Miniaturized UWB Microstrip Antenna for Microwave Imaging

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Abstract: - This article presents the design of a miniaturized microstrip antenna for microwave medical imaging applications. We propose a miniature rectangular printed antenna that meets the UWB characteristics in terms of bandwidth and reflection coefficient. This antenna is designed for a system to detect malignant tumors by microwave imaging. We use certain techniques of miniaturization and expansion of bandwidth in order to achieve our intention. The antenna has an ordinary rectangular radiating patch, therefore displays a good omnidirectional radiation pattern. The proposed antenna exhibits good UWB characteristics and has the capability of operating from 2.68GHz to 12.06GHz.

Keywords:- UWB, microstrip antenna, miniaturized, microwave medical imaging

1. Introduction

Ultra Wideband Radio is a potentially revolutionary approach to wireless communication. The advances in ultra wideband (UWB) systems and applications are progressing at a rapid rate. Microwave Ultra-Wide Band imaging is currently a very promising technology for wireless communications son very high speed, high precision radars and imaging systems [1]. This application involves transmitting UWB signals through the breast tissue and records the received signals from different locations.

Since the acceptance of unlicensed use of the UWB technology in the range between 3.1GHz and 10.6GHz in the USA (FCC, 2002) and more recently between 3.4GHz and 8.5GHz in Europe (ETSI, 2008), the realization of low-cost UWB wireless systems is considered a fundamental research goal both for military and commercial applications [2-3]. The commission has established some regulations regarding the frequency bands and transmission power limits allocated to different UWB applications. UWB is defined as any wireless scheme that occupies either a fractional bandwidth greater than 20% or more than 500MHz of absolute bandwidth [4].However, for radar systems, such as a UWB microwave imaging system for detection of tumor in woman’s breast, a moderate gain directional antenna is advantageous [5].The use of UWB signals in microwave imaging applications in addition to wireless communications requires suitable antennas as transducers between UWB transceivers and the propagating medium. One of the major challenges in antenna technology is the design of ultra wideband compact omnidirectional antenna with constant gain and minimum group delay [6]. The microstrip antennas seem to be ideal candidates and are frequently encountered in UWB applications, including medical imaging. This is due to their low profile, low cost and ease of integration [7].

This paper focuses on designing an ultra-wideband microstrip antenna for Microwave Imaging System applications. This UWB structure will be included in a system for detecting breast cancer. The microstrip antenna that we propose is miniaturized rectangular shape and has desirable performance for UWB antennas. The interest is to achieve increased bandwidth. The reduction in size is also a consideration to be taken into account in the design of this antenna, which would be more easily integrated into the system and reduce clutter. For this some techniques are used [8-11]. Among these techniques, we will use the technique of slots at the radiating element [12]. The use of a partial ground plane promotes the enlargement of the bandwidth [13]. Insert a notch in the partial ground plane can also have a significant effect on the performance of our antenna [14-15].

The proposed antenna is simulated with HFSS and CST software’s and satisfies the VSWR<2