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Design and Study of Planar UWB Antenna Parameter

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Abstract **- Antennas are an integral part of everyday lives and are used for a multitude of purposes. Antenna is one type of transducer that converts electrical energy into the electromagnetic energy in form of electromagnetic waves [1]. The UWB monopole antennas are sincerely developed from the standards of conventional UWB antennas, established on several procedures in phrases of bandwidth enhancement, omni-directional radiation improvement and size reduction, they can provide virtually the identical bandwidth and radiation performances as the traditional UWB antennas however with a lot smaller volumes.**

Keywords **- Bandwidth, CST Software, Monopole antenna, UWB antenna, VNA(Vector Network Analyzer)**

I. INTRODUCTION

Ultra-wideband (UWB) antennas are gaining prominence and becoming very attractive in modern and future wireless communication systems, mainly due to two factors. To begin with, folks increasingly high demand for the wireless transmission price and UWB residences similar to high knowledge expense, low power consumption and low fee, which provide a huge increase to the UWB antennas' study and progress in enterprise and academia given that the Federal Communications Commission (FCC) formally released the regulation for UWB technological know-how in 2002. Secondly, now the wi-fi transportable gadget want antenna operated in different frequencies for various wi-fi transmission services, and operation bands and capabilities are growing increasingly, which may outcome in challenges in antenna design, equivalent to antenna space difficulty, multi antennas interference, and so forth. One UWB antenna can be utilized to switch multi slim-band antennas, which can without problems diminish the antenna quantity.

The bandwidth is the antenna running frequency band within which the antenna performances, such as input impedance, radiation pattern, attain, effectivity, and many others., are desired. The most more commonly used definitions for the antenna bandwidth are the fractional bandwidth (for slender or wideband definition) and the bandwidth ratio (for extremely wideband definition).

The fractional bandwidth is defined as

$$BW = \frac{f_h - f_l}{f_c} \times 100\% \quad (1)$$

The bandwidth ratio is defined as

$$BW = \frac{f_h}{f_l}:1 \quad (2)$$

A. Omni-directional UWB antenna and design:

Along with the wireless system miniaturization and operation frequency increasing, some novel types of omni-directional UWB antennas have been developed in the last decade. In general along with two forms, the UWB planar monopole antenna and the UWB printed monopole antenna, each types are truly developed from the ideas of traditional UWB antennas, such as the biconical antenna, the cone-disc antenna, the cage antenna, and and so on. Based on a couple of strategies in phrases of bandwidth enhancement, omni-directional radiation development and size reduction, they are able to furnish close to the same bandwidth and radiation performances as the conventional UWB antennas but with so much smaller volumes.

Amongst various planar monopole antennas, the rectangular planar monopole is the easiest in geometry, and its radiation sample is probably less degraded inside the impedance bandwidth. These favourable points entice many studies, in most cases on the bandwidth enhancement seeing that the rectangular planar monopole only owns an impedance bandwidth ratio of two:1. From the antenna geometry, the feed gap, the feed point location and the shape of the monopole's bottom, all could impact the impedance matching.

The aforementioned planar monopole antennas attain an ultra-wideband efficiency centered on more than a few strategies, but all of them need a perpendicular ground aircraft, leading to increasing of the antenna quantity and inconvenience for integration with monolithic microwave integrated circuits (MMICs). For the portal wireless device applications, the printed UWB monopole antennas are extra widespread as a result of their less difficult integration than the planar UWB monopole antennas.

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The printed UWB monopole antenna mainly contains a monopole patch and a ground aircraft. Both of them are printed on the identical or opposite part of a substrate, and a microstrip or CPW feedline is used to excite the monopole patch.

II. Proposed Solutions And Design

This chapter describes about methods used to component selection, feed selection, software used, design of conventional UWB monopole antenna.

A. Software used for Micro-strip antenna Or UWB monopole design :

UWB monopole antenna design software's are below used for simulation:

- CST = Passive and Active circuit simulation.
- HFSS = Passive circuit Simulation.
- AWR = Simple 2D simulator,
- ADS =Active/passive lumped model simulator

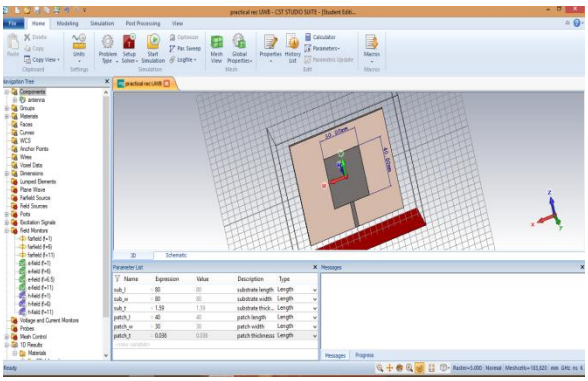
All these above software's used for microstrip antenna or UWB monople antenna design and simulation purpose. These all software give good accuracy and set up time. Electromagnetic Simulation is an advanced technology to yield high accuracy in analysis and design of complicated RF printed circuit and microwave antennas, digital circuits with high speed operation and other electronic components.

- CST MWS makes it possible for the speedy and correct evaluation of excessive frequency (HF) contraptions corresponding to antennas, filters, couplers, planar and multi-layer structures and SI and EMC results.
- CST offers accurate, efficient computational options for electromagnetic design and evaluation.
- The 3D EM simulation software is person-friendly and makes it possible for you to opt for essentially the most suitable approach for the design and optimization of devices operating in a extensive variety of frequencies.
- CST is based upon Finite Integration in Technique (FIT) and is also popular among antenna designers due to ease in simulations.

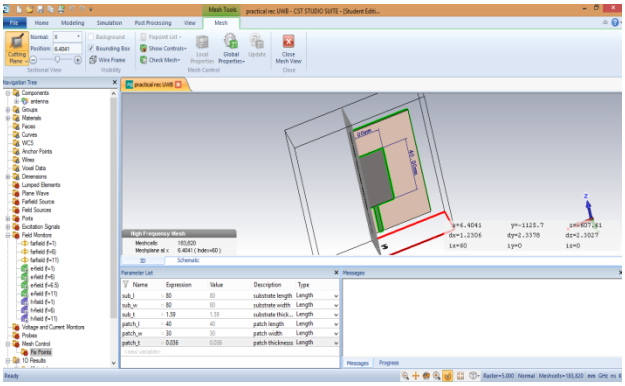
B. Requirements:

1. CST MWS Software
2. Printed Circuit Board Laboratory
3. Vector Network Analyzer

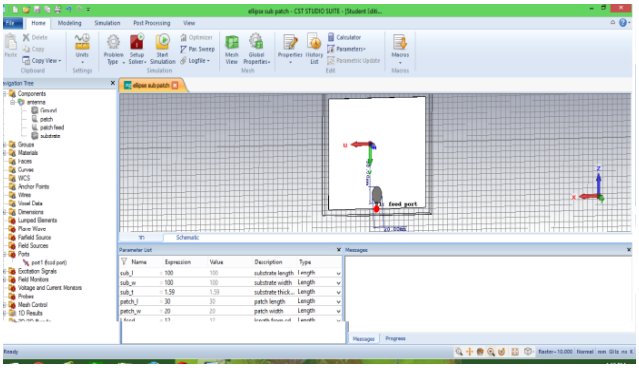
In order to take full advantage of the benefits to be obtained by using multiple antennas place in a mobile for mobile communications, it is necessary to use an antenna array which is both compact and also has low mutual coupling between ports.



Design of rectangular UWB monopole antenna



Mesh view of rectangular UWB monopole antenna



Design of elliptical UWB monopole antenna

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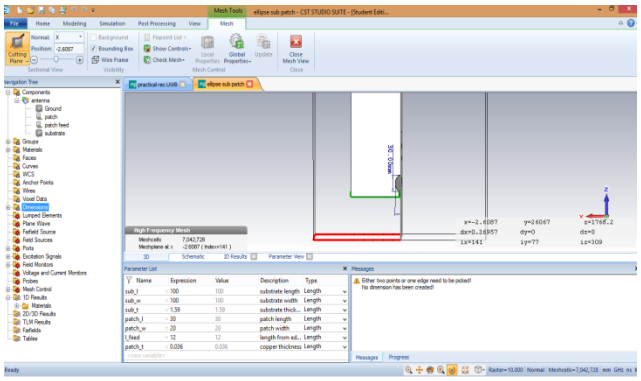
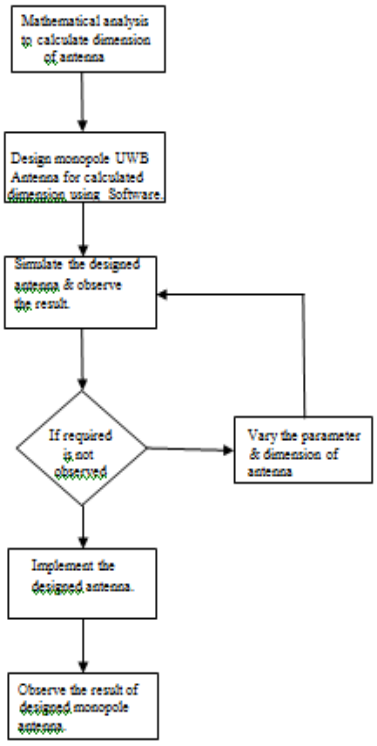


Mesh view of elliptical UWB monopole antenna

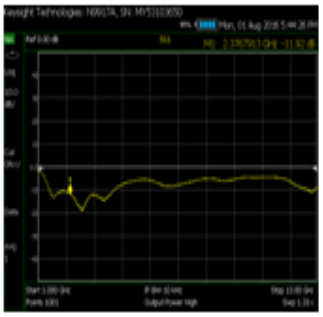
C. Flow Chart :



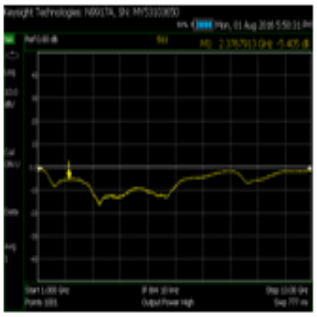
Flowchart of antenna design

III. Proposed Antenna Hardware And Simulation Result

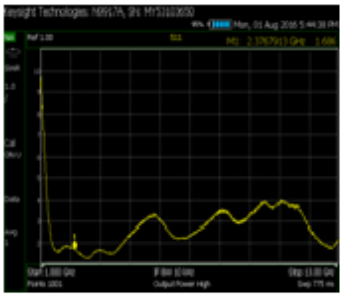
The following figures shows the top view, bottom view and side view of designed UWB monopole patch antenna.



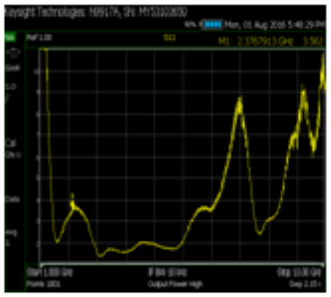
Rectangle S11



Ellipse S11



Rectangle VSWR



Ellipse VSWR

Rectangle smith chart

Ellipse smith chart

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A. Hardware

Rectangular monopole antenna after etching

Elliptical monopole antenna after etching

TABLE I
Result Of Antenna

Parameter (f=2.37679 GHz)		Rectangular Antenna	Elliptical Antenna
S11	Measured	-11.92dB	-5.405dB
	Simulated	-12 dB	-8 dB
VSWR	Measured	1.686	3.562
	Simulated	1.72	2.23
Smith Chart	Measured	50.6Ω-j28.6Ω (2.339pF)	36.6Ω+j56.5Ω (3.781nH)

IV. CONCLUSION

- The Selection of antenna parameters like B.W., VSWR, efficiency, radiation pattern of the antenna.
- CST-MWS software is used for simulation the UWB antenna design & parameter optimization.
- Fabrication & testing results shows the elliptical/circular monopole UWB antenna is more powerful than rectangular monopole antenna. It optimizes antenna parameters.
- UWB antenna has low profile, small size & low manufacturing cost, hence the UWB antenna has been found to be significant demand for wireless applications.
- The designed multiband antenna is very sensitive to changes in dimension of the structure including the ground plane.
- Ground plane of the antenna is used as a radiator resulting in overall size reduction & improvement within it's operating bandwidth.

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