# Monopole C Shape Antenna with a Wide Slot for UWB Applications

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***Abstract* - This paper presents a monopole C Shape antenna is integrated with one side printed circuit board (PCB) for ultra wideband (UWB) applications .The Semi-circular patch placed above the patch with a small circular hole in the patch . A micro strip-fed is attached to one side of the C shape antenna. The patch is designed on the basis of FR4 substrate material with thickness of 1.6mm.The ground plane is introduced in the patch for extra resonant modes and its change the current distribution on the antenna structure. The optimized result changes the upper frequency and decreases the reflection in the higher frequency. The simulated and output results shows that the peak value of antenna is 3 GHZ, S-parameter, VSWR, return loss and refection co-efficient also shown its used for ultra wideband applications.**

***Keywords: C shape micro strip, semi circular patch antenna, printed circuit board, ultra wide range.***

## I. INTRODUCTION

In recent days monopole antennas are very popular for modern wireless and mobile communication technology. Most commonly the application based on diversity techniques, two antennas in a mobile terminal, can enhance the data rate [1]. [2] Have demonstrated that the MIMO technology improves the network throughput, capacity, and coverage without requiring additional bandwidth. Thus, in order to satisfy personal wireless devices, many antennas with reducing the compact size and multiband functionality—including inverted-F antennas, monopole antennas, planar inverted-F antennas, slot antennas, and loop antennas—have been introduced the meantime, various techniques used for reducing antenna size and widening operating bandwidth .A capacitive feed has been introduced into GSM/DCS/PCS/UMTS area network (WWAN) operation [3]. In a cellular communication system, antenna diversity is well -known techniques for performance of wireless communication systems by reducing the multipath fading and co-channel interference [4].To design the multiband antenna, diversity application or MIMO for small portable communications terminals [5].In this paper, increasing the frequency 3 to 10.6 GHZ using the Ultra Wide Band (UWB) wireless communication technology.To determine the peak value of 3 GHz. The UWB antennas have been attracted the researchers in personal and general applications. The FCC (federal communications commission) allocated the use of frequency ranges from 3.1to 10.6 GHz for UWB applications. The micro strip patch antennas are considered for UWB applications. The characteristics of these patch antennas are low profile, compact small size, inexpensive, conformable to planar and non-planar surfaces and omni directional radiation pattern. The use of monopole antenna is a feasible it can be implemented in a smaller area. Using the wide slot provides wide band radiation performance and it can also, be easily fabricated. There are various techniques have been handled by many researchers to design patch antenna for UWB applications.

The square monopole (SM) provides smaller BW than the circular monopole (CM) its radiation pattern suffers less degradation within the impedance BW. A square/rectangular monopole mounted above the circular ground plane. A rectangular patch with slotted ends used. Different techniques have been adapted to attain the band notch function to cut off undesired frequency band from 3 to 5 GHz .It has been observed that printed rectangular monopole antennas are small in size and simple in design and fabrication because of high operating frequency, but its performance is very good for ISM band and multiband applications. The good results for radiation pattern, 3D rectangular plot, 3D polar plot, rectangular plot and polar plot for UWB application. The cutoff frequency range value is 3GHZ.

## II. ANTENNA DESIGN AND STRUCTURE

The monopole antenna integrated with one side PCB circuit board to design antenna one side C shape antenna. This antenna is built using a standard FR4 substrate (dielectric constant=4.5) with a thickness of 1.6 mm etched on the ground plane.

The antenna consists of a C shaped radiator connected to a 50 Ohm micro strip feed line of width 3 mm. The antenna has a size of 40 mm x 20 mm and a portion of ground material is removed, which makes it monopole antenna with a ground plane of a size 32 mm x 15 mm. The antenna can resonate at dual band with a reflection coefficient below-10 dB. The reduced ground plane makes the antenna structure compact and so it can be easily integrated with the packaging device. For the radiator micro strip line of width 3 mm is used. The proposed UWB application technique using monopole antenna optimized HFSS (High Frequency structural simulator) software.

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## II. ANTENNA STRUCTURE AND PRAMETERS

The simulated antenna design is shown in Fig.1. The total size of the antenna is 30 *30mm it is compact one. The metal strip mounted C shape with one side of fr4 substrate a thickness is 1.6mm and relative permittivity of 4.4. In order to obtain better performance the antenna should attain the loss tangent of 0.02. The C shaped slot is etched on the ground plane. The monopole antenna consists of micro strip feed line which itself act as a radiating element. This structure is connected to a matching network of 50-impedance. To reduce reflection caused by sudden changes in the width patch, the feed line is tapered at one end. The point in which the metal strip is connected to the feed line is the most critical section of the design.

By optimizing any changes can increase the upper frequency and hence decreases the reflection in the higher frequency. In order to radiate the energy mounted perpendicular the plane is etched on the ground plane.Also, the plane which suppresses the back radiations and helps to enhance the gain. The feed line used is micro strip line, feed it reduces the spurious radiation, as the substrate used is fr4,the thickness is not high. The bandwidth provided by the feed line is narrow, the radiator patch which overcomes this drawback and provides wide band width.

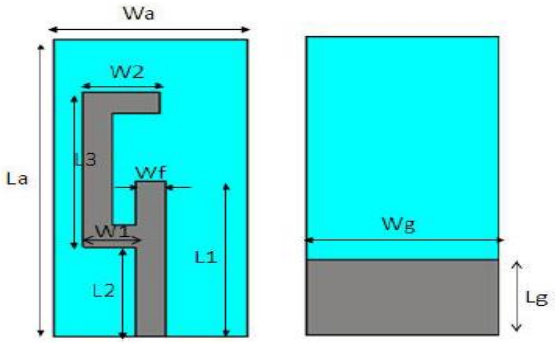


Fig 1 Design of the monopole antenna

## IV. RESULT ANALYSIS AND DISCUSSION

In previous papers, inverted L shaped monopole on the rectangular slot etched on the ground plane. Each antenna has capacitive feed is composed of parasitic loop, two twisted lines, shorting strip it covers five resonant GSM,PCS,UMTS,WIMAX and WLAN uses MIMO.To determine the directivity,VSWR,S-parameter and reduces the width of printed circuit board (PCB).

LIST OF FREQUENCIES OF MIMO MONOPOLE ANTENNA

| Frequency (MHZ) | Wireless application |
|---|---|
| 826-1005 | GSM850 (824-894 ) MHZ<br>GSM900 (880-960) MHZ |
| 1527 -2480 | DCS (1710 -1880 ) MHZ<br>PCS (1850 -1990) MHZ<br>UMTS (1920-2170) MHZ<br>WLAN (2400-2480) MHZ |
| 3439-3690 | WiMAX (3400-3600)MHz |
| 5340-5749 | WLAN (5470-5725) MHZ |

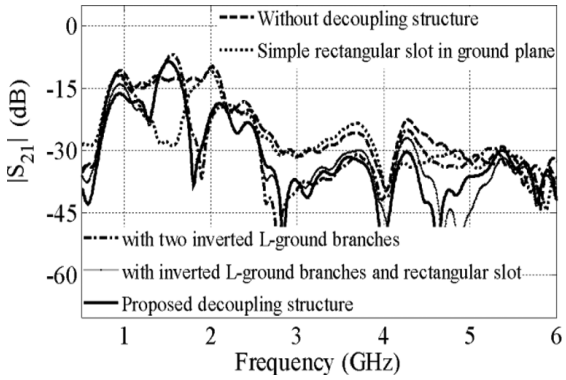


Fig 2 Dual band of MIMO monopole antenna

UWB MONOPOLE ANTENNA

| Frequency (MHZ) | Mobile application |
|---|---|
| UWB(Ultra wide band) | 3.1 to 10.6 MHZ<br>Peak value 3 MHZ |

This paper simulation of the design is carried out by the method of UWB application (HFSS software). Fig 3VSWR of the monopole antenna.To determines return loss, reflection coefficient and VSWR. Fig 4 gives the simulated radiation pattern of the monopole antenna peak frequency range is 3 GHz and radiated power of the proposed antenna. Fig 5 and 6, the simulated gain and directivity of this monopole antenna. Fig 7 3D rectangular S axis plotted graph value 3GHz. Fig 8 simulated rectangular Z axis shown designed of the monopole antenna. A parametric study is conducted and it clearly shows that the following parameters have made changes in the performance of the designed antenna in terms of bandwidth.

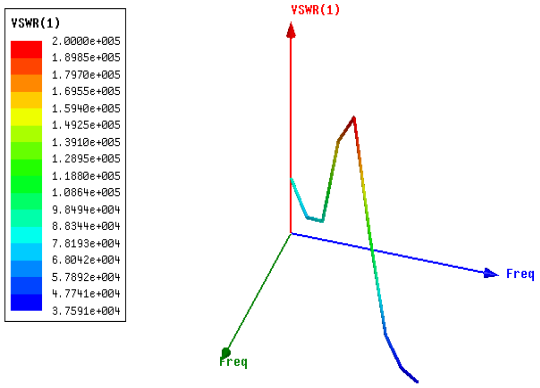


Fig 3 Simulated the 3D Rectangular plot VSWR of designing an antenna

VSWR is referred as voltage standing wave ratio,which describes the maximum to minimum value, function of reflected coefficient it reflected the power form the antenna.It is real and positive value. VSWR between the frequency and theta, “e” represent as a expansion term. Color map, plot from maximum to minimum value; it can be plotted between theta and phi. Violent color map is lowest field can be plotted. The orange color map is highest field can be plotted. To determine the reflection coefficient -10 dB and return loss.

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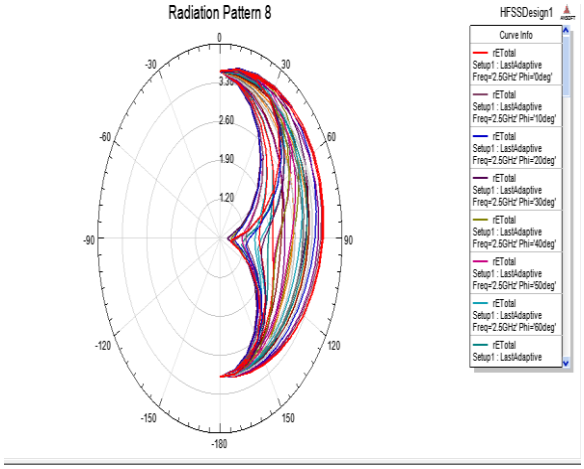


Fig 4 simulated the radiation pattern of designing antenna

Radiation pattern radiates electromagnetic radio waves. The 3-D far-field computed radiation pattern in both E-plane and H-plane. A vertical monopole antenna radiates equally omni directional or azimuth direction. The horizontal dipole antenna is radiating energy in a bidirectional. The radiation pattern shows the directional character and omni directional it covers 360 deg. This antenna behaves like a conventional monopole. When the frequency is increased, based on the radiation pattern and bandwidth.3D Radiation pattern of frequency range increases for 3GHZ it varies the angle is 0 deg to 180 deg between the same "theta" and "phi" it show in Fig 4 there is color variation to see the diagram. The far field radiation pattern of an element which belongs to an antenna array to calculate the accurate value.

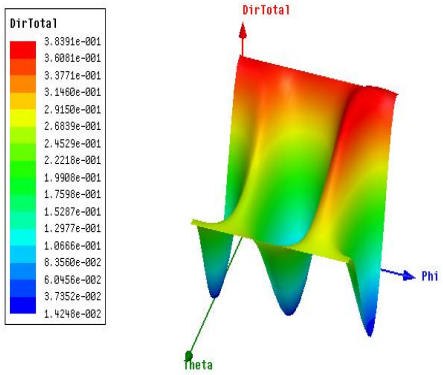


Fig 5 Simulation the 3D rectangular plot directivity of designing an antenna

Directivity means maximum gain and fundamental parameter of the antenna. The directivity of an antenna to focus the energy in one or more specific directions. It radiates energy equally in the entire direction. Color map, plot from maximum to minimum value it can be plotted between theta and phi. Violent color map is lowest field can be plotted. The orange color map is highest field can be plotted.

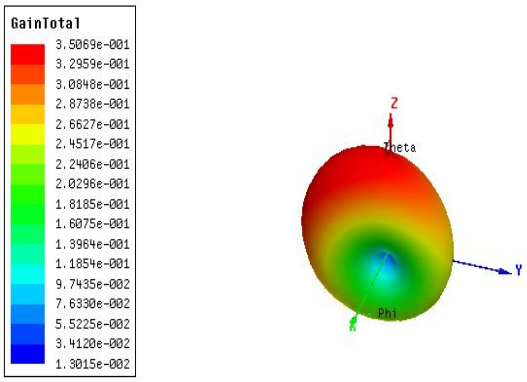


Fig 6 simulated the 3D polar plot gain of designing an antenna

Fig 6 Similar to 3D rectangular plot, the gain is fundamental parameter of the antenna .It is related to bandwidth, size and efficiency. The total value minimum to maximum increases value and peak value is 3GHz.Color map plot from maximum to minimum value; it can be plotted between theta and phi. Violent color map is lowest field can be plotted. The orange color map is highest field can be plotted.

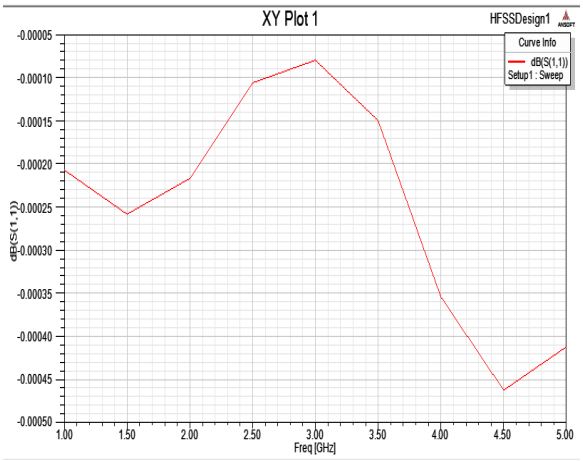


Fig 7 Simulated Rectangular S axis of designed antenna

Rectangular plot between dB is data logarithmic that S - parameter. The cutoff frequency desired value 3GHz for UWB (ultra wide band) application. Fig 7 3D polar plot of the antenna gain, or power gain of an antenna is defined as the ratio of the intensity radiated by the antenna in the direction of its maximum output. By dividing intensity radiated at the same distance from a hypothetical isotropic antenna.

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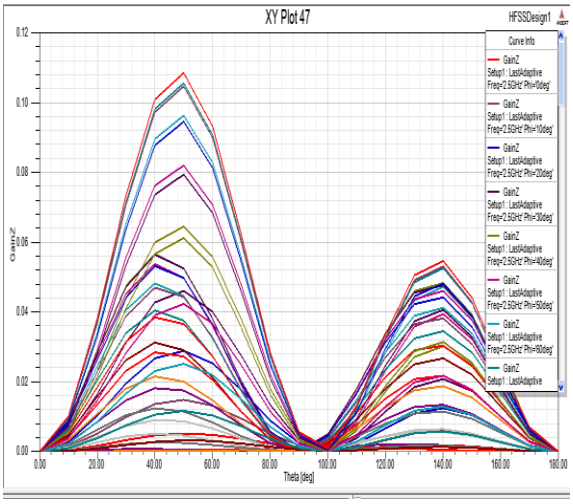


Fig 8 Simulated rectangular gain Z axis of designing antenna

Rectangular gain Z axis are simulated between theta and gain Z .The peak value is 3 GHz and the degrees various for 0 to 50 deg it is represented by a color variation.

## IV. CONCLUSION

Monopole antennas are less fragile, planar and can be integrated with the printed circuit board (PCB) one side C shape antenna which above the ground plane. The major parameters (such as Return Loss, Radiation Patterns, Directivity and reflection coefficient) can be design and applications were studied. Both simulation and measurements have corroborated a good performance of the bandwidth in the antenna systems. To determine the VSWR less than 1.5, the reflection coefficient is -10 dB, tangent 0.02 and dielectric constant is 4.5.It has been observed that printed rectangular monopole antennas are small in size and simple in design and fabrication because of high operating frequency, but its performance is very good for ISM band and multiband applications. However, more work can be done to reduce the width of the printed circuit board (PCB). It has been concluded that the monopole antennas are one of the versatile candidates for UWB applications.

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