Design of UWB Antenna for ISM Band

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Abstract-*Micro strip patch antennas are mostly used in day to day operation due to its advantages like small size and low cost. One of the limitation of micro strip patch antenna is its lower band width. The bandwidth of micro strip patch antenna can be improved by using CPW feeding Technique. In this paper we reviewed possibility of designing different micro strip patch antennas, which is operated at ISM (2.40-2.48 GHz) band.*

Keywords-Microstrip patch antenna, UWB antenna, CPW Feeding Technique, ISM band.

I. INTRODUCTION

The rapid development of micro strip patch antenna began in late 1970's, by early 1980's basic micro strip antenna elements and arrays where fairly well established in terms of design and modeling, and workers were turning their attention to improving antenna performance features (bandwidth), and to increase application of technology. One of application involved the use of micro strip antenna for integrated phased array system, as the printed technology of micro strip patch antenna seem to be perfectly suited to low cost and high density integration with active MIC or MMIC phase filter and T/R circuitry.

Micro strip antenna is characterized by its length, width, input impedance and gain and radiation pattern. In micro strip antenna consist of conducting patch on ground plane separated by dielectric substrate. This concept was undeveloped until the revolution in electronic circuit miniaturization ad large scale integration in 1970. After that many authors have described radiation from ground plane by dielectric substrate for different configuration.

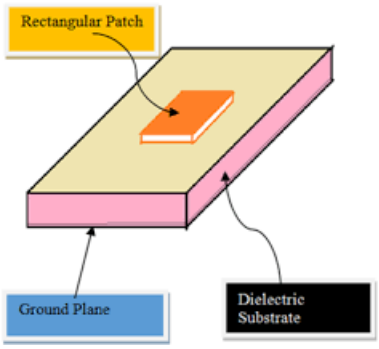


Fig.1 Basic design of Microstrip Patch Antenna

Various mathematical models were developed for this antenna and their applications were extended to many other field. The number of papers, articles, published in journals for last ten years on this antenna shows the importance. End fire radiation can also be accomplished by judicious mode selection. Micro strip antenna consist of very thin metallic strip, (patch) placed small fraction of wave length above ground plane .The micro strip patch is design so that its pattern maximum is normal to patch (Broad side radiator).This is accomplished by properly choosing the mode (field configuration) of excitation beneath the patch. Often micro strip patch antennas are also referred to as patch antenna.

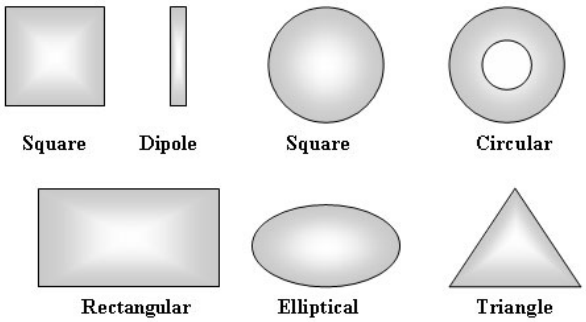


Fig.1 Different Shapes of Patch

The radiating and feed lines are usually photo etched on di electric substrate .The radiating patch may be square, rectangular thin strip, circular, elliptical, triangular or of any other configuration. Square, rectangular, dipole (strip), and circular are most common because of ease of analysis and fabrication ,and their attractive radiation characteristics ,especially low cross polarization radiation .Linear and circular polarization can be achieved either by single element or arrays of micro strip antennas. Arrays of micro strip elements, with single or multiple feeds may also be used to introduced scanning capabilities and achieve greater directivities.

II. INTRODUCTION TO UWB TECHNIQUES USED IN MICRO STRIP PATCH ANTENNAS

Antenna have been widely used in communication industry Mostly of monopole antennas are designed to operate at wireless local area network.(WLAN) application which has advantage of unlicensed industrial ,scientific, medical(ISM) bands. ISM bands include IEEE 802.11 a/b/g WLAN

Standards which have different speed data rates and operating frequency.

The antenna stated that people always complaint about their Wi-Fi signal coverage which is normally low. In an effort to solve this coverage problem, improvement must be made in gain of antenna. A conventional gain of antenna operated at 2.4GHz is normally 2 dBi.

For gain improvement coplanar waveguide (CPW) fed WLAN monopole antenna which is operated at 2.4GHz having option. In this project gain will be improved by using parasitic element, the concept is based on yagi uda antenna which consist of reflectors and directors.

The WLAN is important application used in home network. WLAN has an advantage of industrial, scientific, and medical (ISM) band. Which has standard of IEEE 802.11 a/b/g. IEEE 802.11 b/g is for frequency of 2.4GHz to 2.484GHz.

The usage of monopole antenna is widely in implementation of wireless communication due to its low traffic profile and simple structure .Monopole antenna also exhibit an omnidirectional radiation pattern and its gain is relatively low.

There are many types of antennas used for WLAN application like planar Yagi-Uda antenna, monopole antenna, patch antenna and fractal antenna. Most of the antenna are normally proposed to be operated at ISM band, WLAN for micro wave access (Wi Max), 4G long term evolution (LTE) and radio frequency identification (RFID) application.

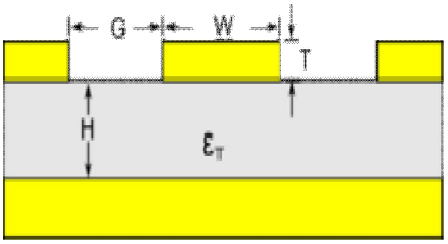
One of the example of fractal antenna used for wireless LAN antenna is proposed in compact size antenna using approach of Koch Meander fractal antenna which is used for WLAN universal bus. (USB) dongle is presented. Some of the feeding technique normally used for monopole antenna are CPW fed and micro strip line fed.

However CPW fed is mostly used due to ground plane whose is on same side with radiating element. This characteristics made CPW fed gained is popularity compared to micro strip line feeding. Micro strip line feeding has ground plane on back side of radiating element. CPW fed is easy to integrate with monolithic micro wave IC and parasitic is one technique used to design antenna.

This micro strip patch antenna is well known for performance and there robust design, fabrication and their use. Advantage of micro strip patch antenna is to overcome their demerits such as easy to design, light weight etc. The application are in various field such as medical field ,satellite, military, air craft, etc. The use of micro strip antenna are increasing widely in all fields, Now they are booming in commercial aspect due to their low cost of substrate material and fabrication. It is also expected that due to increasing use of patch antenna in wide range this could take over use of conventional antennas for maximum application.

Literature review of UWB antenna operating at 2.4GHz is present in this paper. In this paper we present result of UWB antenna designed using HFSS.

III. INTRODUCTION TO CPW FEEDING TECHNIQUE



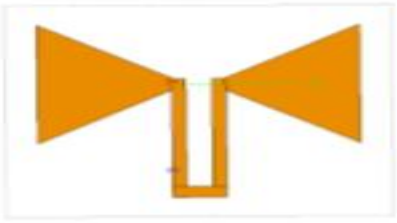
Feed line is one of the important component of antenna structure given below in fig. Coplanar waveguide structure is becoming popular feed line for antenna. The coplanar waveguide was proposed by C.P.WEN in 1969. A coplanar waveguide structure consist of median metallic strip of deposited on surface of dielectric surface slab with two narrow slits ground electrodes running adjacent and parallel to strip on same surface. This transmission line is uniplanar in construction , which implies that all conductors are on same slide of substrate.

Etching a slot and feed line on same substrate eliminates the diagram problem needed in other wide band feeding techniques such as aperture coupled and proximity feed.

Antenna using CPW feed line have many attractive features including low radiation lossless dispersion, easy integration for monolithic micro wave circuits(MMICs) and simple configuration with single metallic layer. CPW feed slot antenna have modified shape reflector have been proposed. By shaping the reflector, noticeable enhancement in both bandwidth and radiation pattern is provide unidirectional antenna can be achieved by radiating antenna.

Possibility of covering some standardized Wi-Fi and Wi-Max frequency band while cling to class of simply structured and component antenna. The return loss

characteristics of CPW feed bowtie antenna at 50 Ohms impedance matching.



Feed type	Return loss (dB)	Fractional Bandwidth (%)
Line	-15	7.08
ACS	-22	5.65
CPW	-7.8	13.57

Advantages:

1. 1 .Low Weight
2. Thin Profile.
3. Linear and circular polarization.
4. Capable of dual and triple frequency operation.
5. Feed lines and matching network can be fabricated simultaneously.

Review:

In [1] UWB antenna is design using FR4 substrate having thickness 1.6mm. The shape of patch in [1] is square like structure with CPW feed technique operated in 2.4GHz to 2.484 GHz .

In [2] a Triple band monopole antenna is designed using FR4 substrate having thickness of 0.8mm.The shape of patch is E shape on top of substrate and inverted L shape in inverted ground plane. It is operated in 2.4 GHz -5.2GHz.

In [3] a UWB antenna is designed using FR4 substrate of thickness 1.6mm. The shape of patch. In [3] nearly circular with I shaped strip operated in 2.4 to 2.48 GHz and UWB (3.1-10.6GHz).

In [4] a UWB antenna is designed using FR4 substrate of thickness 1.6mm. The shape of patch. In [4] is π shaped strip operated in 2.3 to 2.48 GHz and.

In [5] Monopole antenna is designed using FR4 substrate having thickness 1.6mm. The shape of patch In[5] T shape patch with CPW feed, operated at 3 resonating frequencies 2.4GHz,3.5GHz,5 GHz.

In [6] UWB dual band antenna is design for multi standard telecom system using FR4 substrate having thickness 0.8mm. The shape of patch In [6] is of elliptical shape and operated in frequency 2.4GHz to 3.1GHz.

In[7] UWB antenna is designed using FR4 substrate having thickness 1.6mm. The shape of patch In[7] is combination of split ring resonator and E shape patch antenna operated in 1.8-5.7GHz.

In[8] UWB antenna is designed using ROGERS DUROID 5880 substrate having thickness 8mm. The shape of patch in[8] is inverted F shape, operated in range of 2.40-5.8GHz.

Actual patch antenna:

Referring to reference paper we have designed and fabricated the square like structure antenna, operates in an Ism band, Fabricated antenna its hardware part and result are mentioned below, also dimension are given below

By referring to reference antenna and for good results, the designed antenna have been designed by making some changes in the patch of antenna

Both images of reference antenna and actual designed antenna are mention below

All the result obtained are mentioned below

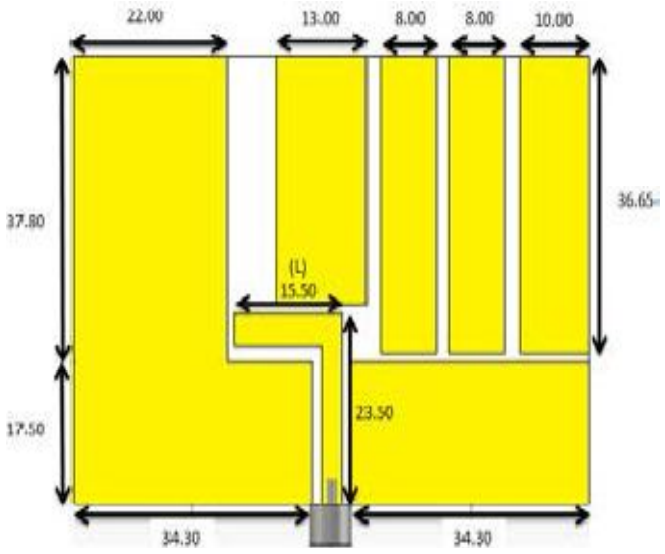


Fig2:- Reference antenna

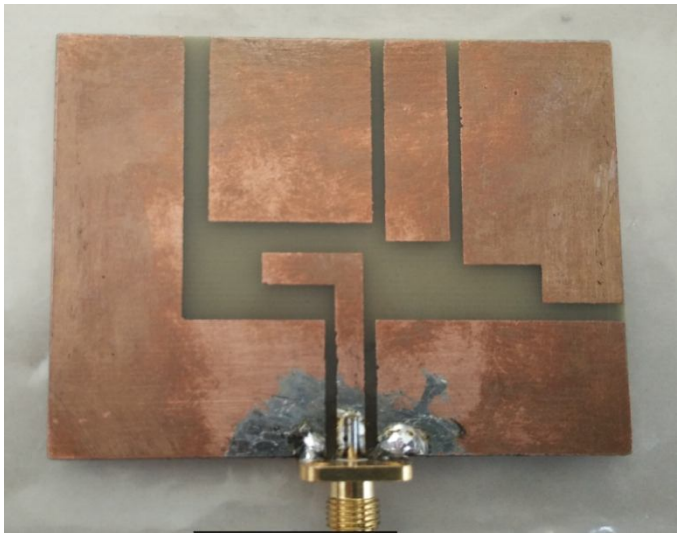


Fig3. Top view of patch antenna

Fig:-4 Ground

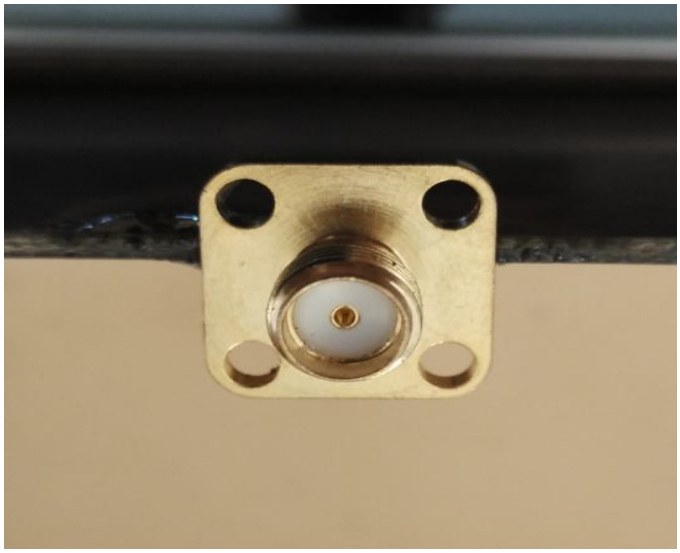


Fig5:- SMA female connector

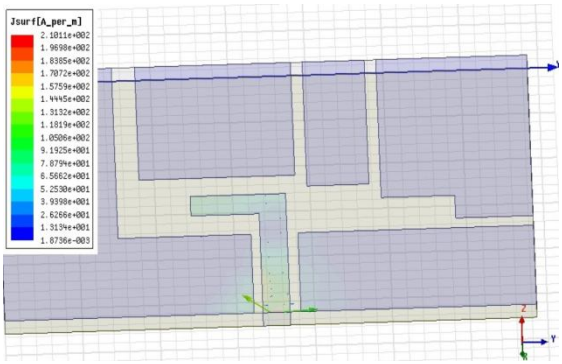


Fig.6 J Field for Patch

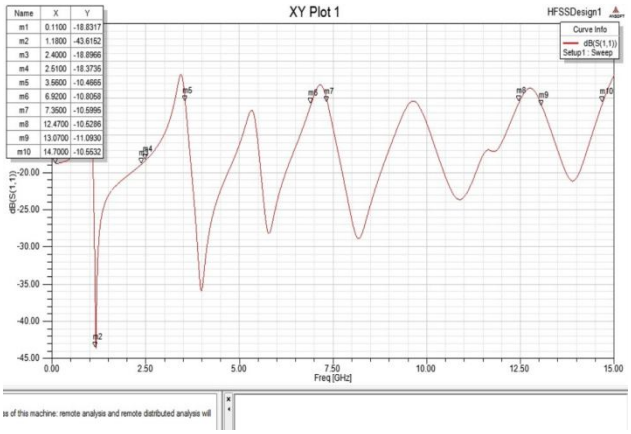


Fig.7 S11 versus Frequency

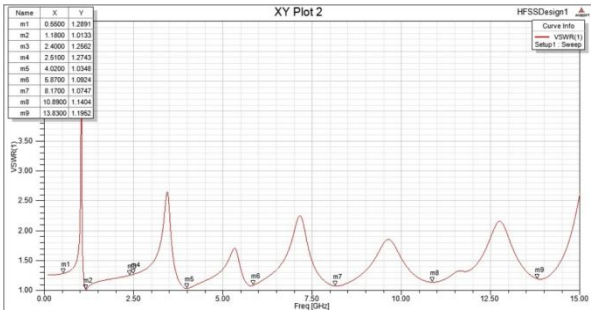


Fig.8 VSWR Vs Frequency

Dimensions above mentioned antenna is 55.3mm x 68.6mm, width is 0.254mm. From this design we got idea for the design antenna by using various patch size and shapes for various applications. This S shape patch have advantage that it is easy to design and can be etched with minimum complexity.

The S shape patch been cut from total rectangle with different dimensions. Two rectangular slot are cut out from patch near feeding micro strip patch line for impedance matching.

Simulation and design of antenna was performs using HFSS.

IV. CONCLUSION

In this paper we reviewed possibility of designing micro strip patch antenna using CPW feeding technique and we observed that wide bandwidth can be achieved using CPW feeding technique which is applicable to UWB band.

We also designed Square shape patch antenna which uses CPW feeding technique using HFSS and we obtained good result in terms of reflection coefficient and VSWR.

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