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Design of UWB antenna with single notch band

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Abstract— In this paper, an ultra-wide band (UWB) antenna is proposed for wide band applications. The antenna under investigation is fed by a 50 ohm micro strip line. The basic shape of the notch and simple patch is presented in paper. A significant enhancement in the bandwidth and y-shape notch has been achieved in a low profile and compactness of UWB antenna with good impedance matching. The proposed antenna is studied thoroughly and presented in the paper.

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Keywords— Ultra wide band Antenna, micro strip feed line, notch, wide bandwidth, gain, bandwidth and Return loss.

INTRODUCTION

Federal Communication Commission in 2002 allocated 3.1-10.6 GHz frequency range as the UWB frequency band. UWB technology provides significant potential in short and long-range communication which is mainly employed for indoor or outdoor applications. There by enabling high data rates and flexible equipment mobility for wide range [1] [2]. Wider bandwidth and smaller dimension rather than conventional antenna parameters has been used in such antenna for telecommunication systems, so useful for more number of users [3]. This concept has gained tremendous impetus in radar based systems like GPS, security based networks, automotive collision avoidance and high bandwidth [4]. The FCC allocated an absolute bandwidth up to 7.5 GHz which is about 110% fractional bandwidth of the center frequency and the large bandwidth spectrum is available for high data rate communications as well as radar and safety applications to operate[5]. The UWB technology has another advantage from the power consumption point of view and due to spreading the energy of the UWB signals over a large frequency band. Notch has use to eliminate at particular frequency of a band and partial reflecting surfaces have been integrated with printed antennas to enhance the performance of the antenna over a narrow or a broad band[6][7].

In this paper, an ultra-wide band antenna is proposed for ultra wide band applications. The main aim of this investigation is to create a notch which helps to eliminate a unwanted frequency with in a band. The designed antenna is operating in the UWB range as is assigned by FCC.The entire antenna designs as well as simulations are performed in HFSS 2014.

THE BASIC CONCEPT

A simple patch is designed for ultra wide band application which is useful for wide range and consist more number of user to provide high bandwidth. Here using a y-shape notch which has to help eliminate an unwanted frequency within a band range. The dielectric substrate has a height of 1mm and a relative permittivity is FR4 epoxy of 4.4. The antenna is fed by a 50 ohm micro strip feed line.

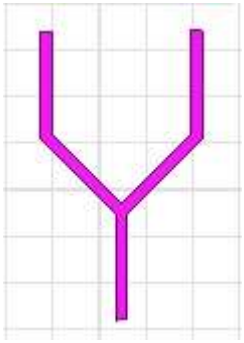

Fig. 1.1 Y-shape notch

DESIGN OF THE PROPOSED ANTENNA

Fig.1.1 depicts the y-shape notch designing for ultra wide band application with width is 0.5mm and length is 4.65mm.the dimension of the 50 ohm microstrip feed line is taken as 22 x 24 mm^2 and height of substrate is 1mm, permittivity is 4.4 shown in Fig1.2.Fig1.3 shows a thin sheet of length 22mm and width is 8.6mm used as ground. The dimension of the 50 ohm microstrip feed line is taken as 8 x 1.9 mm^2.In order to achieve high bandwidth consider to ultra wide band and patch has dimension is 10 x15mm^2,ladder cut dimensions has 1x1mm^2 Fig. 1.4 shows the detailed design of the antenna in HFSS 2014. Fig. 1.5 shows the back side of the antenna having half ground.

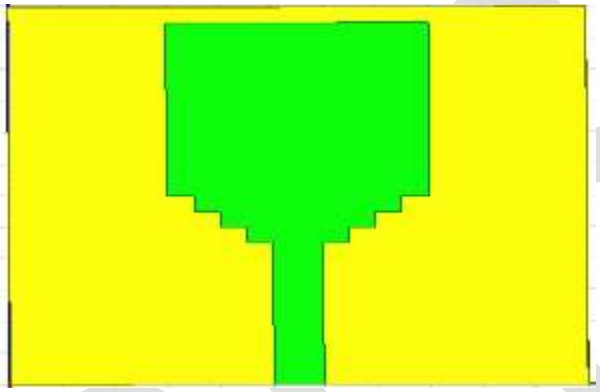

Fig. 1.2 Front View of the proposed antenna

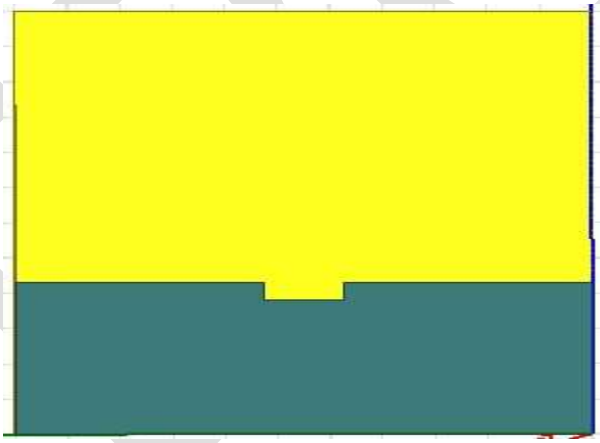

Fig. 1.3 Back side view of the proposed antenna

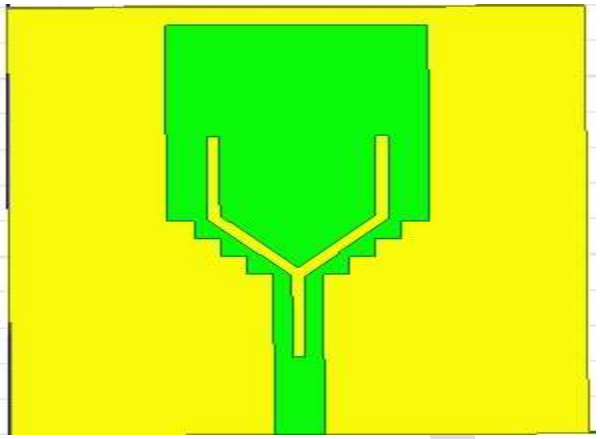

Fig.1.4 Front view using notch

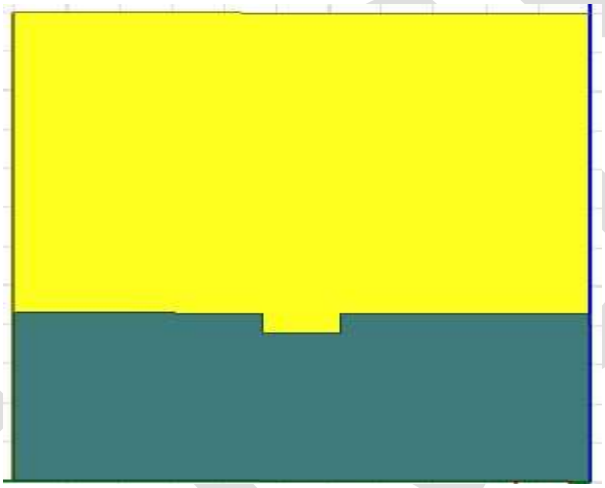

Fig. 1.5 Back view of UWB Antenna

SIMULATION RESULTS

Fig. 1.6 shows the return loss vs. frequency plot of the proposed antenna. It can be seen from the graph that the antenna resonates at 3.8GHz,4.4GHz, 9.55GHz and 11.45GHz having return loss of -10.24dB, -25.14dB, -34.83dB and -10.22dB respectively.

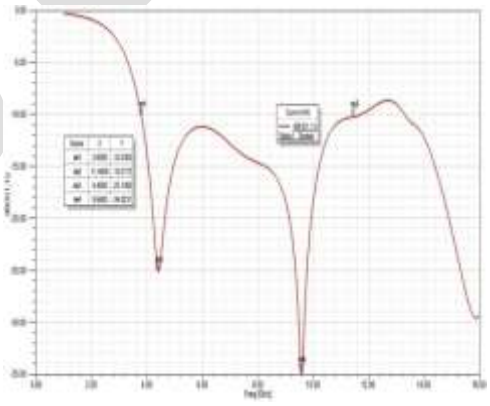

Fig. 1.6 Return Loss of the proposed antenna without notch

Fig. 1.7 shows the radiation pattern of the antenna Radiation patterns are obtained by varying theta (θ) and phi (φ) angles. Here, only θ values are varied but φ remains constant to zero value.

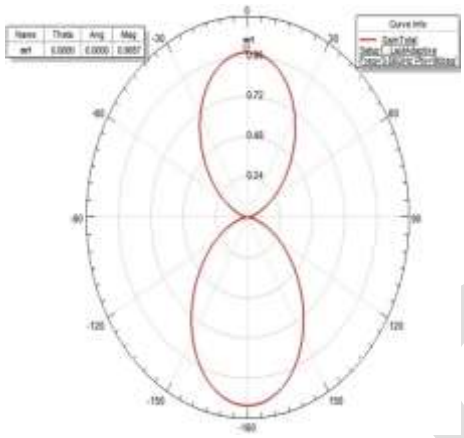

Fig. 1.7 Gain of antenna without notch

Fig. 1.8 shows the VSWR vs. frequency plot of the proposed antenna. It can be seen from the graph that the antenna resonates at 3.85GHz, 11.45GHz having VSWR of 1.78 and 1.9 respectively.

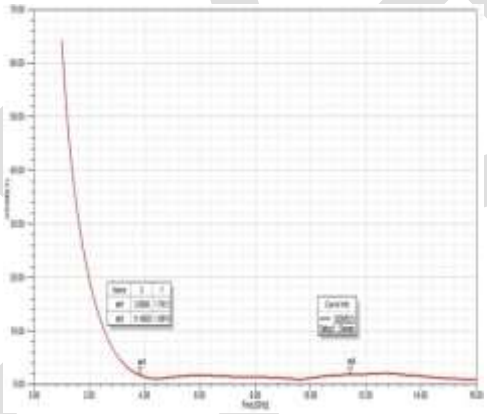

Fig. 1.8 VSWR of the proposed antenna without notch

Fig. 1.9 shows the return loss vs. frequency plot of the proposed antenna. It can be seen from the graph that the antenna resonates at 3.5GHz,4GHz, 4.45GHz, 9GHz and 13.45GHz having return loss of -10dB, -14.82dB, -10.16dB,-31.42dB and -10.20dB respectively.

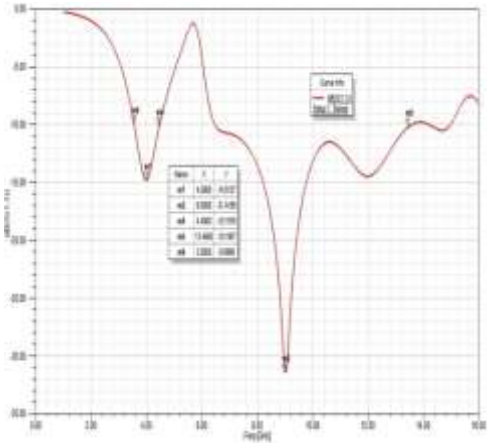

Fig. 1.9 Return Loss of the proposed antenna with notch

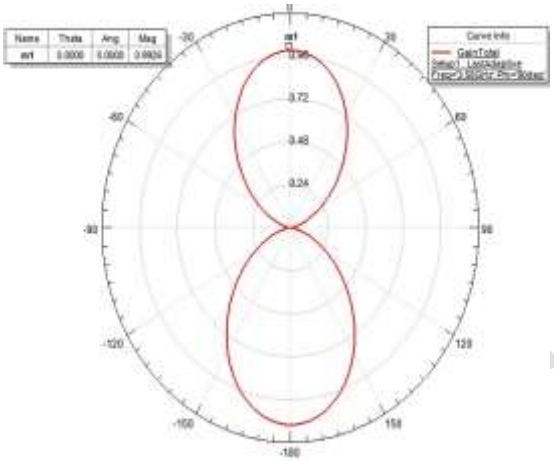

Fig. 1.10 Gain of antenna with notch

Fig. 1.11 shows the VSWR vs. frequency plot of the proposed antenna. It can be seen from the graph that the antenna resonates at 3.5GHz, 13.45GHz having VSWR of 2 and 1.8 respectively.

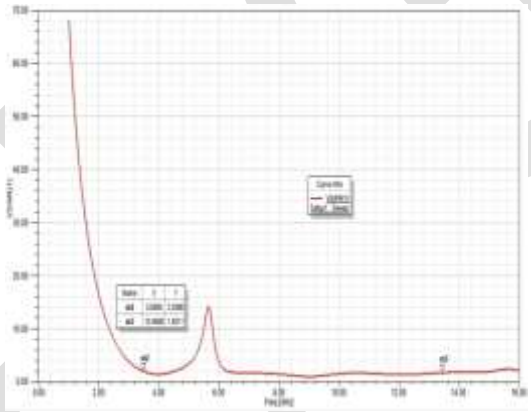

Fig.1.11 VSWR of the proposed antenna with notch

CONCLUSION

The proposed antenna has resonated in multiple frequency bands between 3.55GHz to 13.45GHz and showed wide bandwidth in their respective bands and notch. From above results, it is concluded that UWB antenna using single notch provide wide bandwidth and eliminated unwanted band using notch. it gives better gain, radiation characteristics and VSWR and maintain the compactness of proposed antenna. So, the proposed design has shown compactness and can be incorporated for short and long range communication systems.

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