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UWB PRINTED SLOT ANTENNA WITH DUAL NOTCH BANDS

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Abstract— *UWB printed slot antenna is a vital use these days for the commercial applications. The UWB slot antenna, covering 3.1–11 GHz, is in the shape of an octagon and is fed by a rectangular patch with a bevelled bottom edge [1]. This paper will present the simulation analysis of slot antennas using different frequencies for bandwidths enhancement. Used to UWB with dual notch band techniques to solve the problem of antenna bandwidth in mobiles, wireless, Bluetooth, WI-FI,WI-MAX,W-LAN and broadband etc. These techniques are used to enhance the bandwidth and efficiency of antenna. Some approaches for notch bands are introduction of slots in UWB antenna. The effect of notch band in various antenna parameters like, radiation, efficiency, gain and bandwidth are discussed. Finally the paper reports a brief description bandwidth enhancement of antenna by using three different frequencies and micro strip feed line on substrate with a finite size of ground plane .this slot antenna supports 2500MHz , 3500MHz and 5800MHz frequencies .simulation operations demonstrate that optimum results of antenna and radiation characteristics have been successfully done for UWB slot antenna.*

Index Terms— *Ultra wideband (UWB), printed slot antenna, notch bands, multiband, microstrip feed line, dielectric constant.*

I. INTRODUCTION

Now days, there is large development and usage of mobile phones, tablets, computers, laptops etc, which are connected with communication device ,mobile access points to exchange and transfer data or information. This development and usage of communication devices opened large interest in small antenna and its notch band techniques. From technical point of view, antenna is an important part of these handheld devices that are used for communication purpose. Antenna designers want to design smaller antennas with high efficiency and performance. So, they are using antenna notch band techniques to solve the problem of bandwidth enhancement within handheld devices. Antennas are placed within these handheld devices by reducing its size, so that antenna performance will be better for efficient communication. Antenna performance depends upon its physical size, so its radiation characteristics, gain, directivity, return loss will change. Depending on the applications, different antennas are used within the communication system. High frequency antenna systems are used for mobile communication, wireless, Bluetooth, wi-fi, wi-max, w-lan and broadband applications etc. In today's world of wireless communication, there has been an increasing need for multiband, low profile, more compact and portable communication systems both for commercial and military application. Even the size of circuitry has evolved to transceivers on a single chip; there is also a need to evolved antenna designs to minimize the size. Currently, many portable devices use simple monopole with a matching circuitry. However if the monopole antenna is very short as compared to its wavelength, the radiation resistance decreases. So UWB antenna is having more demand in market because single antenna will work on many frequencies, which has more users friendly. It's like multi band.

II. THE BASIC CONCEPT

UWB printed slot antenna has various advantages. It has some drawbacks also such as bandwidth limitation, low gain, and they do not have good radiation pattern with large size [1]. There are different types of antenna slots used with some specific feeding techniques for enhancement of antenna bandwidth, and return loss. The substrate height and dielectric constant are very important factors that influence variation in bandwidth. In this paper use a notch frequency to show variation of bandwidth and non-uniform slot line widths for lower operating frequency of antenna. This is an antenna which has many applications where low-profile, low cost and high efficiency. Whenever slot has complementary form in strips then the pattern and impedance data used to predict the patterns and impedances of the corresponding slots.

So, slot antenna can use babinet's principle [3]. The slot is generally made of some conducting material like gold or copper and it has many shapes like ultra wide band, tapered, slotted cylinder, and printed slot antenna etc application used. It has a thin profile, fabrication easy, polarization circular and linear, flexible shape and spurious radiation. The frequency ratio depends on the number of slots .their position and the slot length .the radiation edge of patch give rise to the lowest frequency ratio. That is the loading effect of slot maximum at the position of maximum magnetic field, loading effect of slot increase the slot length. Substrate parameters such as dielectric constants, its height can be varied to obtain different return loss and ultimately increase in impedance bandwidth. Impedance bandwidth can be increased by decreasing dielectric constant value of the substrate.

III. UWB SLOT ANTENNA

There are two techniques used for dual notch band in this paper-

(i) **Loading of low Permittivity material in substrate of an antenna-** Since wavelength becomes longer in low permittivity material used in the substrate, the antenna physical size will increase but frequency will decrease. The physical size of an antenna will depend upon permittivity and height. Thus, loading of low permittivity will reduce the bandwidth of antenna .hence bandwidth of antenna will enhance less.

(ii) **Using dual notch bands in UWB printed slot antenna-** In UWB slot antenna design notches band can be used to tune the resonant frequencies by length of strip an antenna and control the separation of a dual frequency. It's adding an extra frequency (2.5GHz) band without changing the size of an antenna. here use as micro strip feed line on substrate.

IV. DESIGN CONSIDERATION

A) Length of stub:

$$L= c/4fr\sqrt{(\epsilon r+1\div 2)}$$

Where,

L is total length any of beveled stub

B) Calculation of Impedance Bandwidth:

$$BW(\%) = 100 * \frac{Fmax - Fmin}{Fr}$$

Where

Fmax is maximum frequency

Fmin is minimum frequency

And Fr is resonant frequency

C) Calculation of width:

$$W = \frac{c}{2fr\sqrt{(\frac{\epsilon r + 1}{2})}}$$

Where c is speed of light in free space

fr is resonant frequency

D) Calculation of length:

$$L = Leff - 2\Delta L$$

E) Calculation of ground plane dimensions:

$$Lg = L + 6h, Wg = W + 6h$$

F) Effective dielectric constant:

$$\epsilon reff = \frac{\epsilon r + 1}{2} + \frac{\epsilon r - 1}{2}\left[1 + 12\frac{h}{W}\right]^{-0.5}$$

Where W is width of patch

h is height of substrate

H) Fringes factor:

$$\Delta L = 0.412h\frac{(\epsilon reff + 0.3)\left(\frac{W}{h} + 0.264\right)}{(\epsilon reff - 0.258)\left(\frac{W}{h} + 0.8\right)}$$

Where W is width of patch

h is height of substrate

4.1. ANALYSIS OF UWB SLOT ANTENNA

In this section we have designed UWB slot antenna shown in figure 1. where the L-shaped strip of width is 0.25mm,0.6mm and thickness of slot is 0.1mm with dielectric constant 3.52 with substrate height 0.8mm.UWB slot antenna making in a perfect electric conductor .antenna is excited by using a micro strip feed line. The edge of the feed line is shorted to the perfect conducting plane using a notch bands. So, the width and length of the feed line can be adjust to achieve a good impedance match UWB printed slot antenna support to frequency is 2500MHz, 3500 MHz and 5800MHz with bandwidth vary 380MHz to 160MHz respectively. Where sweeping between 2MHz to11MHZ and 0.02 numbers step passes.

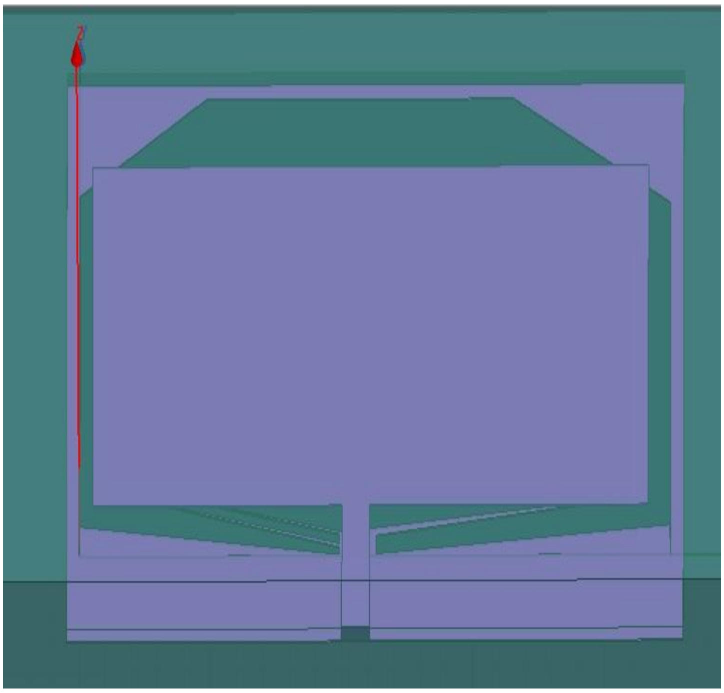

Fig1.UWB printed Slot antenna design using HFSS with dielectric constant (∊r) = 3.52

4.2. SIMULATION RESULTS

A) **Confirmation of Simulated Results:**

UWB printed slot antenna is designed using HFSS software tool and these simulation results are obtained by taking suitable dimensions of antennas, so that antenna gives better performance and better radiation too.

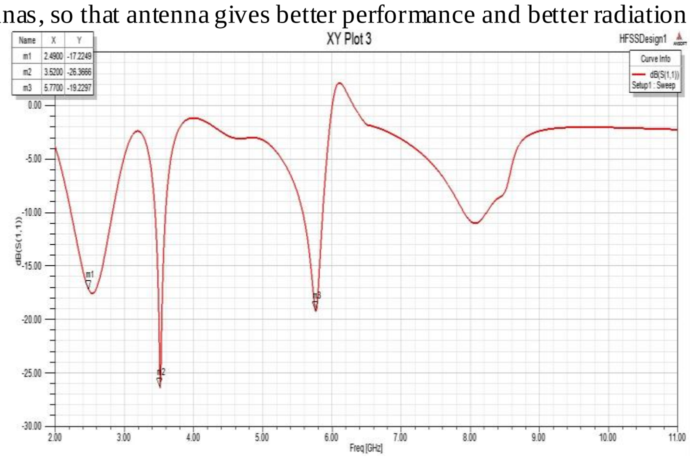

Fig2.Return loss of UWB slot antenna using dielectric substrate resonated at 2.5 GHz (∊r = 3.52)

From above fig2 Shows return loss (S11) of -17.23dB and bandwidth of 16 percent obtained with antenna resonate at 2.5GHz High return loss then impedance matching is good and results in low insertion loss.

B) **Simulated Design**: Shown a fig. 3 and fig. 4 of gain variation. Where frequency is 2500MHz, 3500MHz and 5800MHz.gain varies in accordance with bandwidth. In radiation patterns are obtained by varying theta (θ) and phi (ϕ)

angles but here only theta values varied but phi remains constant. Thus this shows the variation of gain values with respect to theta.

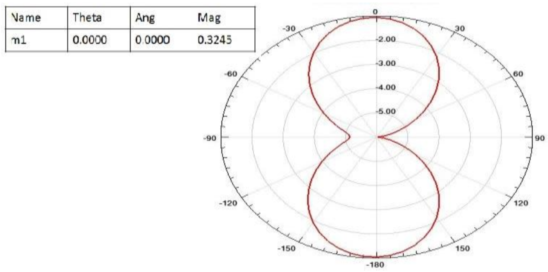

Fig3. Shows Gain of UWB slot antenna using dielectric substrate resonated at 2.5GHz with phi ($\varphi) = 0\mathrm{deg}$.

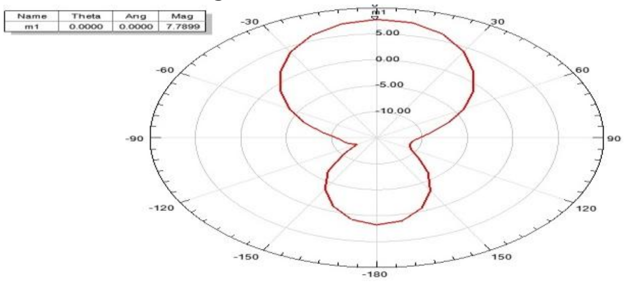

Fig4. Shows Gain of UWB slot antenna using dielectric substrate resonated at 3.5GHz (ϵr=3.38).

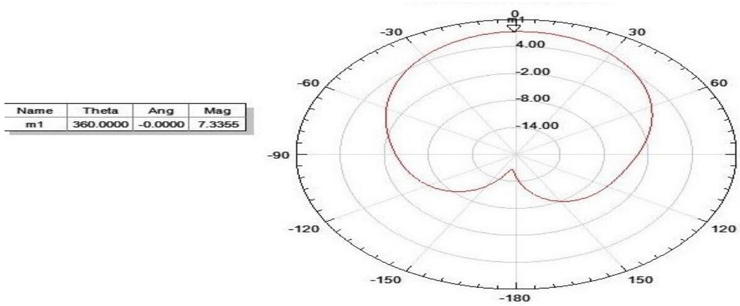

Fig5.Radiation pattern plot shows electric field variation with respect to theta values.

Here electric field has all three components and these components give total resultant electric field and radiation, resonated at 5.8GHz.

TABLE I. COMPARISON BETWEEN DIFFERENT BANDWIDTH OF UWB PRINTED SLOT ANTENNA

NO.OF FREQUENCIES (GHZ)	BANDWIDTH (IN MHZ)	RETURN LOSS (IN DB)
2.5	380	-17.24
3.5	180	-26.38
5.8	240	-19.24

V. CONCLUSION

In this paper, of an UWB slot antenna built an extra band (2.5GHz) and dual notched bands (3.5GHz, 5.8GHz) has simulated using HFSS. Which has used for higher bands transmission. The UWB slot antenna has an octagonal shape and they have variations in radiation patterns over all frequencies 2.5GHz, 3.5GHz and 5.8GHz, with Bandwidth of antenna varies 380 to 180MHz. hence the stubs act independently, and their addition to the slot antenna does not change the behaviour of the original UWB Slot antenna.

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