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Design of Multi band Notched U-Shaped Microstrip Antenna

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Abstract: In this a compact modified U-Shaped design with coplanar waveguide (CPW) fed triple band notched antenna was proposed. The proposed antenna, with compact size of 24×33 mm^2, yields an impedance bandwidth of 120%(S11<-10dB criteria). The notched bands are realized by introducing two different types of slots. Two C-shaped half-wavelength slots are etched on the radiating patch to obtain two notched bands in 3.3-3.7 GHz for WiMAX and 7-7.75 GHz for downlink of X-band satellite communication systems. In order to minimize the mutual coupling between the band-notched structures, the middle-notched band in 5.5-5.8 GHz for WLAN is achieved by using a U-slot defected ground structure. The parametric study is carried out to understand the mutual coupling. The performance of the antenna is evaluated in terms of return loss(S11), VSWR and Radiation Patterns.

Keywords: DGS, VSWR, Radiation Pattern, Return loss

I. INRODUCTION

Micro-strip patch antenna plays a vital role in the fastest growing wireless communications industry and today we cannot think of any development in wireless communication without changes in micro-strip patch antenna technology [1]. These are becoming very useful because they can be printed directly onto a circuit board. These antennas are also called as "Printed Antennas". So printed antennas have been preferred due to their advantages over other radiating antennas i.e., which are conformal, small and compact, cheap and easy to fabrication [2]. Micro-strip Patch Antenna has number of merits such as low profile planar structure, multiband properties using some techniques, low cost and moderate to high gain [3]. The antenna achieves a nearly omni-directional radiation pattern characteristics. Microstrip antennas are designed to have many geometrical shapes and dimensions. This antenna works at different frequencies for the different applications [4]. Microstrip patch antennas are operate at microwave frequencies. Microwave frequencies ranges from 300MHZ TO 300GHZ. The microstrip patch antenna consists of conducting patch on a ground plane separated by dielectric substrate [5]. Now-a-days we need high performance in small size, so the microstrip antennas are perfect to use. Some applications of Microstrip patch antennas are WLAN, WiMAX, X-band satellite communication [6].

The outspread bandwidth of Ultrawide band technology is extensively preferred by academia and industry due to its credible usage in high-speed data transfer and microwave imaging [1-2]. In 2002, the Federal Communications Commission (FCC) released an unlicensed band for commercial use in radio communications in the frequency range of 3.1-10.6 GHz. Basically, a major problem will be caused due to the high mutual coupling between the slots. We have different types of mutual coupling reducing techniques like Electromagnetic Band Gap structure, Split Ring Resonator Structure, Defected Ground Plane Structure etc [7]. In this paper, a novel structure is designed with reduced mutual coupling between the slots. In this paper, first, a U-shape UWB antenna is designed and the parameters are observed. In this antenna, a 3 different U shape slots are cut. The DGS (Defective Ground Plane) Structure is used to reduce the mutual coupling between the antennas [8].

II. ANTENNA DESIGN

The proposed DGS microstrip patch antenna is shown in below figure, in that both front view and back view are shown. All dimensions are taken in mm. The DGS antenna is designed to operate at 3.1-10.6 GHZ frequency Here, the substrate of the proposed antenna is FR4 epoxy (loss free) of size 24mm*33mm*1.6mm, the ground and patch of the proposed antenna is copper. It is excited by microstrip feed line with a width of 3mm.

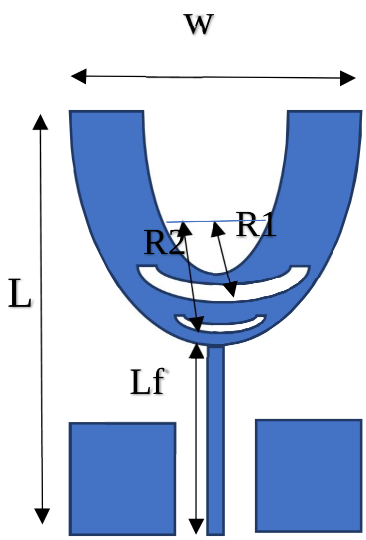

Fig1.1: Front view of proposed antenna

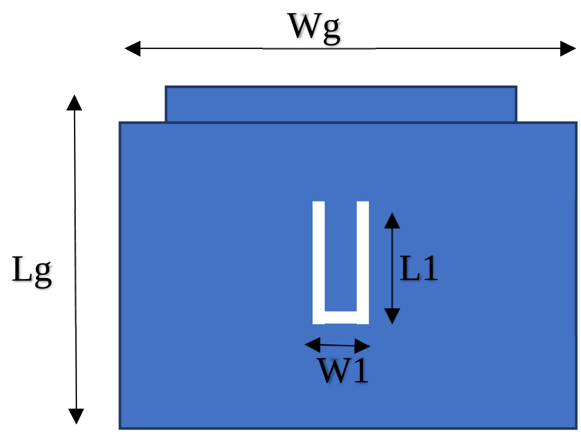

Fig1.2: Back view of proposed antenna

W	L	Wg	Lg	Lf
24	33	20.4	12.7	13.2
R1	R2	L1	W1	
6.6	8.5	8	1.2	

III. RESULTS AND ANALYSIS

The different simulated results (using the CST microwave studio 2016) like return loss, voltage standing wave ratio (VSWR) and E-plane and H-plane radiation patterns are discussed below.

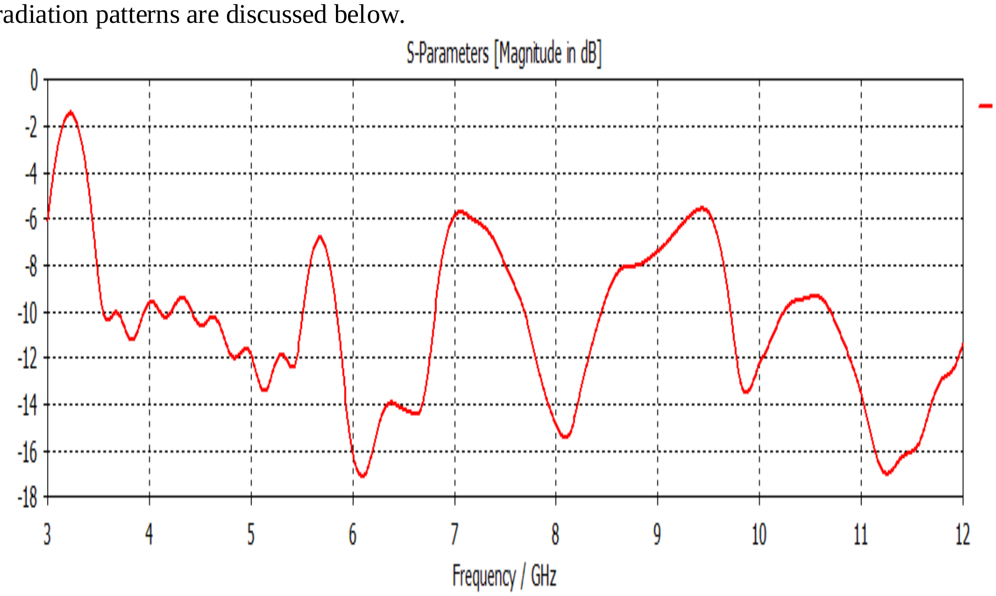

Fig2:S 11 Parameter

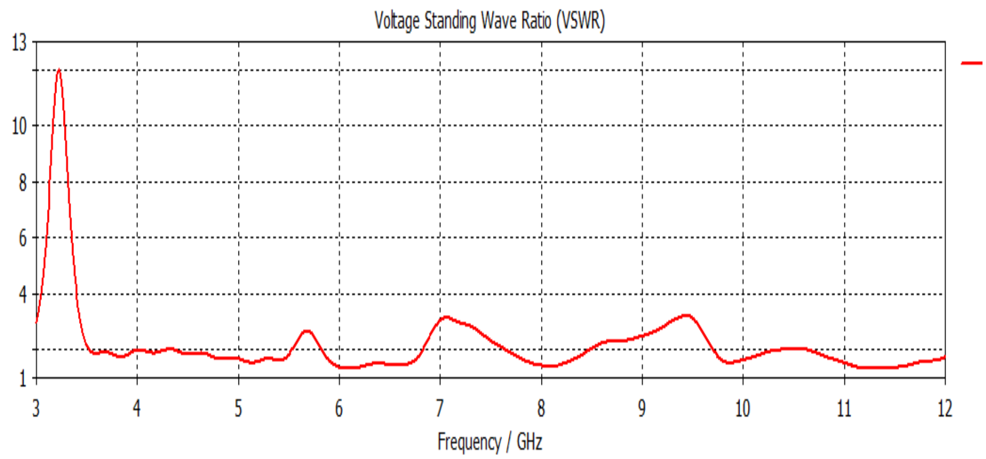

Fig3:VSWR

The below figure shows the output of VSWR. It should be between 1 and 2. The Voltage Standing Wave Ratio is an indication of the amount of mismatch between an antenna and the feed line connecting to it. A VSWR value which is under 2 is considered as suitable for many of the antenna applications.

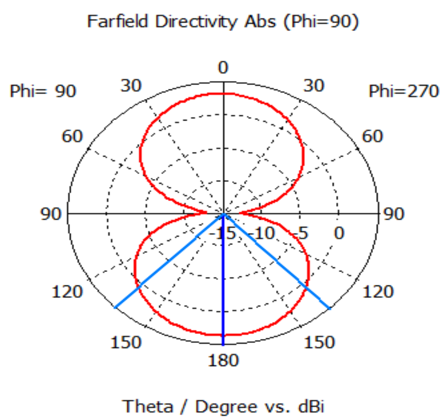

Fig4.1:E-plane radiation pattern at 3.2GHZ

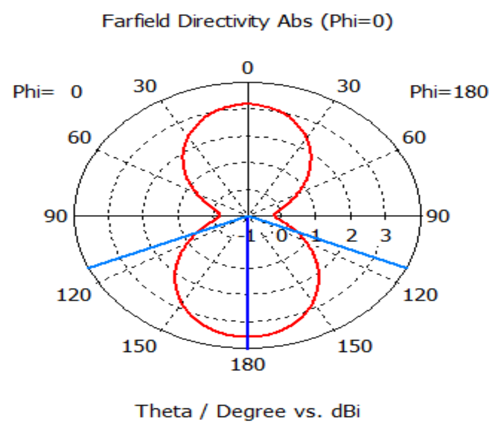

Fig4.2:H-plane radiation pattern at 3.2GHZ

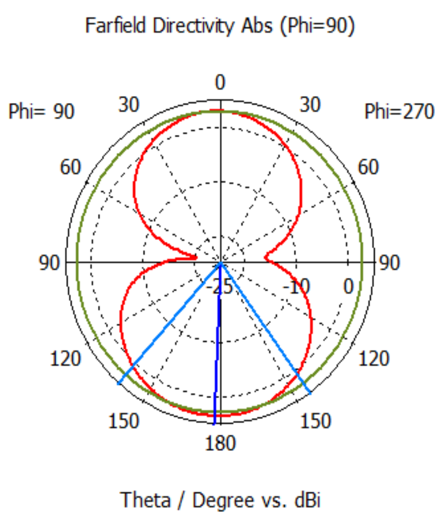

Fig4.1:E-plane radiation pattern at 5.1GHZ

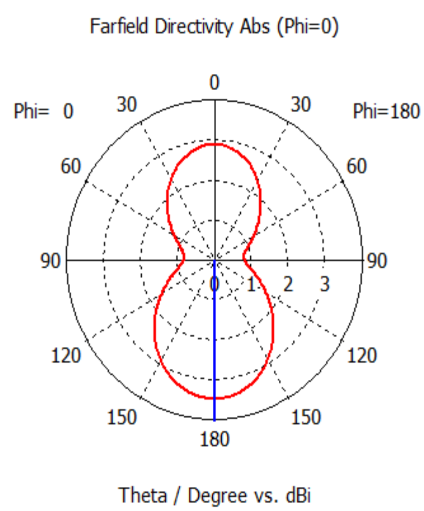

Fig4.2:H-plane radiation pattern at 5.1GHZ

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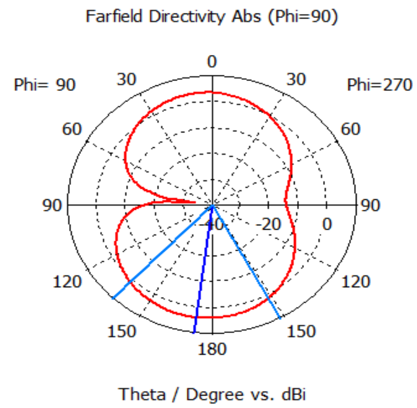

Fig4.1:E-plane radiation pattern at 5.6GHZ

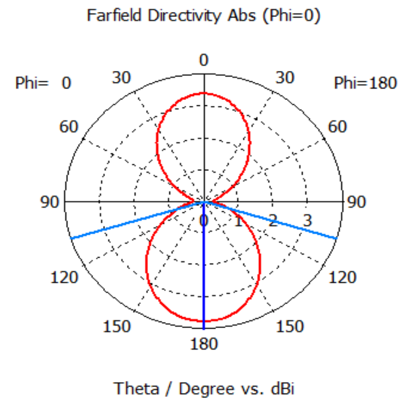

Fig4.2:H-plane radiation pattern at 5.6GHZ

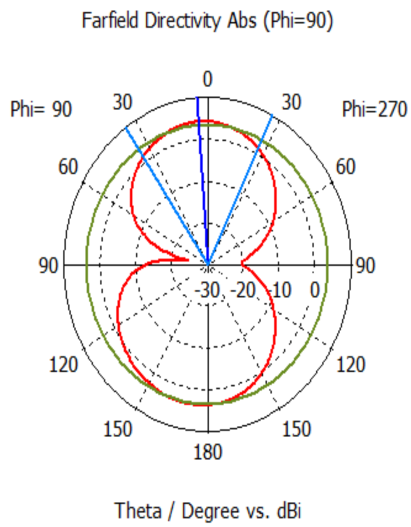

Fig.4.1 E-plane radiation pattern at 6.1GHZ

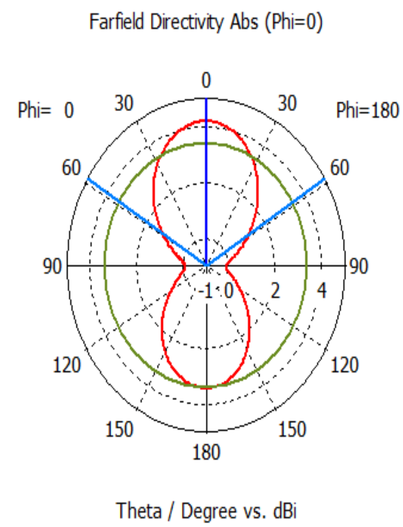

Fig.4.2 H-plane radiation pattern at 6.1GHZ

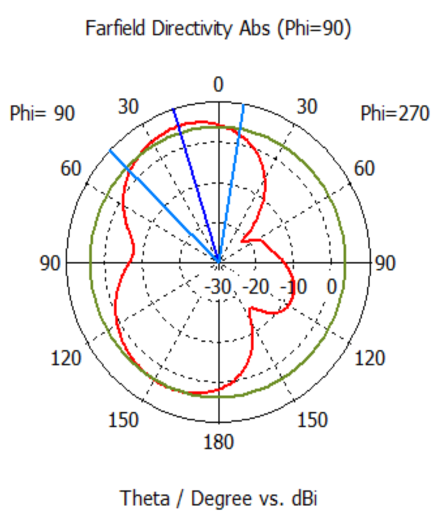

Fig4.1: E-plane radiation pattern at 7GHZ

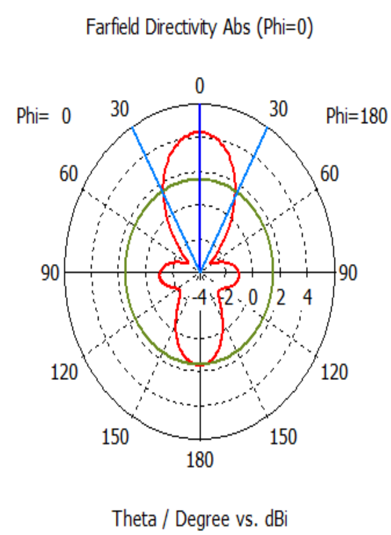

Fig4.2:H-plane radiation pattern at 7GHZ

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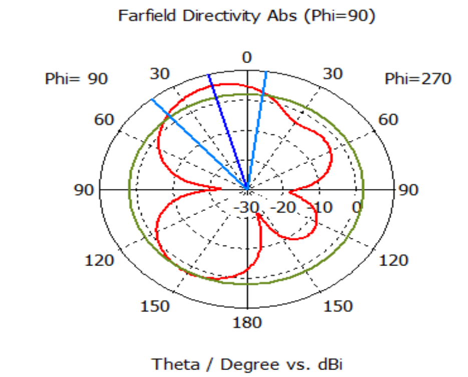

Fig4.1:E-plane radiation pattern at 8.1GHZ

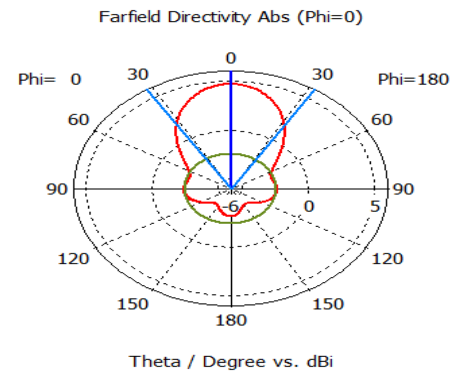

Fig4.2:H-plane radiation pattern at 8.1GHZ

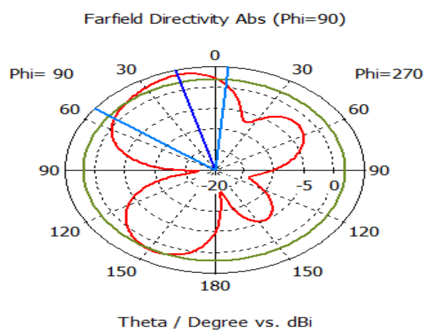

Fig4.1:E-plane radiation pattern at 9.4GHZ

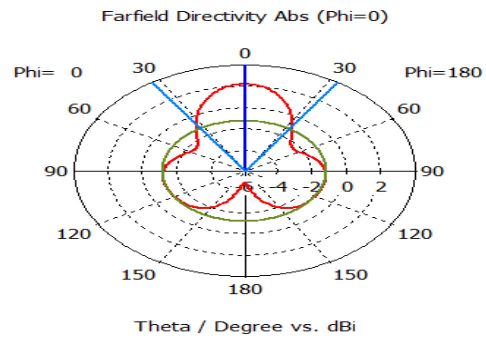

Fig4.2:H-plane radiation pattern at 9.4GHZ

The above figures shows the simulated two dimensional (2D) E-plane radiation patterns and H-plane radiation patterns at 3.2 GHZ,5.1 GHZ,5.6 GHZ,6.1GHZ,7 GHZ,8.1 GHZ and 9.4GHZ. Radiation pattern is the graphical representation which defines the radiating signal of the proposed antenna.

IV. CONCLUSION

This paper reports the design and performance of the UWB antenna with triple band-notched characteristics. Proposed CPW fed patch antenna has two U shaped slots on the patch and another U shape slot on ground. The three rejection bands have obtained by inserting three U-slots of different sizes and at different locations. The proposed antenna has probed in terms of Return loss, VSWR and radiation patterns. The Designed UWB Antenna has 3 Notch bands at different frequencies is very useful for Wi-MAX, X band satellite communication and WLAN etc.

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