Performance of Hyperthermia for Breast Cancer

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Abstract

In this paper, effective, high improvement is future for hyperthermia breast cancer therapy system. This frequency band has remained defined for the breast cancer hyperthermia therapy. The grid extended and small sides are responsible for the undesired cross-polarized radioactivity and chosen copolarized radiation, correspondingly. The inappropriateness of the conservative grid antenna array is guaranteed by examining its radiation goods. The future grid antenna array short side width is different and its long side width is reserved wide as conceivable to improve the radiation properties and to decrease the losses. Also, a indicator has remained used for improvement determination. The proposed grid antenna array attains side lobe level and 3 dB beam width of −27.9 dB and 25.9° for the E-plane and 27.9 dB and 26.3° for the H-plane, correspondingly. The breast phantom is exposed by together proposed and conservative grid antenna arrays for 10 minutes. The proposed grid antenna array attains 8°C temperature growth within the breast phantom area associated to 2°C temperature growth for conventional one. The proposed grid antenna array is extremely efficient, high gain and light weight, and it has a actual appropriate radiation property for hyperthermiabreast cancer therapy.

Keywords - *Breast Cancer, Hyperthermia, Grid Antenna Array, Pencil Beam*

I. INTRODUCTION

Breast cancer is globally the greatest mutual type of cancer between women. Treating and evolving low cost uncovering system are a clinical essential for breast cancer disease. Hyperthermia is a kind of cancer treatment in which body tissue is unprotected to high temperatures using electromagnetic technology. The area of hyperthermia for cancer treatment, counting breast cancer, is to raise the temperature to above 42°C at the tumor location for a sufficient period of time though preserving a usual temperature in additional areas. Preceding studies had shown that microwave hyperthermia is a auspicious noninvasive treatment for breast cancer. The presentation of ultra-wide bandand narrowband microwave hyperthermia based on beam founding was examined theoretically in. Dissimilar shapes were used for temperature promotion determination such as planer array, circular array, square octagonal planar slot line resonator, and hemispherical instruction microstrip spiral array.

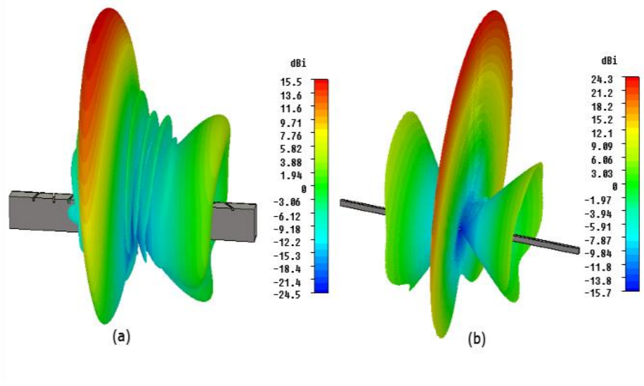

FIG 1(a) 12-Element (with negative squint)(b) 54-Element (with positive squint) Arrays.

In this paper, light weight grid antenna array with diffident probe feed and real suitable radiation arrivals is planned. Originally, a conventional is inspected for hyperthermia needs. The unsuitability of the conventional grid antenna is recognized for that kind of request. As a response, the horizontal fundamentals of the conventional antenna array are altered for energy features development resolve. The planned, simulated, invented and its radiation features are examined for its accuracy for hyperthermia needs. Finally, the proposed grid antenna array is replicated with combination of breast phantom at a distance of 60 mm from the upcoming grid antenna array. The breast phantom is unprotected to the antenna's electromagnetic wave for 10 minutes and with 0.5 watt at the antenna input. The simulation shows that, breast phantom temperature has continued elevate dto 8°C above its usual temperature when the proposed array is used. Also, temperature raise of 2°C is obtained when conventional antenna array is used.

All the aforementioned antennas had very complex feeding schemes and very complex collection shapes. The problem will ascend from the amount of cables, switching system, power partitions and even timing and controlling electronic circuits that will be wanted for that type of antenna arrays.

II. PROPOSED GRID ANTENNA ARRAY DESIGN, SIMULATION AND FABRICATION

The conservative network antenna transmission and radiation possessions are ruled by small side width $s\ w$. The upcoming network collection small thickness is dissimilar to find a suitable radiation characteristics for hyperthermia requests. Network projection collection of 16-elements is obtainable in Figure2 , for breast cancer hyperthermia proposal. It is originated on the alteration of horizontal network basics widths and inspecting the outcome on the contamination appearances. Now, the horizontal component is preserved as single microstrip antenna slightly than modest micro strip line. As the microstrip antenna width increases, their directivity and gain increases too. The width of the microstrip antenna should be one half of the guided wavelength for antenna contamination efficiency enhancement. The proposed projection collection must need high advance and competence by changing the network projection collection short side width ws. The proposed projection collection has modest probe feed and simple construction method. The difference between the half-power beam widths of the E- and H-planes is used to assess the pencil beam quality. The prototype is designed and fabricated on RT/ Duroid 5880 substrate. This substrate is chosen for its low loss tangent and its low dielectric constant which are two important parameters for any microstrip antenna construction.

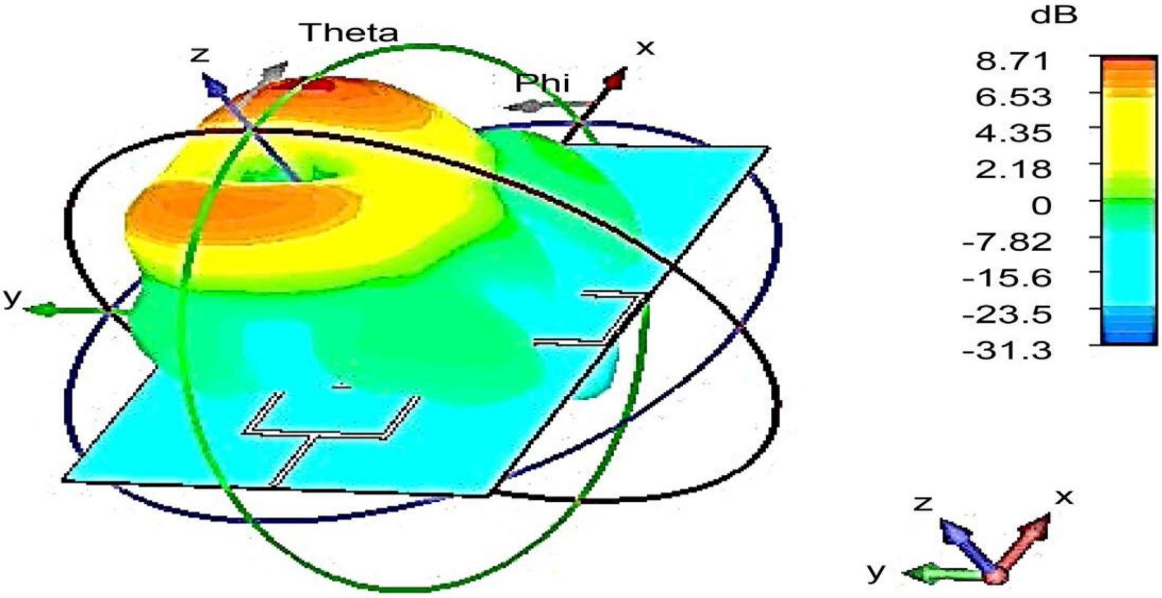

FIG 2 Simulated Radiation Pattern of the Conventional Grid Antenna Array at 4.83 GHz.

The proposedgrid antenna array size is 150 × 175 × 1.5 mm3. The substrate dielectric constant and loss tangent are 2.2 $r\ \varepsilon$ = and tanδ = 0.0009 , respectively. A metal reflector with 20 cm × 20 cm and at 9.5 mm from the projection is used for gain enhancement purpose. The proposed grid collection is analyzed using (CST) simulator. Figure 3 shows the simulated 11 S results for the microstrip grid array antenna.

The proposed projection bandwidth is lengthy from 4.8 GHz to 4.9 GHz at resonant frequency of 4.86 GHz, Figure 3. The length of the horizontal element is 26 mm and the element width is 11 mm. The simulated half-power beam width is 25.9˚ in the E-plane and 26.3˚ in the H-plane at 4.86 GHz, Figure 4. Figure 4 indicates that a pencil beam radiation is obtained. The proposed Figure antenna array has a gain of 17 dBi, fractional bandwidth of 2.1% and efficiency of 93% at 4.86 GHz. Figure 4shows a photo of the proposed fabricated grid antenna array.

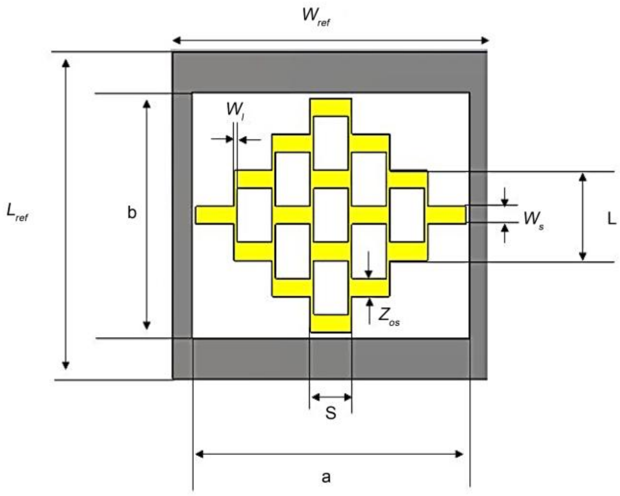

Fig 3. Proposed Grid Antenna Array

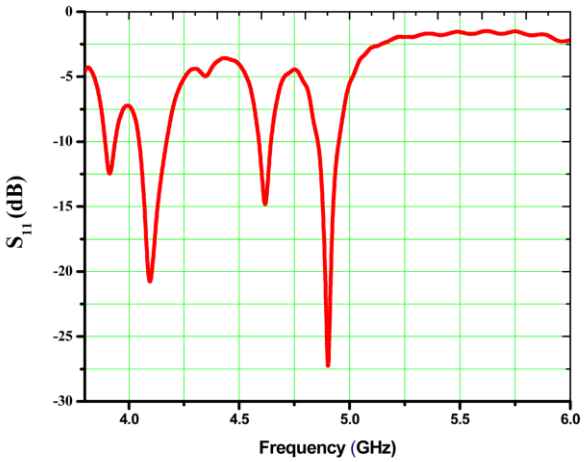

Fig 4 Simulated 11 *S* of the Proposed Grid Antenna Array.

III. METHODS IN HYPERTHERMIA

A. Local Hyperthermia

It heat is applied to a minor area, such as a tumor, by numerous methods that allocate energy to heat the tumor. Dissimilar kinds of energy might be used to apply heat, counting microwave, radiofrequency, and ultrasound. Dependent on the tumor location, there are numerous methods to local hyperthermia.

B. External

This methods are used to treat tumors that are in or just below the skin. External applicators are located about or close the suitable region, and energy is absorbed on the tumor to increase its temperature.

C. Intraluminal Or Endocavitary

If actions may be used to treat tumors within or close body hollows, such as the esophagus or rectum. Reviews are located exclusive the cavity and inserted into the tumor to bring energy and heat the part directly.

D. Interstitial

This methods are used to treat tumors deep inside the body, such as brain tumors. This method permits the tumor to be heated to higher temperatures than outside methods. Below anesthesia, reviews or indicators are introduced into the tumor. Imaging methods, such as ultrasound, might be used to create sure the analysis is correctly located within the tumor. The heat basis is then introduced into the probe. Radiofrequency ablation (RFA) is a kind of interstitial hyperthermia that practices radio waves to heat and kill cancer cells.

E. Regional Hyperthermia

If numerous methods might be used to heat large parts of tissue, such as a figure hollow, organ, or member.

F. Deep Tissue

It methods might be used to treat cancers inside the body, such as cervical or bladder cancer. Outside applicators are located about the body cavity or organ to be preserved, and microwave or radio occurrence energy is absorbed on the amount to raise its temperature.

G. Regional Perfusion

This methods can be used to treat cancers in the arms and legs, such as growth, or cancer in certain structures, such as the liver or lung. In this process, certain of the patient's blood is detached, intense, and then driven (perfused) back into the member or organ. Anticancer drugs are usually assumed through this treatment.

H. Continuous Hyperthermia Peritoneal Perfusion

CHHP is a method used to treat cancers inside the peritoneal cavity (the planetary within the abdomen that holds the intestines, stomach, and liver), including primary peritoneal mesothelioma then stomach cancer. Through surgery, heated anticancer drugs flow from a warming device through the peritoneal cavity. The peritoneal cavity temperature spreads 106-108°F.

I. Whole-Body Hyperthermia

It is used to treat metastatic cancer that has extent through the body. This can be consummate by numerous methods that increase the body temperature to 107-108°F, counting the use of thermal chambers (similar to large incubators) or hot water blankets.

The efficiency of hyperthermia action is connected to the temperature attained during the treatment, as well as the distance of treatment and cell and tissue characteristics. To guarantee that the wanted temperature is reached, but not exceeded, the temperature of the tumor and neighboring tissue is watchedthrough hyperthermia treatment. Using local anesthesia, the doctor inserts minor needles or tubes with tiny thermometers into the action area to screen the temperature. Imaging methods, such as CT (computed tomography), may be used to type sure the reviews are properly positioned.

J. Future Hold for Hyperthermia

A amount of tests must be overcome earlier hyperthermia can be measured a normal action for cancer. Numerous clinical trials are being conducted to appraise the usefulness of hyperthermia. Some trials continue to examination hyperthermia in combination with additional therapies for the treatment of dissimilar cancers. Other studies focus on humanizing hyperthermia methods.

IV. PROPOSED SIMULATED HYPERTHERMIA SYSTEM

Breast phantom for microwave hyperthermia takes stayed reported in. It was manufactured by combinations of low-cost resources such as water, oil, salt, gelatin and formaldehyde. These resources were used to happen the tissues' dielectric permittivity, conductivity, and thermal possessions across the incidence band 3 - 6 GHz. the resources possessions which are used in building breast phantom in CST simulator. Together conventional and proposed network projection collections are used for gaining the temperature delivery inside the breast phantom. shows the replicated scheme where conventional network projection array is located at 60 mm from the breast phantom and at a frequency of 4.83 GHz. Figure 5shows the thermal supply after 10 minutes and with 0.5 watt at the projection input. The temperature delivery is not unchanging inside the phantom due to the heterogeneous structure of the breast.

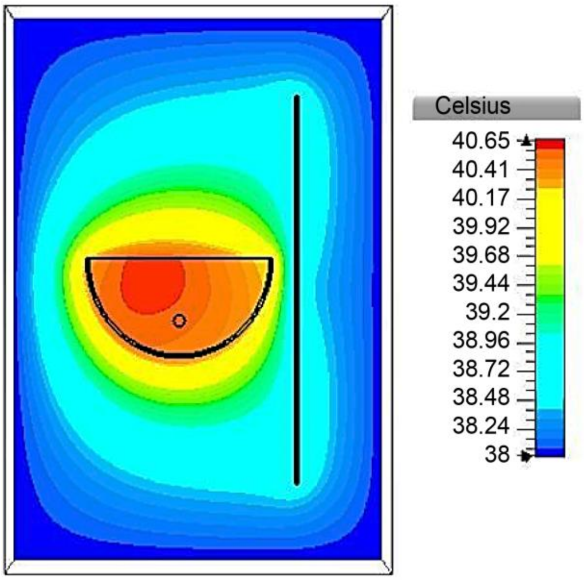

Fig 5 Heat Distribution in Breast Phantom using Conventional Grid Antenna Array

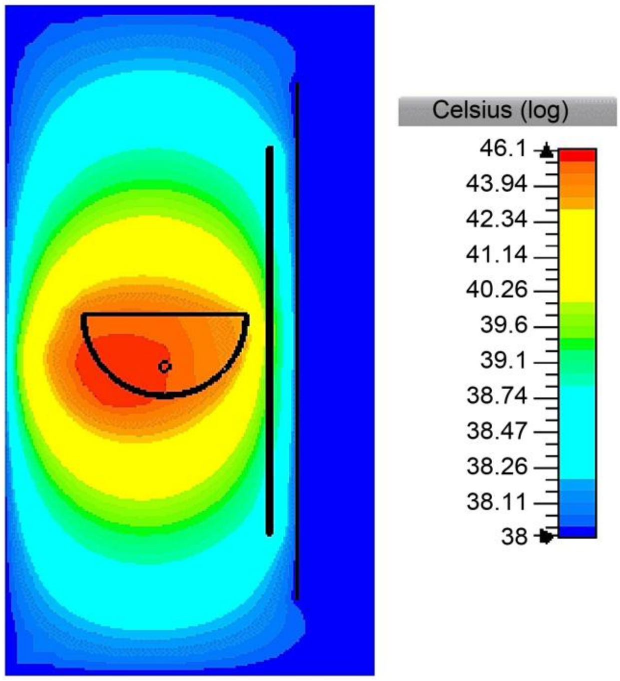

Fig 6 Heat Distribution In Breast Phantom Using Proposed Grid Antenna Array.

The replicated temperature growths from 38˚C to 40˚C inside the phantom area. This temperature growth is inadequate for breast cancer action process. Figure6 shows the proposed simulated scheme where the future network projection collection is located at 60 mm from the breast phantom and at a occurrence of 4.86 GHz. Figure 6displays the replicated thermal delivery after 10 minutes and with 0.5 watt at the planned network projection collection input. A accurate temperature of 38˚C is selected for the body and the background temperature. The simulated temperature increases from 38˚C to 46˚C within the phantom area. This temperature increase is very sufficient for breast cancer treatment process.

V. CONCLUSION

In this paper, temperature increase, CST Microwave Studio simulator for joining the electromagnetic and thermal simulation results was used, and this temperature delivery though using together proposed and conservative network projection collections was shown. This was exposed for 10 minutes and with 0.5 watt at projection input. The conservative network projection collection attained hotness growth of 2 in this area. This temperature growth is inadequate for hyperthermia therapy. The conservative collection short side was changed for radiation goods improvement. The proposed network projection collection extended side width remained reserved wide for fatalities discount. The planned antenna improvement, competence, 3 dB beam width, and its structure were very appropriate for hyperthermia requests. It is worthy to reference that the future hyperthermia network projection collection scheme increases all this tissues to 46˚C without any judgment between tumor tissues and breast tissues. So, very careful medical process wants to be measured when by this type of cancer treatment.

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