بسم الله الرحمن الرحيم

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

﴿ قـــســـم ﴾

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %

بعض الوثائق الأصلية تالفة

بالرسالة صفحات

لم ترد بالأصـــل

Cairo University
Faculty of Engineering,
Dept. of Systems and Biomedical Engineering

Use of Interstitial Antenna for Brain Tumors Hyperthermia

Thesis

Submitted in Partial Fulfillment of the Requirements for the Degree of
Master of Science

By

Eng. Asmaa El-Sayed Farahat
Microwave Engineering Dept.
Electronics Research Institute (ERI)

March 2006

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ABSTRACT

Hyperthermia cancer therapy is used in conjunction with chemotherapy and radiotherapy, since the cytotoxic effect of anti-tumor drugs is enhanced and the cell killing ability of ionizing radiation is potentiated by hyperthermia. For brain tumors, the antennas used for heating are implantable interstitial antennas, usually some forms of dipole antennas fed from a coaxial line. The specific absorption rate (SAR) distribution in the brain due to the near field of the antennas is required to be localized and uniform within the tumor, weak outside the tumor.

The main objective of this thesis is to introduce a design of an interstitial short dipole antenna capable of producing a localized regional heating for brain tumors hyperthermia. The proposed antenna is then tested in treating brain tumors. The analysis of implanting the antenna inside the human head for hyperthermia treatment is done using finite-difference time-domain (FDTD) numerical simulation programs.

The research includes the following, the analysis and design of a short dipole antenna that can be implanted inside the brain tissues, which are considered dissipative media. Simple analytic formulas for studying the dipole behavior in a dissipative medium are used to determine the dipole parameters such as half-length, radius and the operating frequency. Low frequencies are found to be the best choice for the interstitial heating inside the brain, specifically frequencies around 400 MHz. The dipole half-length and radius are chosen to achieve the best matching properties for nearly full delivery of generator power to the antenna. The dissipated power near by the dipole is calculated. The FDTD is then used to analyze the effectiveness of implanting the designed antenna for brain tumors hyperthermia. Since, the FDTD is reliable and common in use in modeling human body; it is used to model the human head. An anatomical based realistic head model is implemented using a high resolution magnetic resonance images (MRI) data set for the human head. In this work, a development of the FDTD code is made. A Uniaxial perfectly matched layer (UPML) is used to terminate the FDTD problem space. The developed code is

verified by comparing some results with the commercial package XFDTD. The SAR distribution generated inside the head due to the implanted antenna is calculated. A bio-heat equation which takes into account various heat exchange mechanisms such as heat conduction, blood flow, metabolic heat production, and EM heating, is solved using the FDTD in order to calculate the temperature rise due to interstitial heating of brain tumors. A FDTD thermal model is used for the heat analysis. The proposed antenna is tested with different types of brain tumors such as Cerebellar Astrocytoma and Menegioma.