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REVIEW OF ULTRA WIDE BAND ANTENNAS

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Abstract — ***Ultra-wideband is a radio technology invented by 'Robert A .Scholtz and others that for an short range and high bandwidth communication of the radio spectrum can use a very low energy level.The ultra-wide band antennas are applied where larger bandwidth for the transmitting signal is needed. Wide bandwidth in the range from 500 MHz to the frequencies above 8000 MHz are covered by ultrawideband antennas. It is a wireless technology which uses very low power for short distances and transmits large amount of digital data over a wide spectrum of frequency bands. In this paper, a review of various techniques to realize ultra wide band micro strip antennas (MSA) is presented. By using different techniques like basic planar monopole antenna and the variations of the same by using different shapes of radiating monopole antenna, like, bi-conical, Bowtie, etc. these antennas are realized.***

Keywords- Planar Monopole Antenna; Ultra wideband; Band notched; Multiple stop band component;

I. INTRODUCTION

In now day's the wireless system has become a part of human life. This wireless system is used in almost all the electrical and electronics equipment. An antenna is a basic element of the wireless system. Antenna is an electrical device which transmits the electromagnetic waves into the space by converting the electric power given at the input into the radio waves and at the receiver side the antenna intercepts these radio waves and converts them back into the electrical power. So many systems such as remote controlled television, cellular phones, satellite communications, spacecraft, radars, wireless phones and wireless computer networks make use of antenna. Nowadays demand of compact antennas is increasing due to emerging of new wireless devices. Increase in the satellite communication and use of antennas in the aircraft and spacecraft has also increased the demands of a low-profile antenna that can provide a reliable communication. Federal communication commission (FCC) has declared 3.1-10.6 GHz as ultra wide band frequency range. Recently, in UWB application, monopoles of various configurations have been used as they possess numerous qualities such as nearly omnidirectional radiation pattern, simple structure and low cost. In addition, these systems have low power consumption and low interference and immunity to multipath fading.

II. PLANAR MONOPOLE UWB ANTENNA

The monopole antenna was invented in 1895 by radio pioneer 'Guglielmo Marconi'. A monopole antenna is a class of radio antenna which consists of a straight rod shaped conductor often mounted perpendicularly over some type of substrate called a ground plane. The monopole is a resonant antenna in which the rod functions as an open resonator for radio waves which are oscillating with standing waves of voltage and current along its length. The planar monopole antennas yield a very large-impedance BW. To avoid impedance mismatch, the micro strip antennas with edge probe feeding are used. The formula for rectangular micro strip antenna (RMSA), to calculate resonance frequency is given by

$$f_0 = \frac{c}{2\sqrt{\varepsilon_{rs}}}\sqrt{\left(\frac{m}{Ls}\right)^2 + \left(\frac{n}{Ws}\right)^2}$$

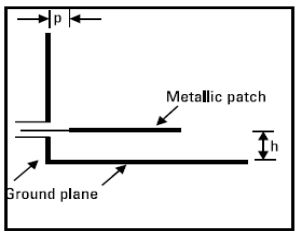

Figure 1. Planar Monopole Antenna

III. SLOT CUT UWB ANTENNAS

Slot antennas are used in UWB systems due to the several advantages such as low profile, light weight, ease of fabrication and wide frequency bandwidth. This type of antenna has been realized by using micro strip line and CPW feeding structures.

3.1. Square Monopole UWB Antenna

Here we present a printed antenna with dual band-notch function for ultrawideband applications. This antenna consists of a square radiating patch with an E-shaped slot, a pair of L-shaped slits and a ground plane with a V-shaped protruded strip. This antenna provides a Bandwidth ranging from 2.89–17.83 GHz. We use two L-shaped slits in the radiating patch to obtain single band notch characteristics. For gaining a dual band notch function, an E-shaped slot is added in the centre of the radiating patch. Also, additional resonances are excited by inserting a V-shaped protruded strip in the ground plane. By measuring the results, it is concluded that this antenna gives a very wide bandwidth with two band notches and coveres all the 5.2/5.8-GHz WLAN, 3.5/5.5-GHz WiMAX and 4-GHz C-bands. The designed antenna has a small size area of 10*16 mm.

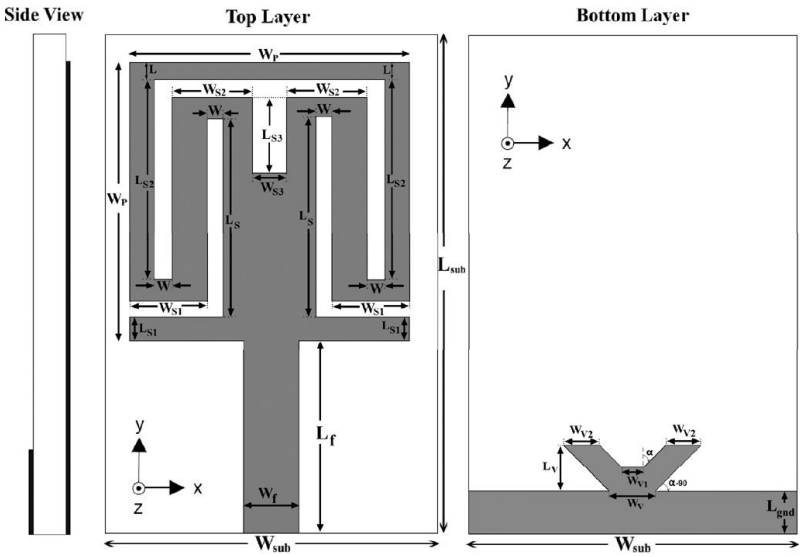

Figure 2. Geometry of the proposed antenna

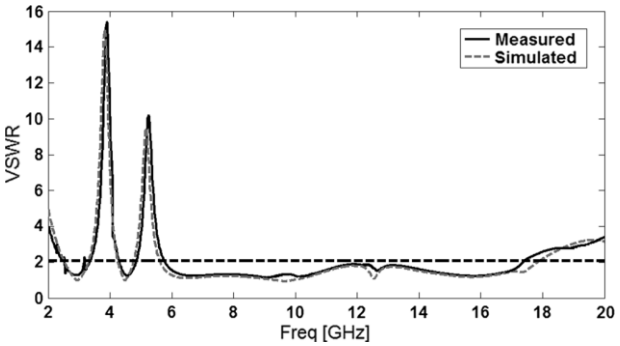

Figure 3. Measured and simulated VSWR characteristics for the proposed antenna.

3.2. Band Notched UWB Antenna.

A band notched UWB antenna is shown in Fig.4(a). This antenna has a semicircular wide slot and is fed using circular micro strip line. This antenna operates with a band-notched frequency at 5GHz. In the circular micro strip patch, a U-shaped slot is cut to achieve the band-notch characteristic. Here a rectangle substrate with relative permittivity of 2.65 and thickness of 1mm with length and width of 80mm and 50mm, respectively is used. The dimensions of the antenna are shown in Fig.4(a). This antenna gives a wide operating bandwidth of 3.1-10.6 GHz which covers the UWB.

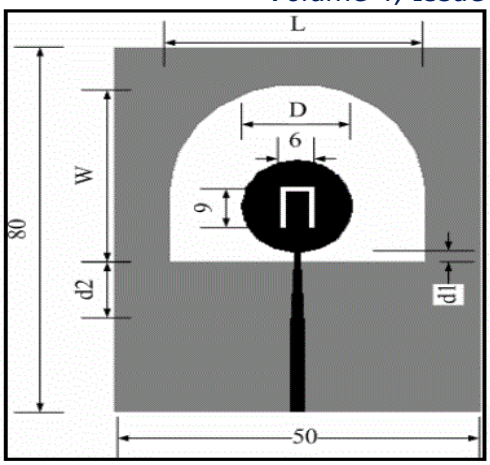

Figure 4(a). Geometry of band notched UWB antenna

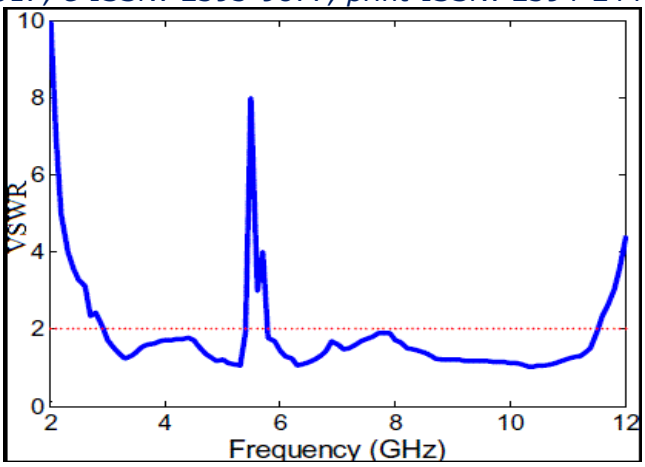

Figure 4(b). The amplitude characteristic of field distribution

Also, a notch band is achieved for the antenna by cutting narrow U-shaped slot inside the circular patch whose width is 1mm. Thus, for this frequency band, the antenna becomes non-responsive which leads to band notched operation. Here for this antenna, a sharp notch band is achieved at 5 GHz.

3.3. Multiple Stopbands UWB Antenna

Here a CPW-fed circular monopole UWB antenna with multiple stop bands is presented. The CPW feed line is connected with all three pairs of L-shaped slots. Here we use a substrate of single layer with the relative permittivity 2.65 and the thickness of 1mm. The dimensions of the antenna are as shown in Fig.5(a). In this antenna, we are using three L-shaped slots which are quarter wavelength slots. Thus, we are getting three stop bands at 2.4GHz, 3.5GHz and 5.8GHz.

Within the passband, the antenna has nearly omni-directional radiation patterns. The antenna has the impedance bandwidth defined by S_{11}< -10dB from 1GHz to 6GHz and has three stopbands at 2.4 GHz, 3.5 GHz and 5.8 GHz respectively.

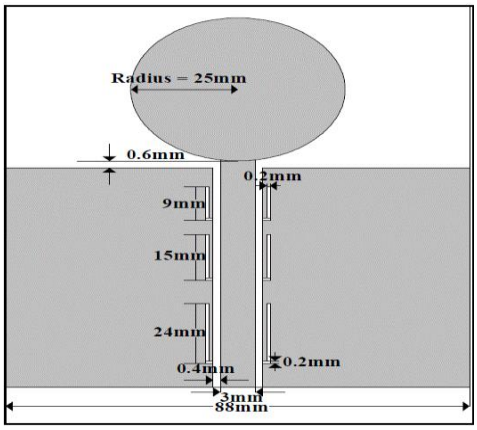

Figure 5(a). Multiple Stopbands Ultra Wide Band Antenna

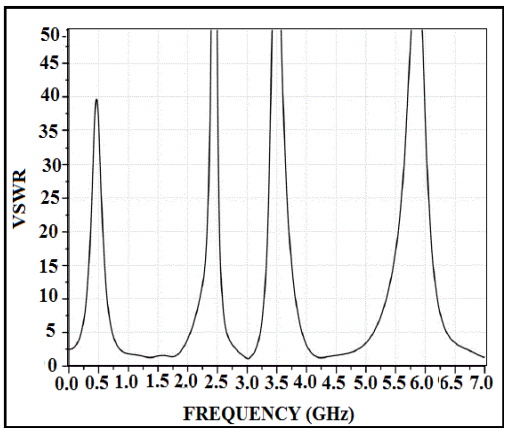

Figure 5(b). Simulated VSWR

IV. Conclusion

In this paper, we have briefly reviewed the slot cut UWB antennas. This paper summarizes various benefits of monopole antennas such as low cost and small geometry as well as benefits of UWB antennas such as wide usable bandwidth, band rejection, bandwidth enhancement and reduced radar cross section. The above proposed antennas give a good scope for UWB applications and further experiments on different shapes of monopole antennas can yield better results.

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