane. FR4 lossy was used as a substrate having height 1.6mm and having dielectric constant of 4.3.
Following is the simulated result of the proposed antenna.

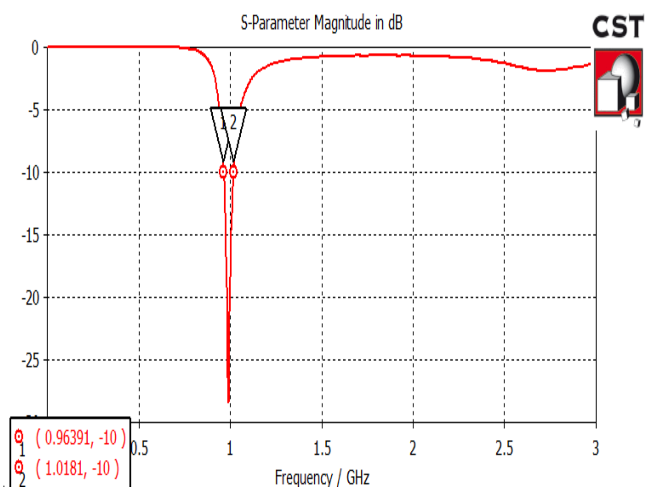

Figure 2. Simulated result of the proposed antenna, showing return loss of -28 dB and bandwidth of 54 MHz

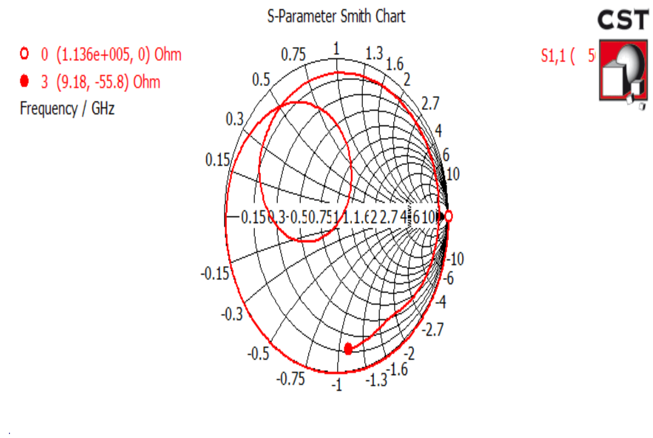

Figure 3. Smith Chart of the simulated patch antenna.

This simulated result shows the return loss of the proposed design showing the return loss of -28dB, which is sufficient enough to treat breast cancer by using imaging technique and can be used in treating hyperthermia as well. Because the range of frequency for such biomedical application is 1 to 1.5GHz.

III. CONCLUSION

A small, single band microstrip antenna is presented. Yagi Uda type of radiator and same type of ground plane are designed. The antenna produced acceptable characteristics when compared to the requirements surveyed from various research papers. This proposed design can also be modified up to a next level, like enhancement of bandwidth, conversion into multi bands and even smaller sizes to reduce the volume of measurement system in general. The proposed antenna has advantages like wide angular width and small size which makes it realizable for the proposed job. The antenna will be crafted and further analyses will be done to understand its capabilities in a realistic case.

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