A New Olympic Ring Shaped Antenna for UWB Applications

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***Abstract*— In this paper, we propose a new Olympic Ring Shaped antenna for UWB applications. The proposed antenna is designed to operate from 3.1 to 10.6 GHz. It consists of a five circular ring shapes form an Olympic ring shape with a partial ground plane. A detail of proposed antenna simulation is done using CST software and measured results are presented and discussed.**

***Keywords*-Ultra wideband antenna; Olympic ring; CST;**

I. INTRODUCTION

Since the acceptance of the Ultra Wide Band (UWB) impulse radio technology in the USA, there has been a considerable research effort put into UWB radio technology worldwide [1]. UWB antennas are specially designed to transmit and/or receive very short time durations of electromagnetic energy [2]. Therefore in the progress of UWB technology the transmitting and receiving antenna design has become a challenging topic. UWB technology is based on the use of very narrow pulses, in the order of nanoseconds, which covers a very wide bandwidth (3.1 to 10.6 GHz) in the frequency domain. In this paper, we propose a new ultra wideband antenna for UWB applications. The proposed antenna consists of five rings that form an Olympic ring shape with a partial ground plane. Investigations based on experiments and simulations are conducted. The simulation is performed using the commercially available simulation software CST Microwave studio. The proposed antenna is successfully implemented and the simulated results show reasonable agreement with the measured results. In this design, a 3.1 to 10.6 GHz frequency range for $S_{11} < -10$ dB is obtained, Radiation patterns and VSWR are also examined.

II. ANTENNA DESIGN

Figure 1 shows the configuration of the proposed antenna, which consists of five rings that form an Olympic ring shape with a partial ground plane. The antenna, which has compact dimensions of 32 X 40.57 mm^2, is printed in front of substrate FR4 of thickness 1.6 mm and relative permittivity 4.3. The width dimension of each circular ring is 1 mm and the dimension of ground plane is chosen to be 32 X 18.8 mm^2. The excitation is a 50 ohm micro strip line printed on the partial grounded substrate. Note that the design dimensions of the proposed antenna are obtained using CST Microwave studio. By selecting these parameters, the proposed antenna can be tuned to operate in the 3.1 – 10.6 GHz frequency range.

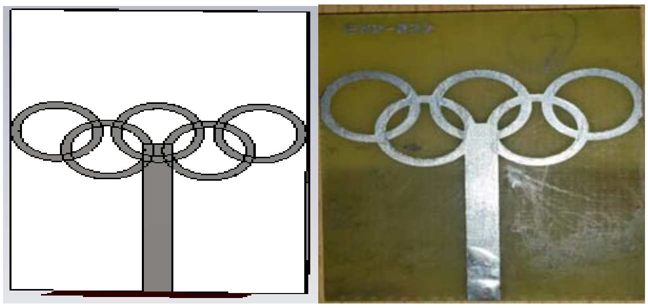

Fig. 1. CST model amd picture of the proposed antenna.

III. RESULTS AND DISCSSION

The CST software is used to simulate the proposed model. The Anritsu Vector Network Analyzer (37397C) is used to measure the Return Loss S11 and VSWR. The simulated and measured return loss result of the proposed antenna is shown in Figure 2 . The simulated bandwidth of S11 < 10dB varies from 3.1 GHz to 10.6 GHz and the measured one from 3.1 GHz to 10.6 GHz. The simulated and measured VSWR results of the proposed antenna are shown in Figure 3. The simulated bandwidth of VSWR ≤ 2 ranges from 3.1 GHz to 10.6 GHz and the measured one from 3.1 GHz to 10.6 GHz. Both of them cover the UWB range of 3.1 to 10.6 GHz for short wireless communications. Figure 4 shows the simulated far field radiation patterns at different frequencies. Figure 5 shows the simulated E-field distribution at different frequencies.

IV. CONCLUSION

A new ultra wideband (UWB) antenna has been proposed for UWB applications. The simulated results conducted by the CST Microwave simulator show reasonable agreement with the measured results. The entire frequency band almost obtained for S11 < 10 dB and VSWR ≤ 2 is obtained from 3.1 – 10.6 GHz.

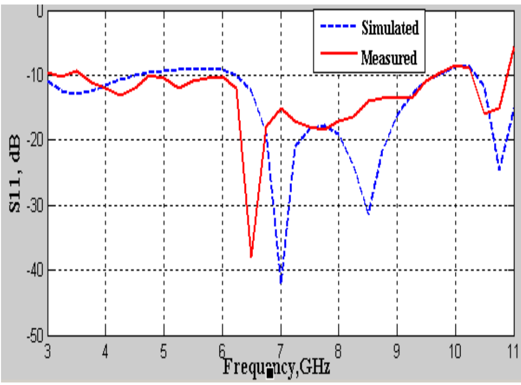

Fig. 2. Frequency vs. Return loss.

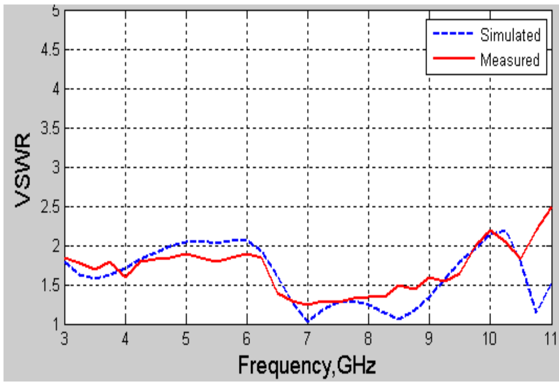

Fig. 3. VSWR curve.

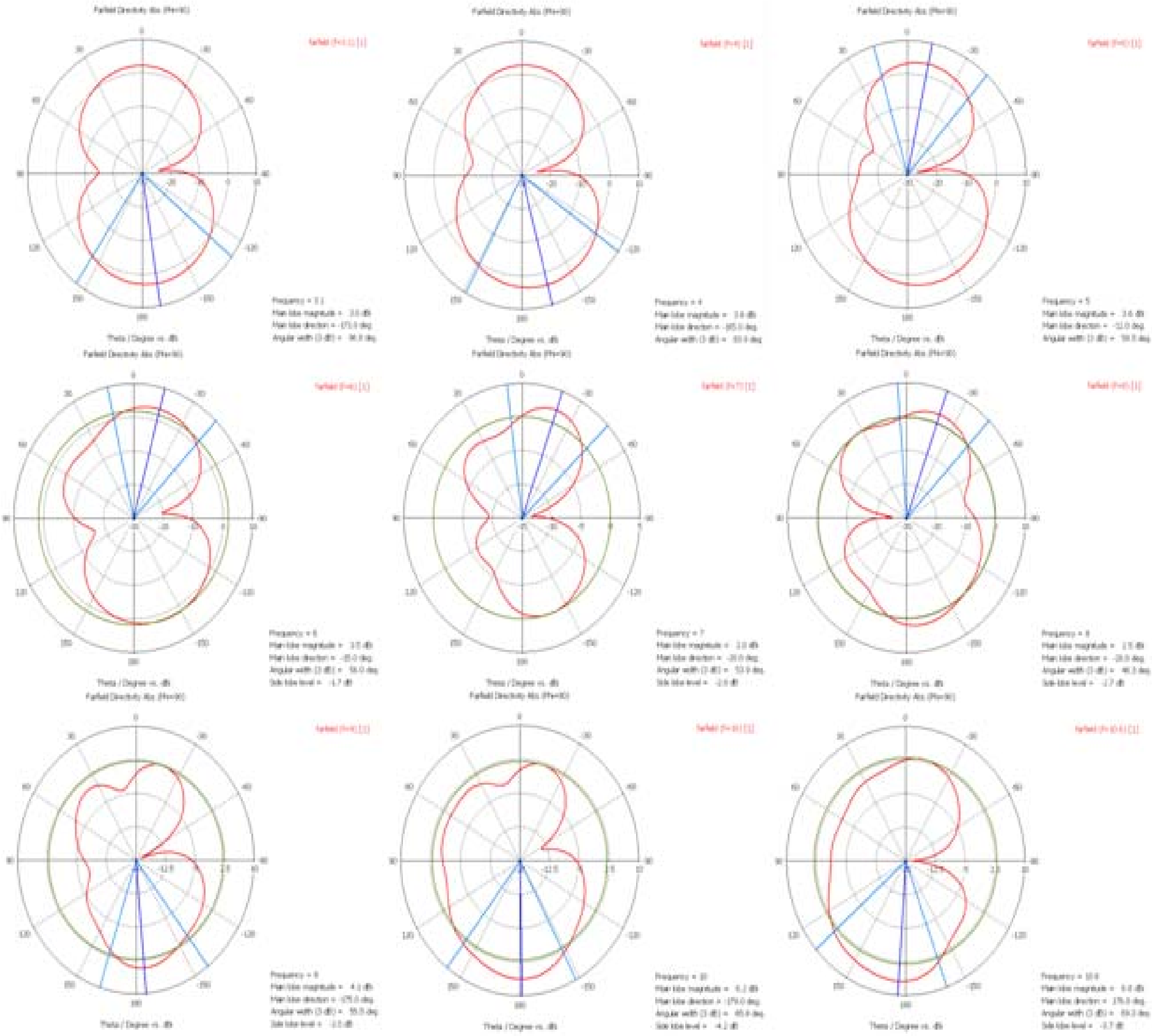

Fig. 4. The simulated far field radiation patterns at different frequencies. Top row from left to right: 3.1GHz, 4 GHz, 5 GHz. Middle row from left to right: 6 GHz, 7 GHz, 8 GHz. Bottom row from left to right: 9 GHz, 10 GHz, 10.6 GHz.

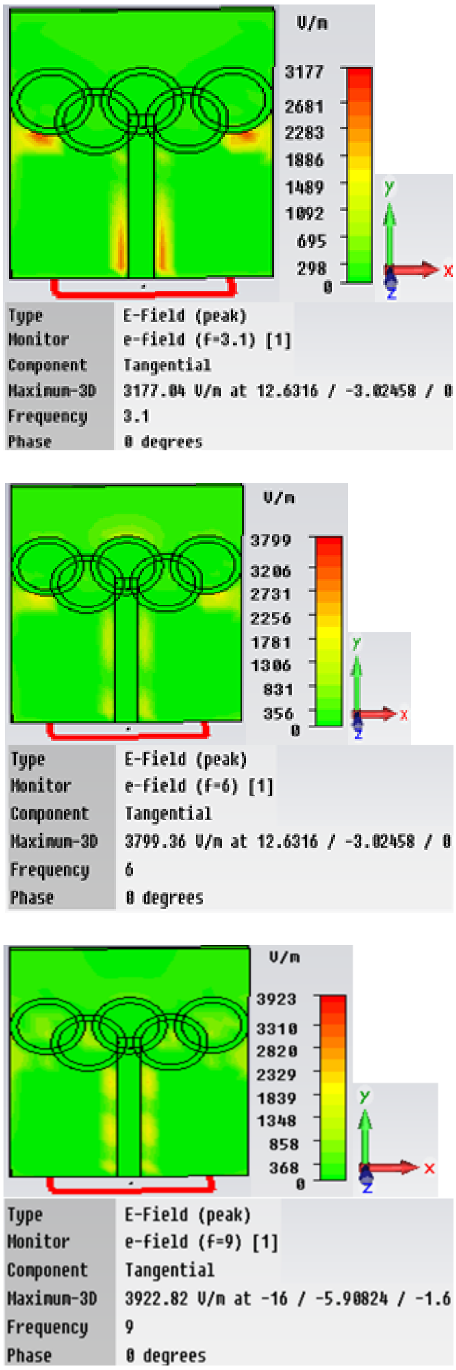

Fig. 5. Simulated E-field distribution at 3.1 GHz (up), 6 GHz (middle) and 9 GHz (bottom)

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