# Compact Ultra Wide Band10 Segment Antenna using Partial Ground for Wireless Application

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*Abstract:* **This paper presents design of a 10 segmentantenna for ultra-wideband (UWB) applications.It shows good bandwidth of 6.66GHz ranging from 3.85GHz to 10.14GHz .Here a partial ground technique is adopted with a 10 segmentpatch antenna structure. Various parameters including gain, VSWR, directivity and efficiency are shown. These results show that the design can be suitable for different applications with high accuracy, accurate VSWR and less losses.CST Microwave Studio software is used to perform simulations of patch antenna.Also this antenna shows good radiation characteristics and results a desired gain across the band, which makes the antenna a perfect choice for UWB applications. Simulated parameters indicate that the proposed antenna exhibits good linearly polarized radiation pattern.**

***IndexTerms*–Ultra Wide Band (UWB), Partial Ground, 10 segment, Voltage Standing Wave Ratio (VSWR)**

## I. INTRODUCTION

Over the past few decades, wireless communication systems have been developed substantially. Along with rapid growth in the number of wireless communication users and applications, the demand for different types of wireless communication systems such as GPS, GSM1800, Bluetooth, WLAN UWB and UWB vehicular radar are also increasing rapidly. UWB is rapidly advancing as a high data rate wireless communication technology. As is the case in conventional wireless verbal exchange structures, an antenna additionally plays a very essential position in UWB structures. However, there are more challenges in designing a UWB antenna than a narrow band one. Federal Communications Commission (FCC) allowed 3.1–10.6 GHz unlicensed band for UWB communication. As per Federal Communications Commission (FCC), UWB band ranges from 3.1 GHz to 10.6 GHz, a band of 7.3 GHz wide. A bandwidth of each radio channel is more than 500 MHz, depending on its center frequency.UWB antennas are vital for UWB communication systems and have attracted many researchers towards it. The design goal to be achieved in case of UWB antenna design is wide impedance matching, radiation stability, low profile, compact size etc. But UWB has a disadvantage of multipath fading like other wireless systems. UWB provides a high data rate that is suitable for different wireless applications. UWB technology also allows spectrum reuse.

The Micro-strip antenna has emerged as one of the most famous antennae for distinctly directive antenna applications due to its light profile, low weight, and easy layout and fabrication, easy integration with other circuit components and Minimum cost. The best project associated with Micro-strip antenna design is to miniaturize the circuit size even as retaining certain antenna characteristics. A patch antenna consists of a metal surface bonded to a grounded dielectric substrate.

The partial ground plane elimination reduces the lower back- lobe radiation of the micro-strip antenna by suppressing the surface layer wave from the edges of the antenna ground plane. The field of minima is at the ends of the removed ground plane on the partial ground plane.

## II. DESIGN OF PATCH ANTENNA

It is important to have a basic knowledgeabout Micro-strip Antenna before start a project work.Research papers, journal , books, thesis, dissertations and the internet are the sources of collection of information about our research work.Antenna used as a device that can improve the systemefficiency , all parameter performance in terms of bandwidth, VSWR and gain. .Mainly micro-strip patch antenna can fulfill the requirements of wireless system. It has highly directive antenna applications. The associated challenges with micro-strip antenna design is to miniaturize the circuit dimension by maintaining certain antenna characteristics of a patch antenna is a device of a metallic film bonded to a grounded dielectric substrate. The relative permittivity and thickness of the substrate layer are usually small hence patch behaves as a parallel plate transmission line. The dimensions of proposed patch antenna are as follows: substrate width(sw) is 23.54mm,substrate length(sl) is 24.60mm$^2$,substrate height (sh) is 1.524mm,ground width(wg) is 23.54mm,ground length(lg) is )13.29mm, Margin (M) is 0.5and radius(r1) is 6.59mm.The substrate used for design is FR4 with a height of 1.524mm, loss tangent of .02 and dielectric constant is 4.4.The screenshot of antenna in simulation window is as shown in figure below:

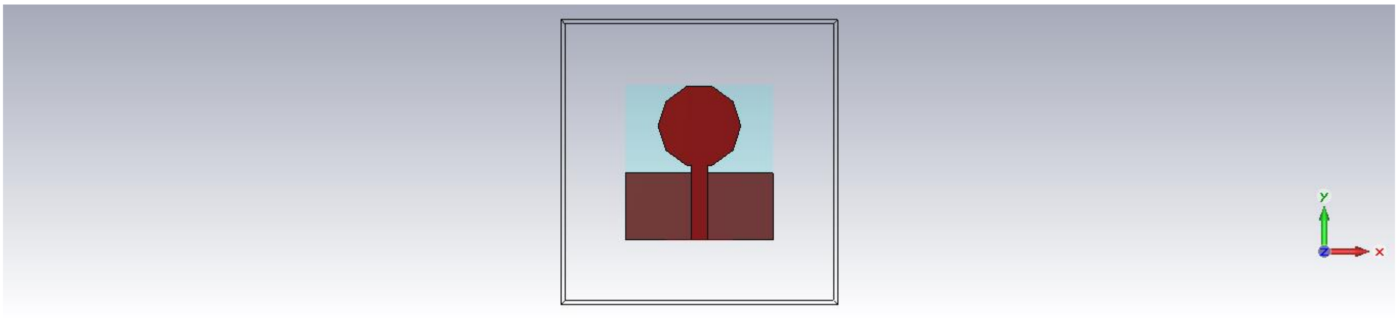


Fig.1 screenshot of front view of proposed antenna

The partial ground is rectangular in shape fig1.The shape of the antenna is 10 segmentwith a micro-strip feed line of 50ohm. Blue color part shows the removed part of the full ground and the brown color part shows the partial ground in fig.2.

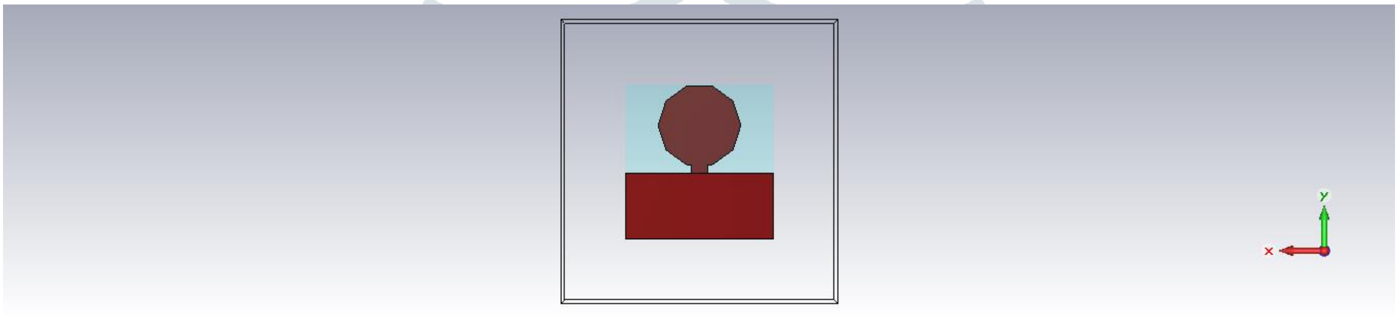


Fig.2 screenshot of back view of proposed antenna

## III.SIMULATION RESULTS AND DISCUSSION

The proposed antenna parameters are optimized to get minimum return loss and good radiation efficiency using 10 section patches antenna.

### 3.1 S-parameters for slotted ground

Simulation results for10segment patchantenna is show in fig.3 and fig4. It shows the UWB range 3.8GHz to 10.4GHz. This range provides 6.66GHz bandwidth. At 4.71GHzresonant frequency the return loss is -57.61dB and at 6.49GHz frequency the return loss is -22.62dB in partial ground. Greater bandwidth is achieved by using partial ground.

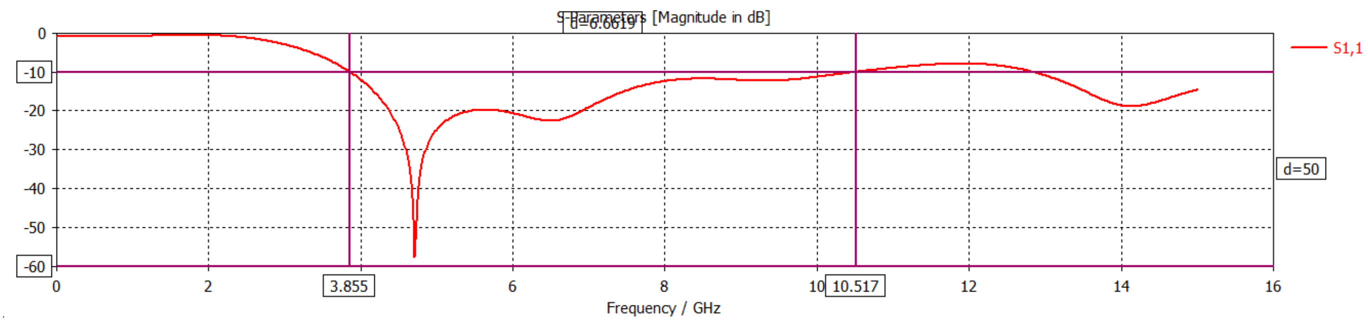


Fig.3 Resultant waveform for UWB range3.8GHz to 10.4GHZ

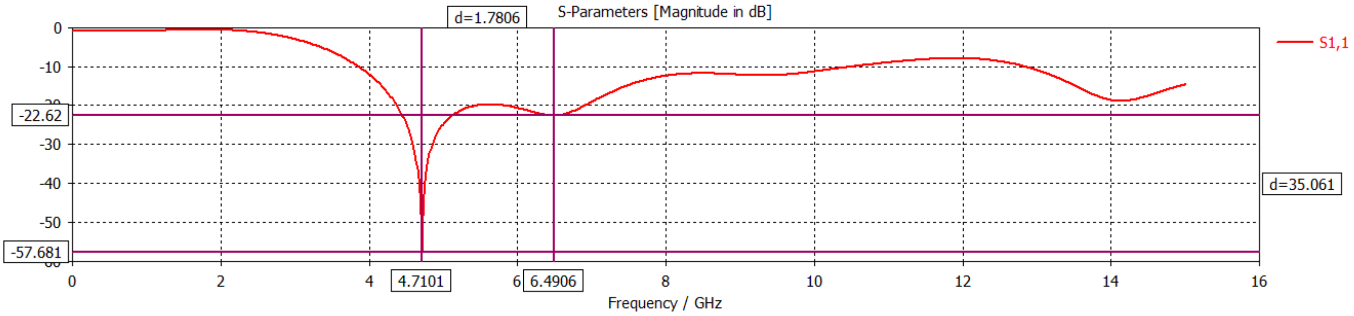


Fig.4 Resultant waveform at peak 4.71GHz and 6.49GHz with return loss -57.68dB and-22.62dB

### 3.2 VSWR

The VSWR is lies Between 1 – 2 shows in Fig. 5. This Plot shows the VSWR and Frequency plot of proposed partial shaped patch antenna.

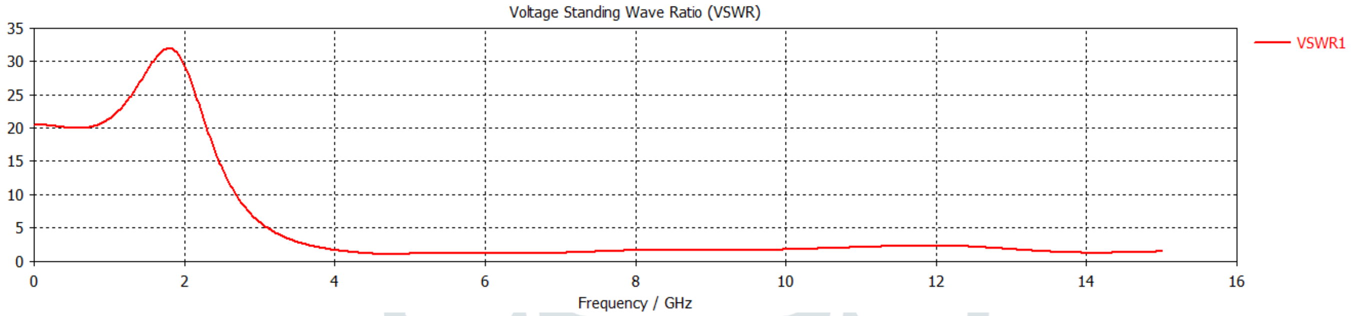


Fig. 5 Resultant plot between VSWR and frequency

### 3.3 Radiation pattern

The radiation pattern ofproposed antenna is given in fig.6 and fig.7

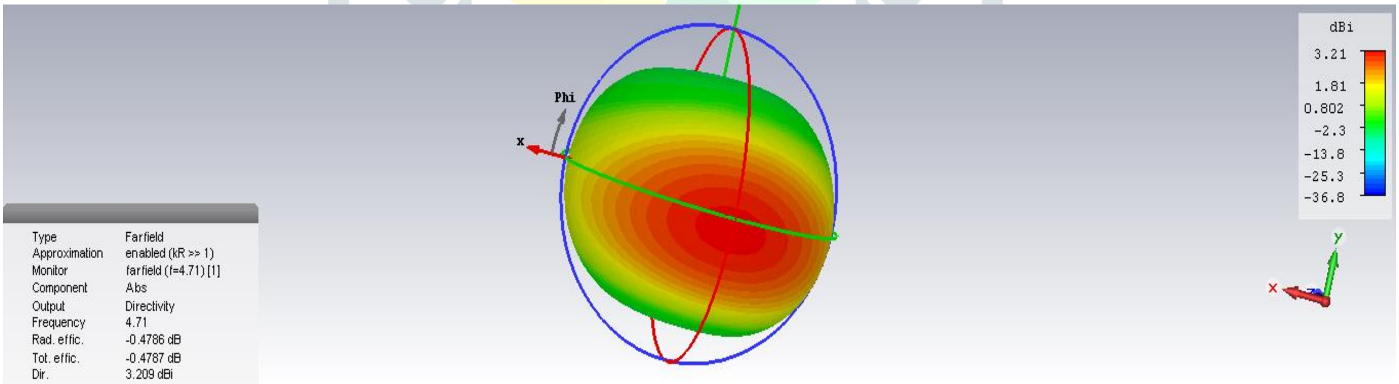


Fig.6 Frequency 4.71GHz far field 3D plot

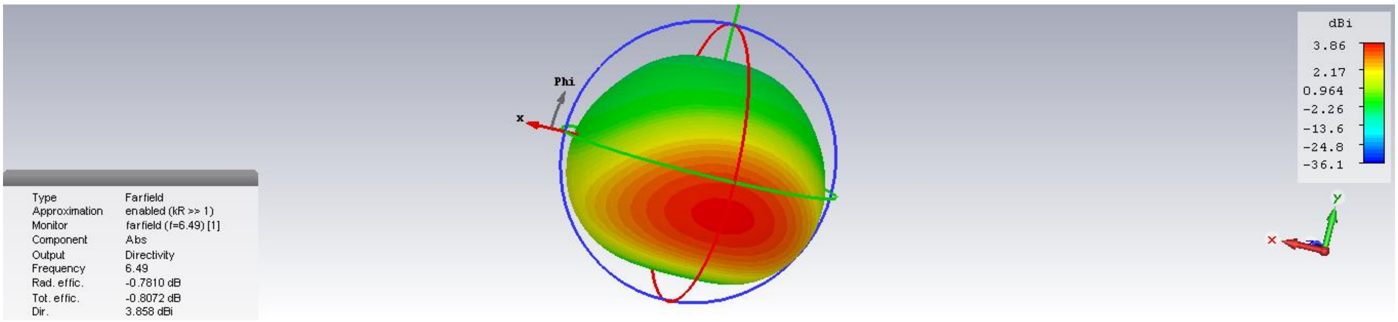


Fig.7 Frequency 6.49GHz far field 3D plot

### 3.4 Gain and radiation efficiency

Gain and radiation efficiency is given in fig.8, fig.9, fig.10 and fig.11 using the polar plots and 3D plots at resonant frequency 4.71GHz and 6.49GHz.Gain at 4.71Ghz frequency is 2.73dB and Gain at 6.79Ghz frequency is 3.08dB. The Radiation efficiency for 4.71GHz is -4786dB and Radiation efficiency for 6.79Ghz is -7810dB.

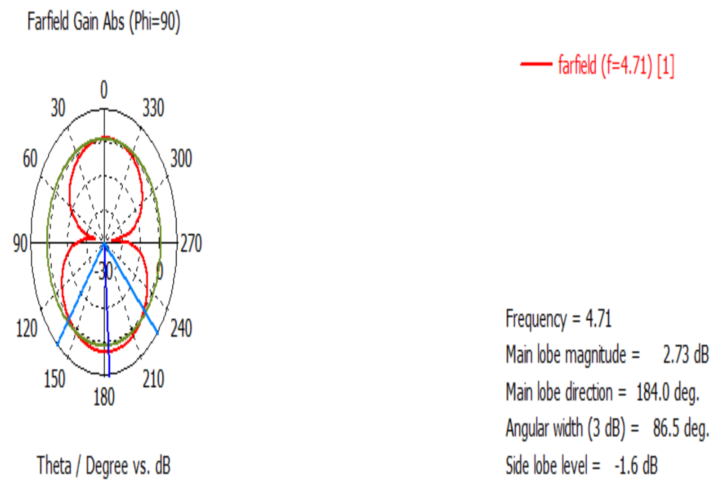


Fig.8: 4.71GHz gain polar plot

The above Figure-8 shows the gain polar plot at 4.71GHz for UWB patch antenna. In the polar plot the main lobe magnitude is 2.73dB and side lobe level is -1.6dB.

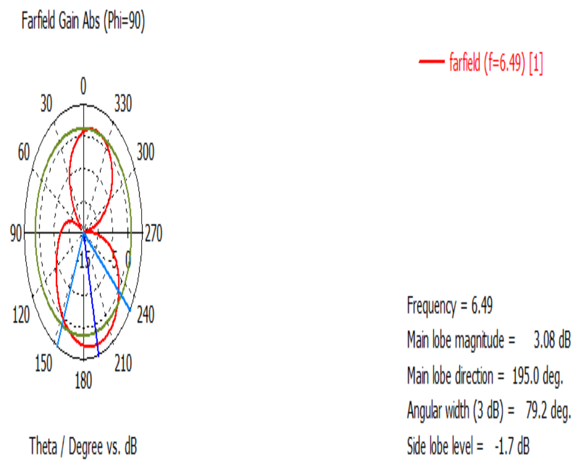


Fig.9:6.49GHz gain polar plot

The above Figure-9 shows the gain polar plot at 6.79GHz for UWB patch antenna. In the polar plot the main lobe magnitude is 3.08dB and side lobe level is -1.7dB.

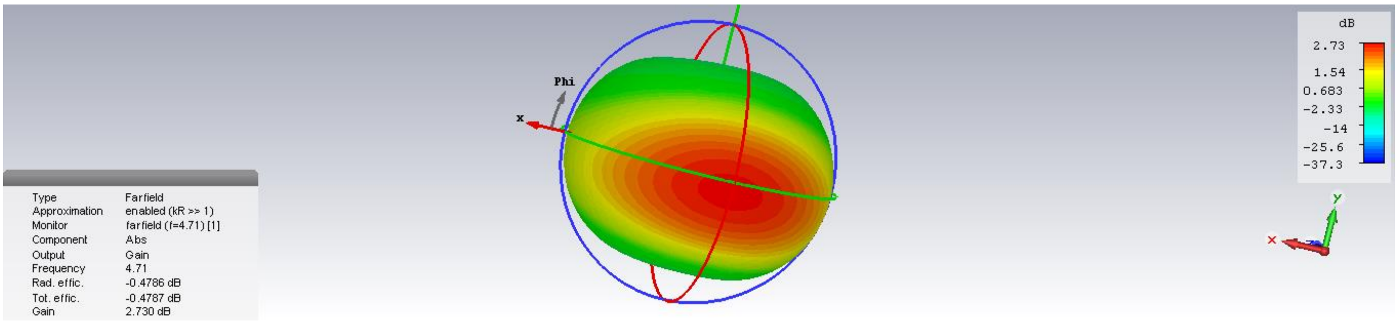


Fig.10: 4.71GHz gain 3D plot

The above Figure- 10 shows the 3D Plot at frequency 4.71GHz. At this frequency gain is 2.73dB.

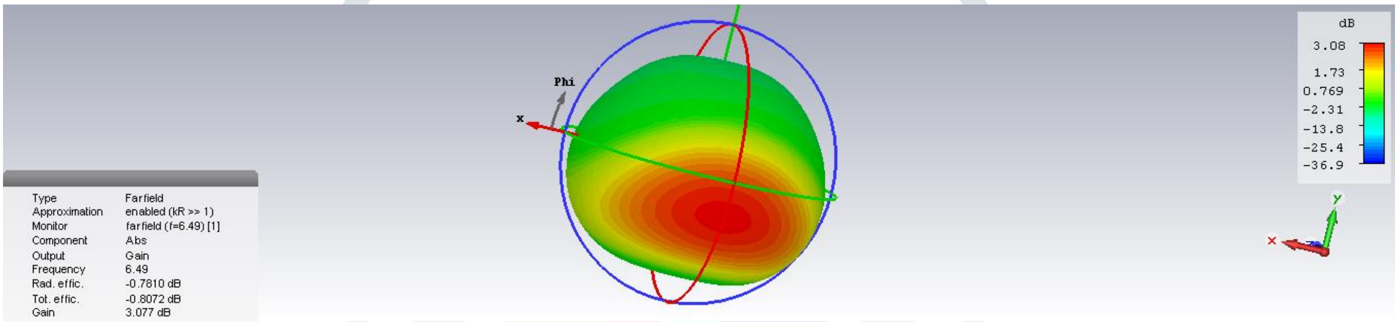


Fig.11: 6.49GHz gain 3D plot

The above Figure- 11 shows the 3D Plot at frequency 6.49GHz. At this frequency gain is 3.08dB.

## IV.CONCLUSION

A 10 segment circular Micro-strip Patch Antenna proposed for UWB range 3.8GHz to 10.4GHz range using partial ground technique that shows bandwidth up to 6.66GHz. The top geometry of the suggested antenna consists of a circular 10 segment radiating. The bottom part comprises of a partial ground. Parametric analysis has also been performed to achieve the optimal performance of the antenna. Many aspects of UWB antennas are available for the effectiveness of design on S parameters and axial ratio. The proposed UWB Antenna resonate at peak frequency 4.71GHz and 6.49GHz with poor return loss. This partial ground technique also provides high gain.

## V. SUGGESTION FOR FUTURE WORK:

It can be extend to two, four , six or more antenna like antenna array with proper dimension ,different- different shapes of patch and many other assumptions in right direction. One can also calculate the bandwidth effect, gain many other parameter effects using differentdielectric material and different types of other techniques.

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