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Recent Trends for the Devolopment of Uwb Microstrip Patch Antennas

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Abstract- The ultra wide band (UWB) circular microstrip antennas are devoloped and simulated for wide band communication applications.In these a circular radiating aperture is made available for broad band characteristics.The proposed antennas consists of the vertical and horizontal elements of L-type probe fixed at front and back portion of the substrate respectively.These antennas are excited by a microstrip line which is connected to a vertical component of the L-type probe and electromagnetically couples the signal to the horizontal component of the L-type probe.This new concept of placing a couple of triangular slots at the top of the antenna is proposed to enhance the bandwidth from 83.1% to 99.15% is achieved.

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Recent Trends for the Devolopment of UWB Microstrip Patch Antennas

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Abstract- The ultra wide band (UWB) circular microstrip antennas are devoloped and simulated for wide band communication applications.In these a circular radiating aperture is made available for broad band characteristics.The proposed antennas consists of the vertical and horizontal elements of L-type probe fixed at front and back portion of the substrate respectively.These antennas are excited by a microstrip line which is connected to a vertical component of the L-type probe and electromagnetically couples the signal to the horizontal component of the L-type probe.This new concept of placing a couple of triangular slots at the top of the antenna is proposed to enhance the bandwidth from 83.1% to 99.15% is achieved.

I. Introduction

Wireless communication is progressing to exhibit very huge rise and wide implementation in a broad variety of applications.Wide bandwidth antennas are receiving more attention because a single antenna can cover various applications.Ultra wide band(UWB) is necessary for several applications as it exhibits numerous advantages,like less complexity and low expense,reluctant to severe multipath and jamming[3] .Federal communications commission(FCC) approves the frequency band (3.1-10.6 GHz) is occupied by the UWB radio system.

The designing of a printed slot antenna is a desireable solution for bandwidth improvement ,rather than increasing anenna size and thickness to overcome the bandwidth limitation of the microstrip patch antenna and thus making suitable for ultra wide band (UWB) applications[2].

This paper presents two wide band circular slot planar bidirectional antennas with L-type probes.A new concept of placing two triangular slots at the top of the antenna to enhance the bandwidth is also proposed in this paper.

II. Antenna dimensions and design

A circular microstrip antenna is as shown in fig1(a&b). The antenna uses a 0.1mm FR4-epoxy substrate with a relative permittivity (ε_r) of 4.4 and dielectric loss of 0.02.The dimensions of the substrate are $L_a = 100$mm and $L_b = 100$mm .The centre of the ground plane has a circular slot with radius R of 36mm.The L-shaped probe has horizontal and vertical components placed at front and backside of the substrate.The length of the vertical probe $L_c = 26$mm and 1mm wide (W_c).The vertical probe is extended to the edge of the substrate through an inductively matched microstrip feed line of 118Ω with a width (W_e) of 0.4mm and length (L_e) of 13.5mm long to impedance match the 50Ω coaxial cable.The horizontal component of the L-type probe is 27mm long (L_d) and 1mm wide (W_d). A 3.4mm long patch (L_f) with a width of $W_f = 2$mm is placed at the end of the vertical probe,which could enhance the capacitance between the vertical and the horizontal elements of the L-type probe[4].

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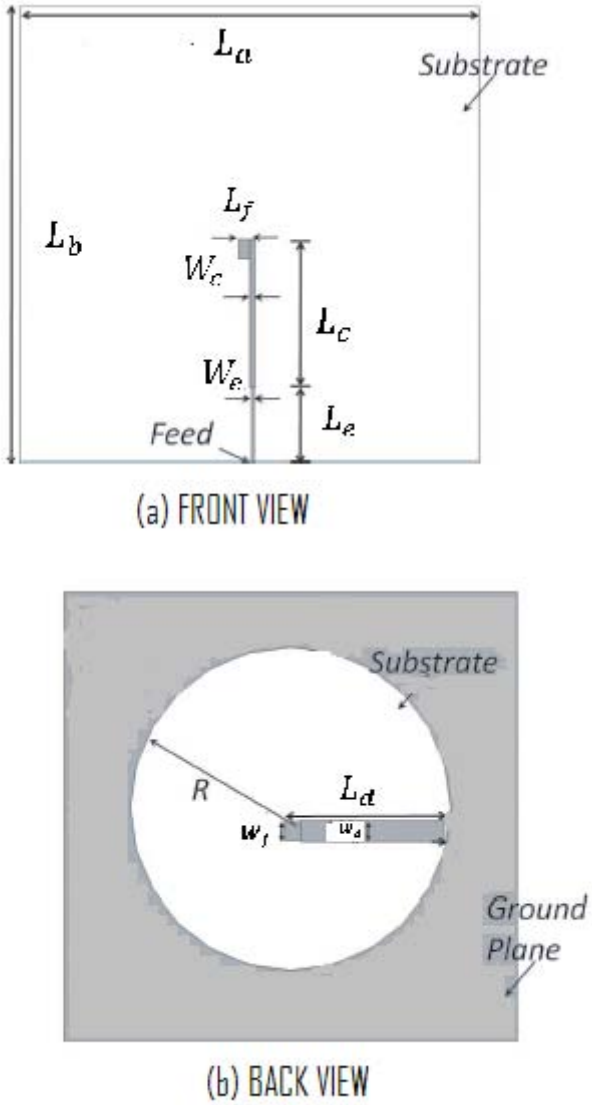

Fig. 1: Microstrip patch Antenna with circular slot

III. Results

The simulation of the antenna is done in Ansoft HFSS version 13.0.The front view of UWB circular microstrip patch antenna in HFSS is shown in fig2(a) and the S_{11} characteristics are shown in fig2(b). The S_{11} characteristics exhibits broad bandwidth of 81.1% (3.9GHz-9.3GHz) at $< -10\text{dB}$.

The antenna generates bidirectional radiation pattern,since it is a slot antenna. The radiation patterns are shown for various phi values of 0,30 and 60degrees at 2.4GHz in fig3(a),fig3(b) and fig3(c)respectively. Simulation of geometries for antenna performance optimization is started with a circular patch antenna and end up with another circular patch antenna with triangular slots.

The front view of UWB circular microstrip patch antenna with triangular slots in HFSS is shown in fig4(a) below and the S_{11} characteristics are shown in fig4(b). The S_{11}characreistics exhibits broad bandwidth of 99.15% (3GHz-8.9GHz) at $< -10\text{dB}$.The bidirectional radiation patterns are shown for various phi values of 0,30 and 60degrees at 2.4GHz in fig5(a),fig5(b)and fig5(c) respectively.

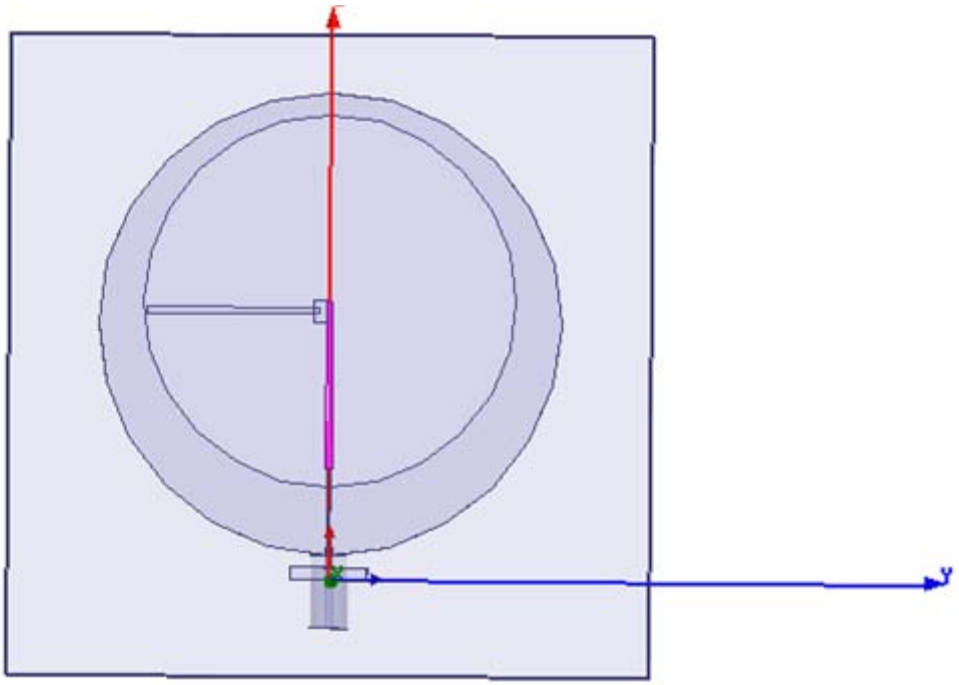

Fig. 2 (a) : Front view of UWB circular patch antenna in HFSS

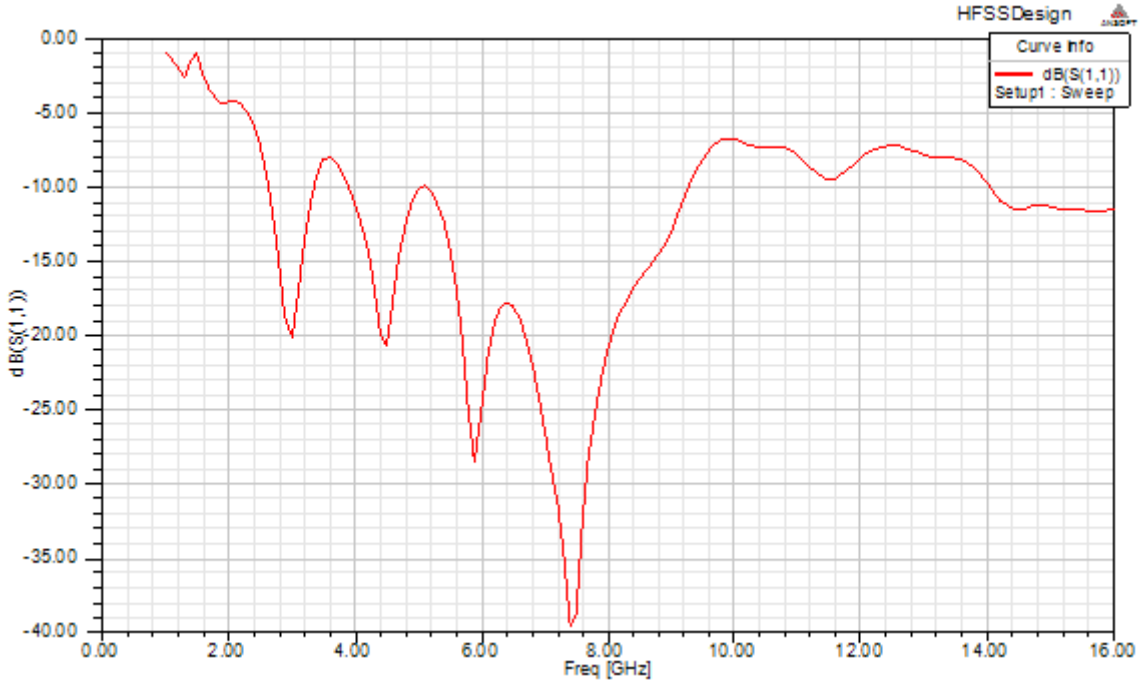

Fig. 2 (b) : Simulated graph of S_{11} for circular patch antenna

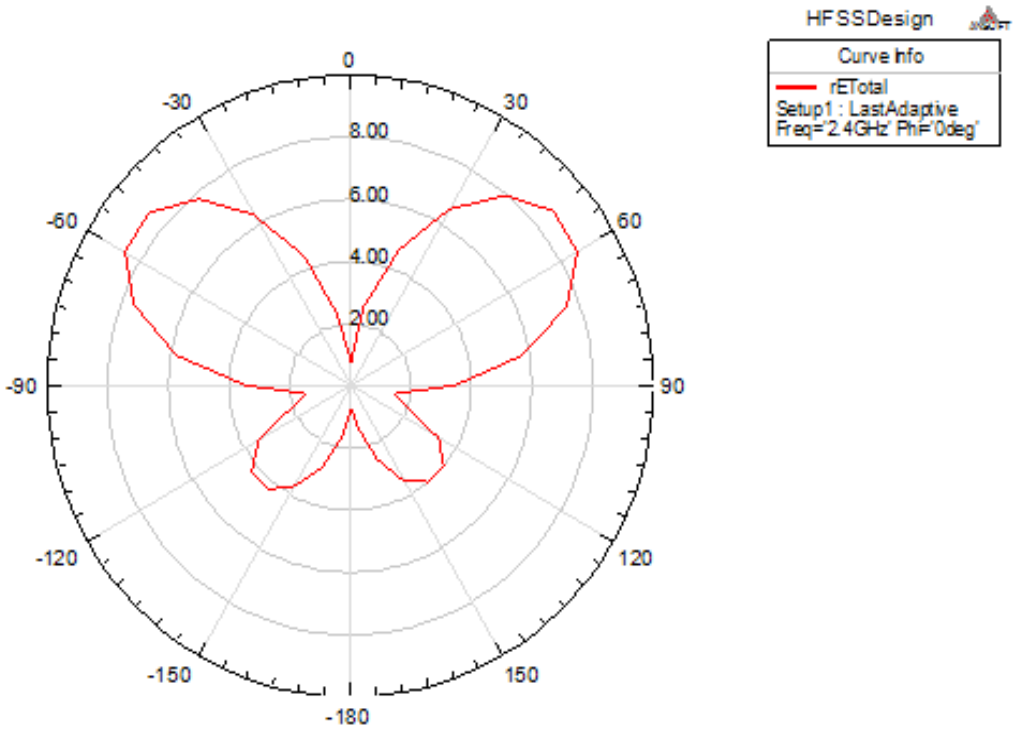

Fig. 3 (a) : Radiation pattern of circular patch antenna for frequency=2.4GHz and phi=0deg

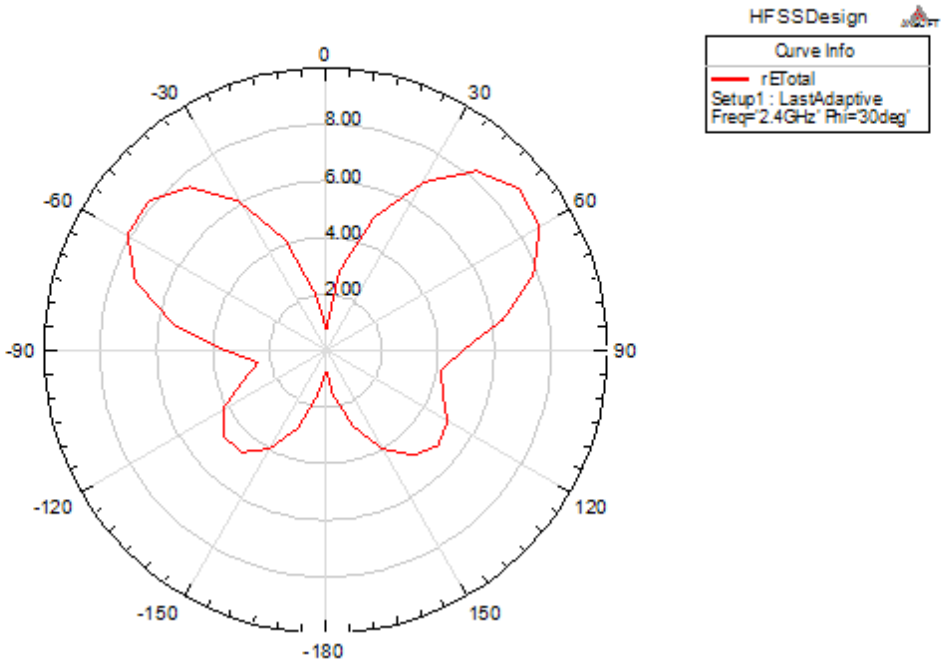

Fig. 3 (b) : Radiation pattern of circular patch antenna for frequency=2.4GHz and phi=30deg

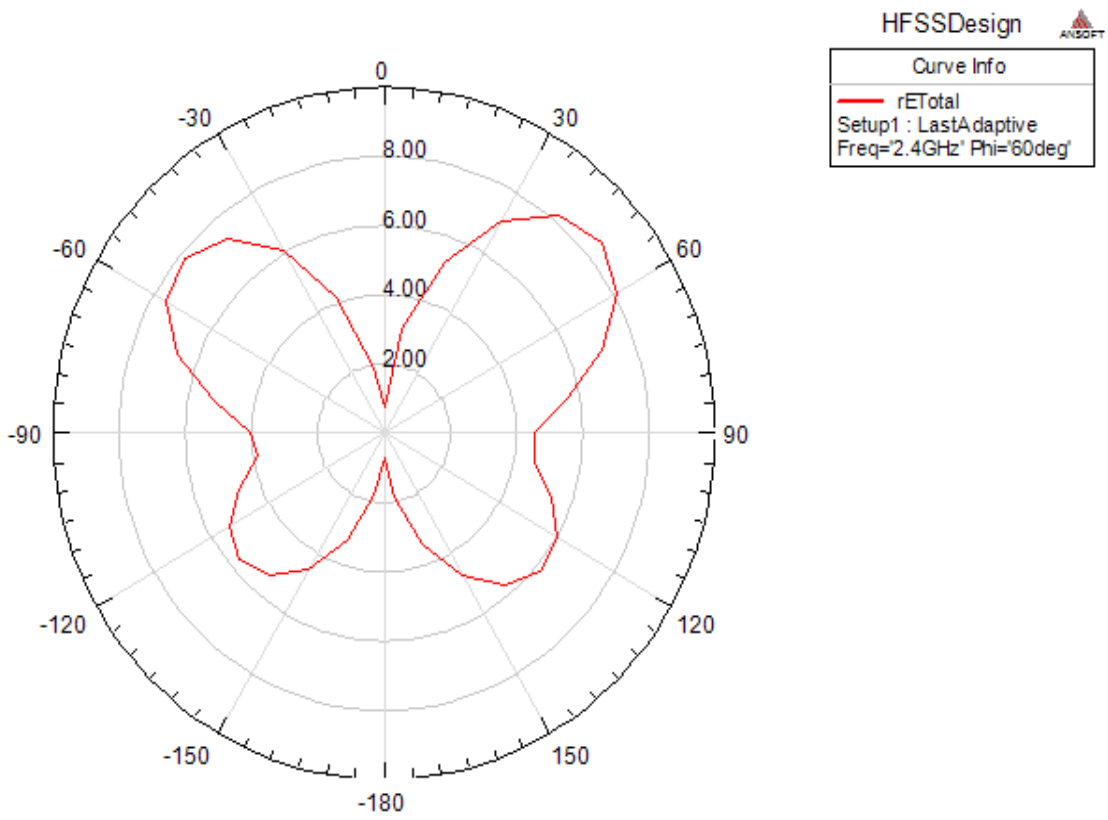

Fig. 3 (c) : Radiation pattern of circular patch antenna for frequency=2.4GHz and phi=60deg

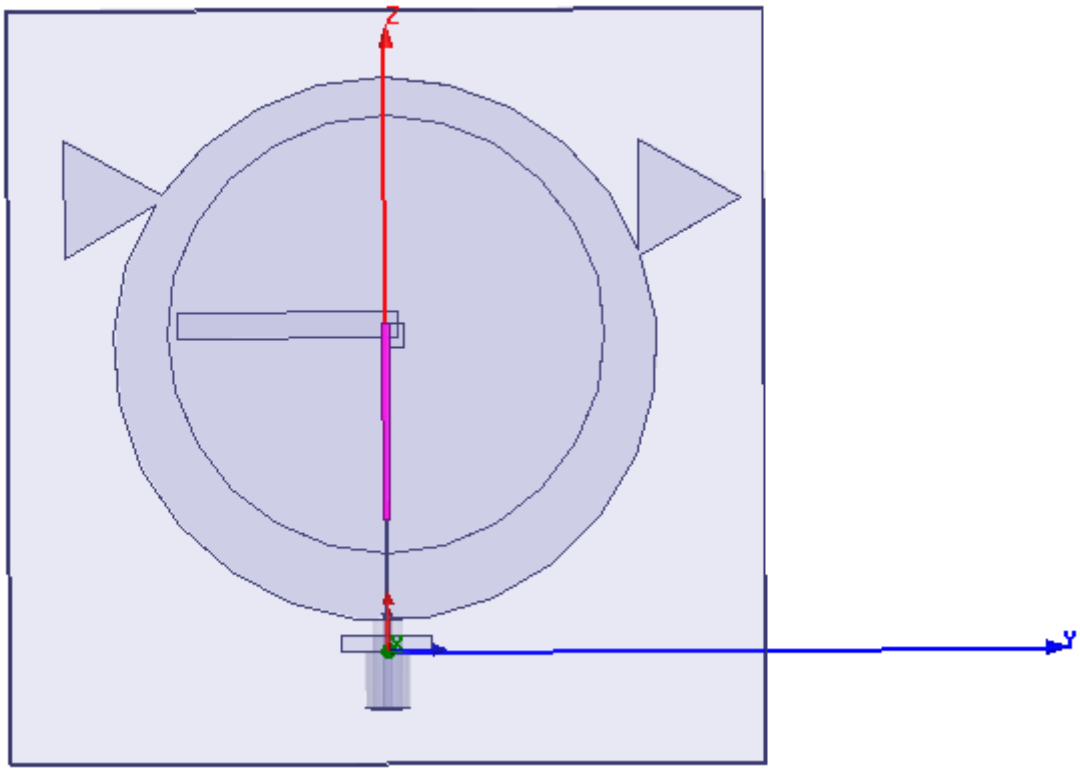

Fig. 4 (a) : Front view of UWB circular patch antenna with triangular slots in HFSS

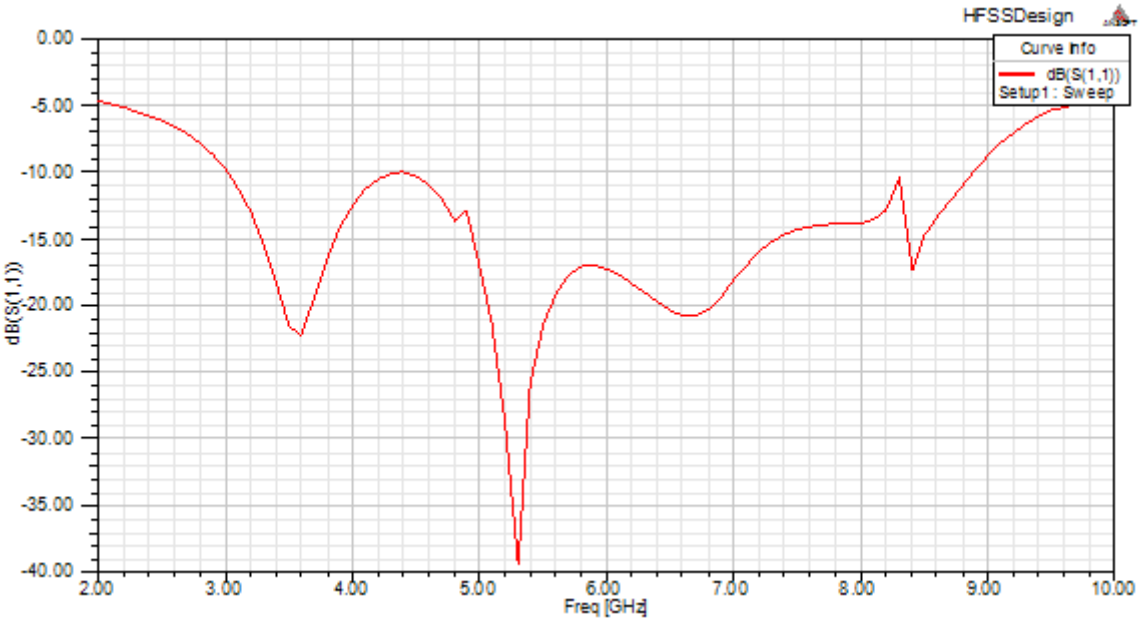

Fig. 4(b) : Simulated graph of S_{11} for circular patch antenna with triangular slots

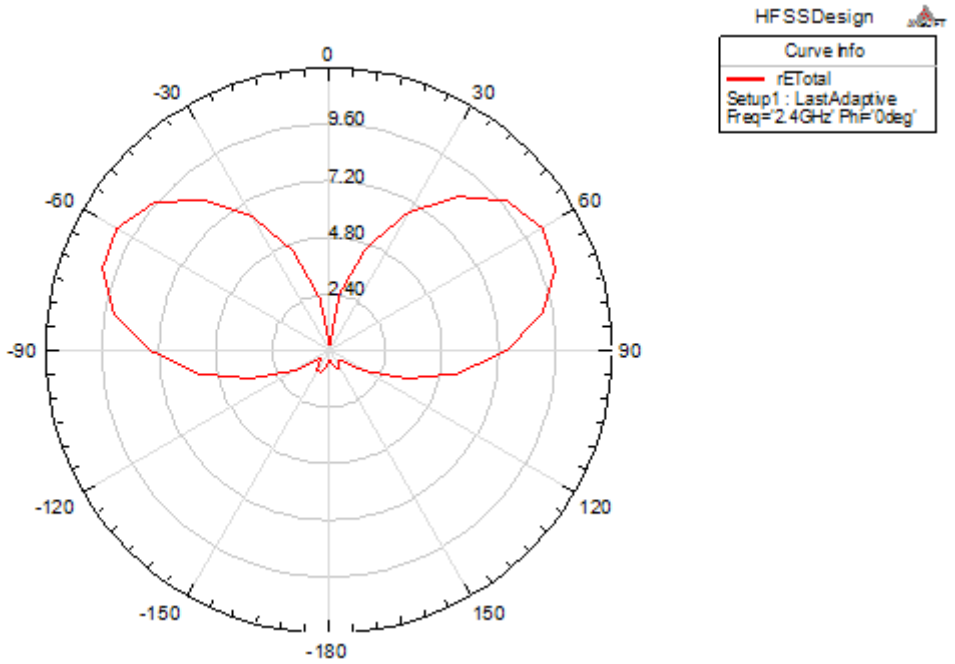

Fig. 5 (a) : Radiation pattern of circular patch antenna with triangular slots for frequency=2.4GHz and phi=0deg

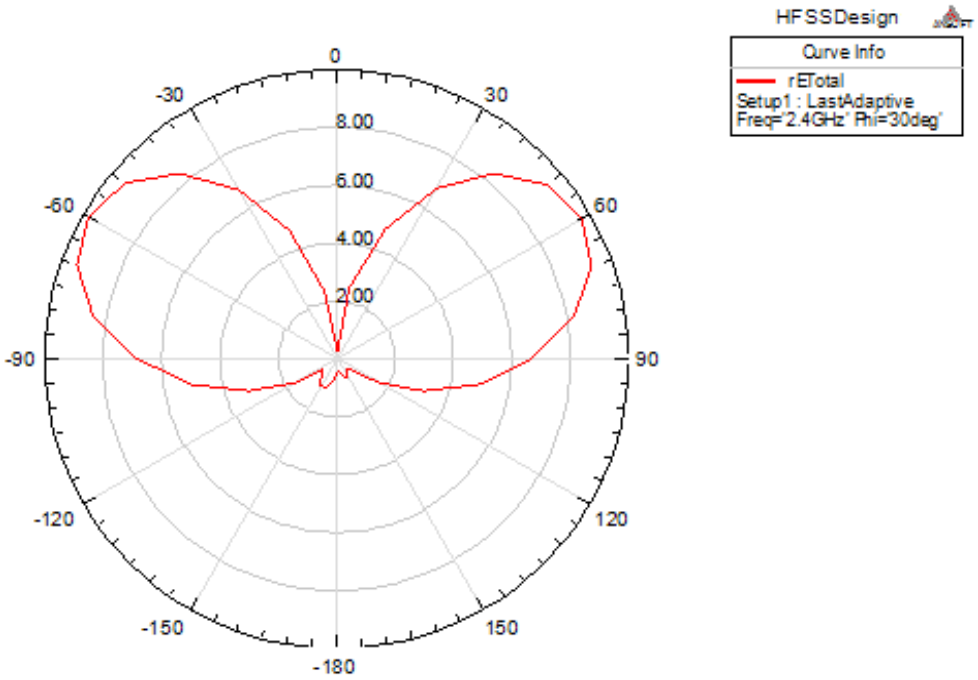

Fig. 5 (b) : Radiation pattern of circular patch antenna with triangular slots for frequency=2.4GHz and phi=30deg

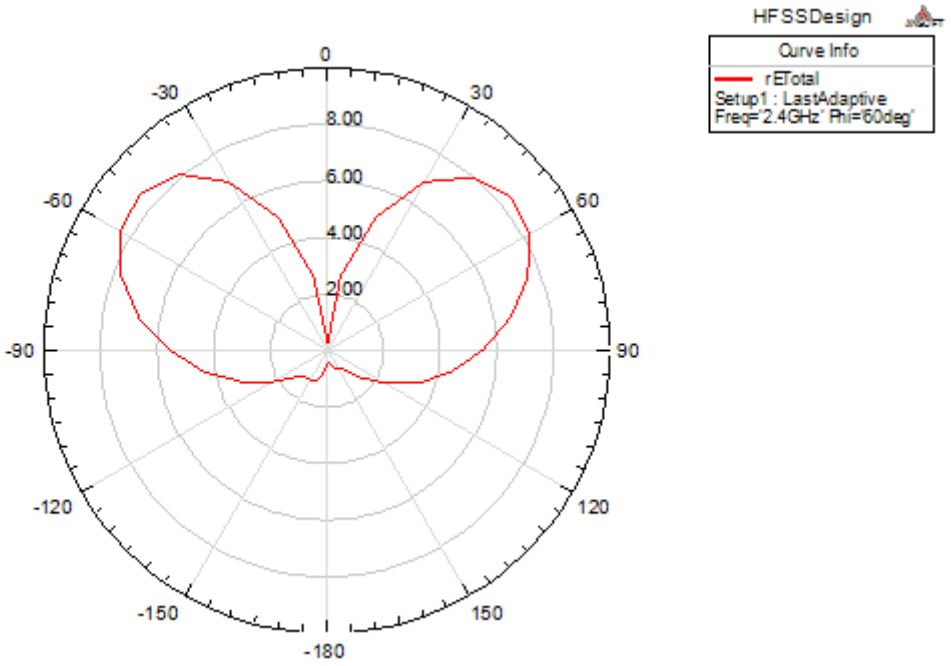

Fig. 5(c) : Radiation pattern of circular patch antenna with triangular slots for frequency=2.4GHz and phi=60deg

IV. Conclusion

Circular slot Wide band antennas having L-type probes are proposed in this work.The two proposed antennas are suitable for the UWB applications mainly for wireless communicatons and they found to exhibit excellent return loss characteristics.The circular microstrip patch antenna could achieve a simulated <-10dB S_{11} bandwidth of 83.1% and the circular microstrip patch antenna with triangular slots could achieve a simulated <-10dB bandwidth of 99.15%.With these techniques the draw back of the reduced bandwidth that the conventional microstrip antennas usually exhibits is completely reduced to a great extent.

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