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Simulation Study of a Modified Rectangular Microstrip for the Hyperthermia Breast Cancer Procedure with SEMCAD X Solver

Kasumawati Lias^{1*}, Nabilah Abdul Jaffar², Norlida Buniyamin², Hazrul Mohamed Basri¹, Wan Azlan Wan Zainal Abidin¹, Kuryati Kipli¹, Nur Alia Athirah Mohtadzar¹

¹Faculty of Engineering, Universiti Malaysia Sarawak (UNIMAS), 94300, Kota Samarahan, Sarawak

²Faculty of Electrical Engineering, Universiti Teknologi MARA (UiTM), 40450, Shah Alam, Selangor

*lkasumawati@unimas.my

Abstract. A modified rectangular microstrip is introduced and presented as an applicator for hyperthermia cancer procedure. SEMCAD X solver is used as the simulation tool to investigate the rectangular microstrip, which is applied and radiated to the breast phantom. The research is carried out in order to enhance the penetration depth, which is up to 100mm and improve the focusing capability, which means that to reduce the unwanted hot spots at the vicinity area of the treated tissue. The specific absorption rate (SAR) distributions of 1 and 10 g weights of breast tissue are obtained as simulation results. The operating frequency utilized for the study is 915 MHz, with three operating powers of 10, 100, and 200 W. Beside rectangular, a circular microstrip applicator with microstrip feed line is also simulated in order to determine which shape of the microstrip applicator presented the greatest results in term of the depth penetration and focusing capability. As expected, the greatest SAR is provided by the microstrip applicator with rectangular shape. By that, the rectangular microstrip applicator is further explored and modified. From the outcomes, the rectangular microstrip with structure 4 presents the utmost specific absorption rate deposition; the required penetration depth is achieved, and focusing is enhanced with minimal unwanted hot spots at the vicinity of the treated area.

1. Introduction

Microstrip antenna introduces many inventive works and is one of the most dynamic fields in communication applications. Microstrip patch is generally designed and developed with various shapes, such as square, rectangular, circular, triangular, and elliptical or some other common shape. The most widely used among all are rectangular and circular shapes.

The fundamental structure of microstrip antenna comprises a metallic radiating patch element, which is integrated into a grounded dielectric substrate. Rectangular and circular patches are extensively used because they easily provide feed line flexibility, multiple frequency operation, linear and circular polarizations, frequency agility, and good bandwidth [1]. The basic configurations of both patches are illustrated in Figures 1 (a) and (b).

