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Microstrip Antenna for Biomedical Application based on Yagi Uda Technique

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Abstract – *Recently many researchers are adopting microstrip antenna for biomedical application to treat cancer by using hyperthermia. This is achieved by integration into the implantable medical devices and radio-frequency (RF)-enabled biotelemetry,because of their high flexibility in design, conformability, shape and size.Numerous researched are using various distinguished techniques to design or modify such kind of antennas.A detailed survey has been done before proposing this antenna for such severe application.The objective of this paper is topropose an antenna which can be used in treating disease like tumors using hyperthermia.*

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

I. INTRODUCTION

In the current world, breast cancer is a next main reason of the women's cancer death worldwide. Each and every year about more than 80,000 women are dying in INDIA because of this breast cancer and about 3000,000 women are dying in whole world because of this cancer. In United State, for the year 2012 almost 232714 women were diagnosed and 43,909 were died because of breast cancer. In the same year for China almost 187213 women were diagnosed and 47984 were dies because of breast cancer. And in the same year in India 144937 were diagnosed and 70218 were died because of it. Frequency of death due to breast cancer in US is for every 6 diagnosed ladies one is dying, in China for every 4 ladies diagnosed 1 is dying and whereas in India one out of each second lady diagnosed with breast cancer is dying. This bio data has been on the IARC (International Agency for Research on Cancer) a counterpart of WHO in 2012 which a woman's in India has 1 in 4 chances for developing invasive breast cancer through her lifespan and in 2000 the danger was 1 in 8. An estimation has been done about the causes of the breast cancer and observed that every year the rate of new cases is increasing, in last year itself 155000 novel reason of breast cancer were in India out of them 78000 were died as of the same. Breast cancer, that is utilized to call the prime killer of the urban women, is becoming a large problematic worldwide today. Lot of investigation is being done to get exempt of this prime killer of the women. Experts suggested that to detect it as early as possible and to treat it.

For treatment of tumourswhich are located close to the surface of the body, theelectromagnetic field energy is applied through externalantennas (applicators) [1], [2], [3].

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

However, focus is on the MICS band,because of its advantages of being available worldwide andbeing feasible with low-power and low-cost circuits, reliablysupporting high-data-rate transmissions, falling within arelatively low-noise portion of the spectrum, lending itself tosmall antenna designs, and acceptably propagating throughhuman 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 rectangular block with cut of same design in center.

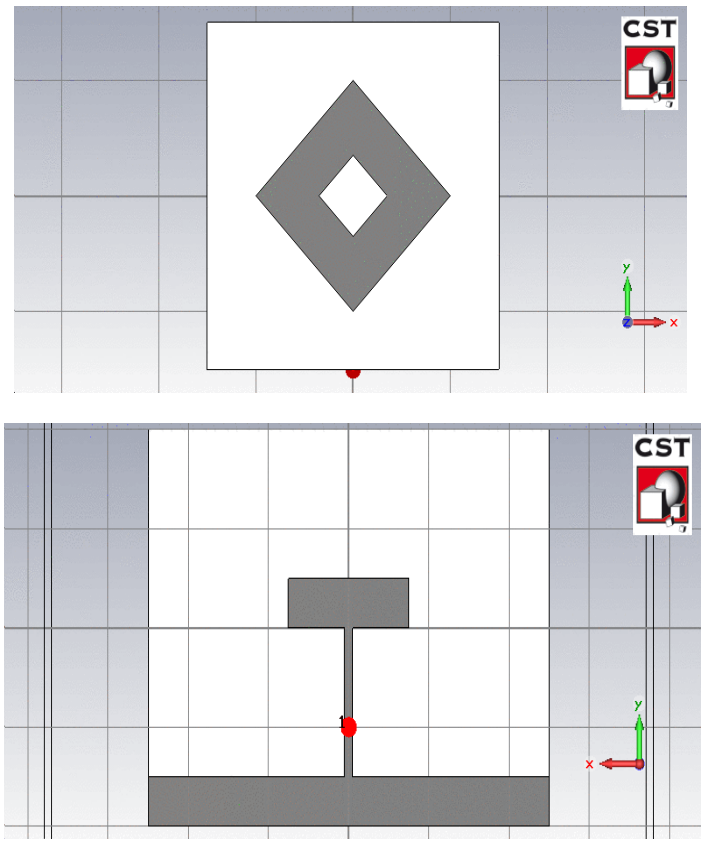

Figure l. Back and front side of the proposed antenna, inspired by yagi uda antenna

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.

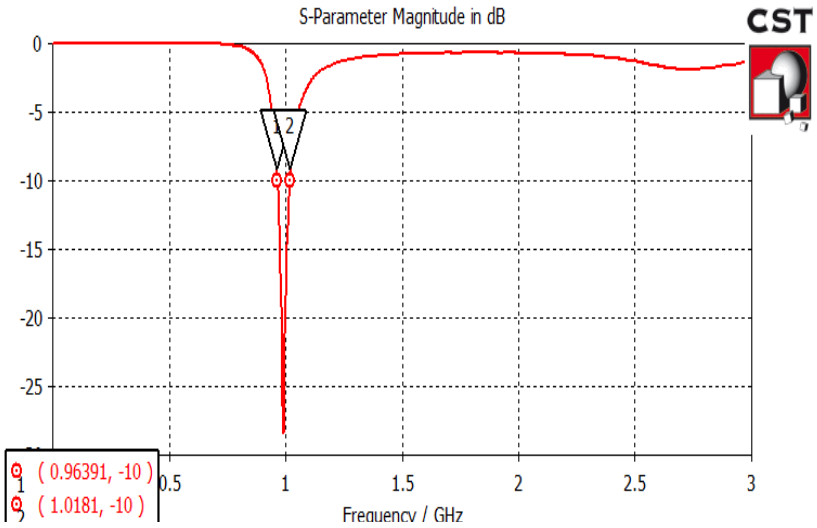

Figure 2. Simulated result of the proposed antenna, showing return loss of -28 dB and bandwidth of 54MHz.

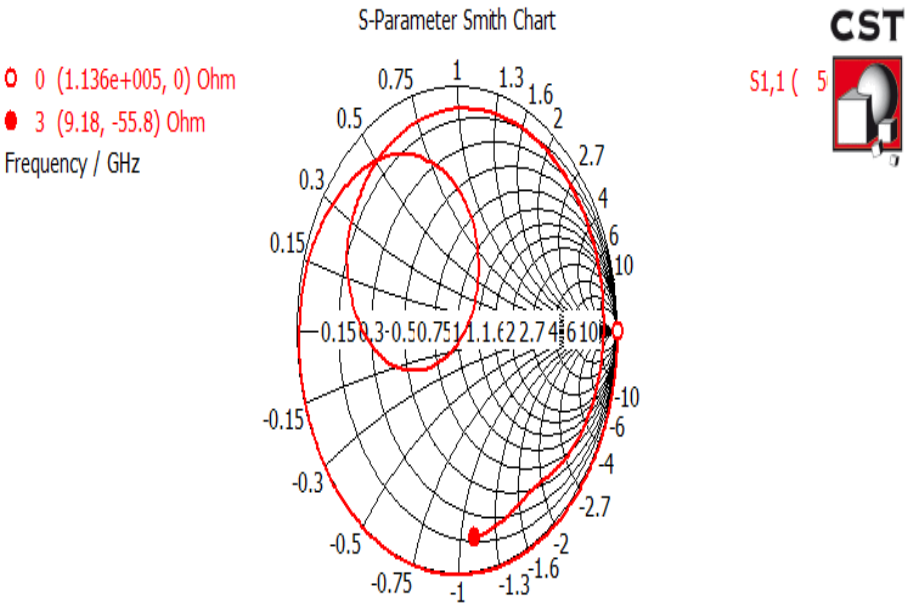

Figure 3. Smith Chart of the simulated patch antenna.

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. YagiUdatype of radiator and same type of ground plane are designed. Theantenna produced acceptable characteristics whencompared 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 evensmaller sizes to reduce the volume of measurement systemin general. The proposed antenna has advantages like wideangular width and small size which makes it realizable forthe proposed job. The antenna will be crafted and furtheranalyses will be done to understand its capabilities in arealistic case.

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