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Study on breast cancerous organ's depth and coverage parameters via Debye and monostatic rader techniques with UWB-microstrip patch antennas.

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Abstract

A 5 GHz class of Microstrip Patch Antenna (MPA) designed, simulated, fabricated and measured has been presented in this research paper. Furthermore, comparative study on existing Debye test bed and Monostatic radar techniques have been implemented for depth and coverage of cancerous organ parameters respectively via 2 × 2 array pattern of Ψ_U shaped UWB-MPAs. The proposed MPA offers enhanced design parameters and lesser complexity than existing 3GHz MPAs. For an example, the proposed UWB-MPAs prototype provides operating frequency of 4.53 GHz (15.99% of Fractional Bandwidth (FBW)) and complexity of 18.64 × 23.92 × 1 mm^3. Hence, these MPAs have to analyse the vector dimensional and depth of cancerous organ has been presented in paper.

Keywords: Breast cancer diagnosis system, Debye test bed, Monostatic radar technique, Fractional bandwidth and UWB-MPAs.

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Introduction

Breast cancer is a major challenge and health issue of the present society. The death rate has doubly risen in the past 30 years. The various diagnosis systems are authorized and followed to reduce the death rate. The Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET) are the existing diagnosis trials. The X-ray mammography (XRM) is an efficient diagnostic tool but it has some limitations in the screening detection methods. They are, the heavy chemical dose applied on the human breast to affect ionization effects within the body and the harmful radiation effects during the clinical tests. Both of the above results provide in the injurious health issues. Normally, these radiology diagnostic trials do not offer the tissue's sample based analysed report. These drawbacks of MRI, XRM and other existing techniques are recovered using the Microwave Imaging (MI) methods in [1]. The proposed test beds are able to conduct below 10 GHz range of microwave signals which requires the Specific Absorption Ratio (SAR) value of 4 W/Kg limitations. The microwave transmission of medical diagnosis has thermal and radiation effects. The thermal effect is used in therapy treatment which removes the cancerous organ. As the result of diagnosis, test beds provide the ionization and injurious effects. The radiation effect offers the non-ionization; cost effective, harmless effects and more number of clinical trials are possible to under the screening test. The Microwave Imaging (MI) methods provide the UWB based a radar approach which classifies the tumor resolution stages using scattered mapping algorithms. Consequently, efficient MPAs designs are required for breast cancer detection in UWB-MI diagnosis methods. The proposed UWB-MI diagnosis system and the drawbacks of prior diagnosis systems are discussed in the [1-3].

Materials and Methods

The compact size of 2 × 2 array pattern of MPAs with 5 GHz UWB band of operation and Industrial Scientific and Medicine (ISM) band of applications are presented in this section. The conductive patch strips propose to design a 2 × 2 array of four radiating elements. The proposed MPAs are design and simulated and fabricated procedures are followed in [3]. Furthermore, their complexity is lesser than existing design. Analyze of depth and coverage of parameters is justified in cancerous organ by existing test bed of [3]. The 5 GHz resonance class of 2 × 2 array patterns of MPAs and equivalent dielectric breast model are justified for depth of cancerous organ using different dielectric strengths of coupling materials. It has shown in Figure 1, the early time peak response of 25.75 dB has been obtained at 4.475 GHz. These scattered drops have clearly described the opposite values of dielectric strengths in the scattered responses. As the scattered drops of the higher dielectric strength offer above the 85 dB of scattered drops. These kinds of values are not reordered in the Agilent (N99917A) Microwave Analyzer with VNA. The healthy tissue module consisting of MPAs logically connects to wristband which is measured using Agilent (N99917A) Microwave Analyzer with VNA [3]. The return losses of 41.78 dB (S_{ii}), 47.45 dB (S_{jj}) has been obtained at 2.414 GHz and 2.301 GHz. While, coupling losses (S_{ji}=S_{ij}) of 47.781 dB;