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Integrated Triple Notch Bands Compact UWB Antenna for Wireless Communications

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Abstract: ***To Suppress Conventional Narrow Band Communication Technologies From The UWB Frequency Band An Integrated Triple Notch Bands Compact UWB Antenna Is Proposed. Band Notches Are Wimax (3.1-3.8 Ghz) ,WLAN(4.8-5.825 Ghz) And X Band (6.5-7.5 Ghz).To Attain UWB Frequency Band 2.9-14.5 Ghz From Compact UWB Antenna Introduced Slots In A Rectangular Patch With DGS. The Projected Compact UWB Antenna Arrangement Is Made-Up On FR4 Substrate With VSWR Is Less Than 2 Except For Selected Notched Bands. The Proposed UWB Design Is Suitable For Impenetrable Surroundings For Wimax/WLAN/X Band Dense. The Partial Defective Ground Structure Is Proposed To Improve Impedance Matching And Impedance Bandwidth Is Utilized.***

Keywords: DGS, Operating Bandwidth VSWR, UWB Antenna

I. INTRODUCTION

Because of its advantages like planar and non planar, resistant to severe multipath, jamming and low cast. A lot of broadband antennas are start frequency from 3.1-10.6 GHz, researchers are paying attention on the UWB micro strip patch antennas to avoid potential difference between existing conventional wireless communication technologies. There are many popular approaches to overcome the overlapping between existing narrow band communications and UWB frequency band. Those are cutting slots in patch and ground plane, strips in near the radiating patch V-shaped slot, pentagon shaped slot ,U slot, cone slot, SRR near the feed line and elliptical shaped slot [7].Many researchers paying attention on characteristics of the UWB antenna while designing. Those are compact size, moderate gain and Omni directional radiation and low cost. [3]. While designing UWB antenna one of the key issue is the compact size to provide wide bandwidth. To improve the impedance bandwidth monopole antennas are used. To get the frequency band notch function, several antennas have been reported [4].

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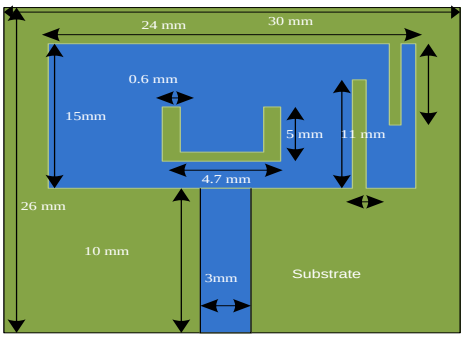
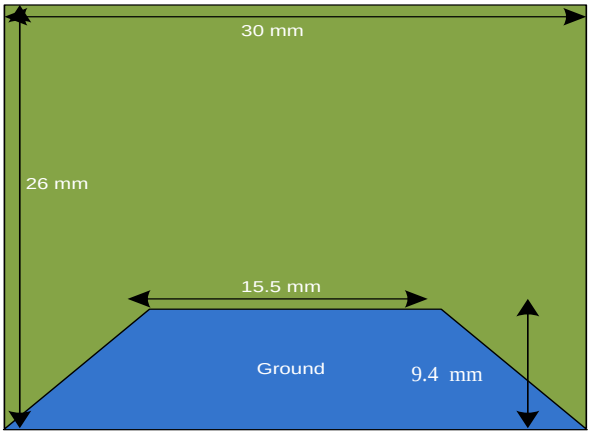
Dual notched bands are achieved by a pair of U-shaped stubs near the feed line and T-shaped stub on the patch. The space among the radiating patch and bottom plane are used to improve impedance matching and impedance BW [6].To achieve the notched band by U-shaped stub length and due to U and T-shaped cuts in the Radiating patch. And trapezoidal slot in the Ground plane are used to achieve dual notch bands [3]. Existing wireless communication networks Bluetooth, WLAN,WiMax and ITU bands are achieved by placing the elliptical slot ,T and L-shaped slots on the radiating patch to improve the impedance bandwidth depends on the stubs length is equal to the half wavelength and slots on the radiating patch [7]. To achieve three notched

Bands from the compact printed micro strip feed line UWB monopole antenna semicircular and slots etched on the top layer patch [8]. Dual notch band characteristic and wide bandwidth are achieved by placing inverted fork-formed slots in the ground plane [4]. Extra and dual bands are achieved by inserting L-shaped stubs in the ground plane and slots near to the feed line. The UWB slot antenna provides an impedance matching between patch and feed line [9]. Compact antenna achieved a double band notch characteristics using inverted U shaped slot cut on the ground plane [5]. Dual notched band characteristics are attained by placing an annular ring and patch with Q-slot to obtain rejection band [10]. A triple band notch achieved by SRR slot on an elliptical patch for WBAN [2]. Polygonal shaped patch with multiple inverted L-shaped stubs are used to get ultra wideband bandwidth by a miniaturized coplanar waveguide feed monopole antenna [1]. In this paper, proposed integrated triple notched band compact UWB antenna is analyzed by embedding U slot, a pair of Rectangular slots and Ground with defective ground structure.

II. ANTENNA DESIGN



a) Top View



Bottom view

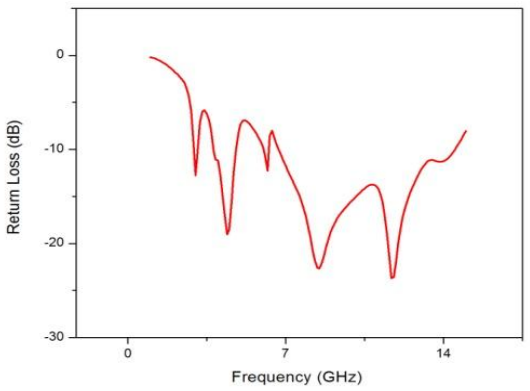
Fig.1. the proposed UWB Antenna

The projected integrated triple notch bands UWB Antenna structure is consisting of substrate area of 26 ×30 mm^2 with a thickness of 1.6 mm. The current distribution on the patch with U and a pair of rectangular slots will have an effect on the performance of the compact UWB proposed antenna. The proposed antenna it seems to be a dipole antenna because patch on the substrate and partial defective structure on the ground. And also provides good impedance matching over entire UWB frequency band.

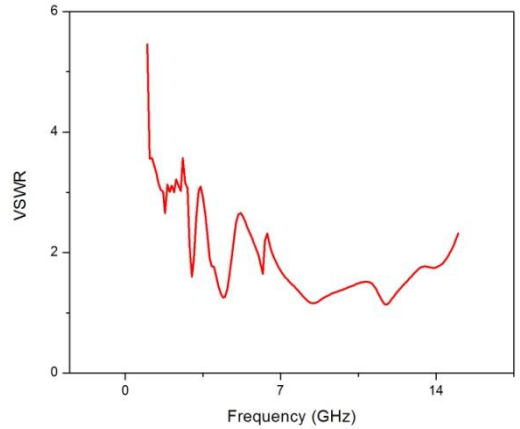
Figure.1 explains the construction of the proposed integrated triple band notches compact UWB antenna top view consists of rectangular patch with slots and bottom view consists of partial defective ground structure. To provide the good impedance bandwidth between patch and feed line width is chosen as 3 mm. Three quarter wavelength of the slots will cover the rejected bands are WiMax, X and WLAN. And defective structure and dimensions of the radiating patch are used to provide high impedance bandwidth. Existing communication networks such as WLAN, WiMax and X bands are rejected from the Ultra wideband antenna, we incorporated rectangular slots and U slot on the patch and DGS. All simulations are done with Ansoft High frequency structured simulator.

III. RESULTS

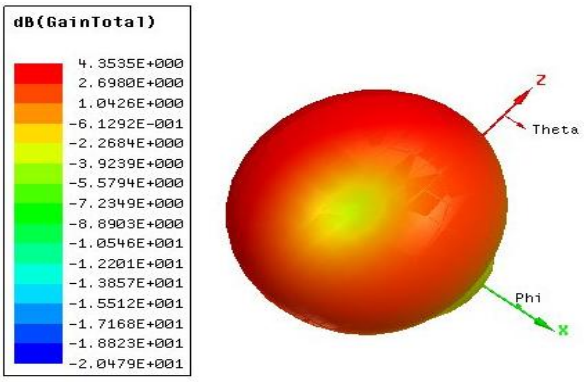
The proposed UWB integrated triple notched band compact antenna structure is simulated with High frequency structure simulator. To achieve triple notched bands from the UWB antenna, it consists of a U slot and pair of rectangular slots is etched on the radiating patch. And antenna produced band notches with center frequencies at 3.5 GHz, 5.5GHz along with 6 GHz. In the proposed antenna by adding these slots and DGS antenna covering the band of frequency commencing 2.9- 14.5 GHz impedance BW of 11.6 GHz. And also provides triple notched band from 3.1-3.8 GHz, 4.8- 5.825 GHz as well as 6.5-7.65 GHz respectively.Fig.2 shows the proposed integrated triple Notched band compact UWB antenna simulated results.



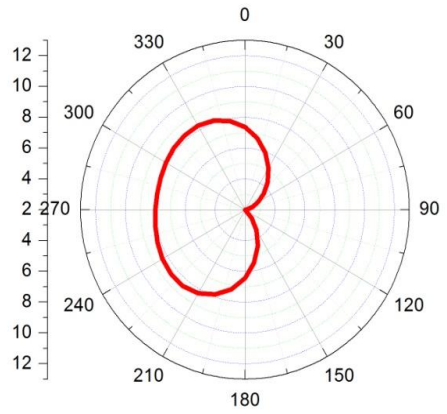
a) Return loss



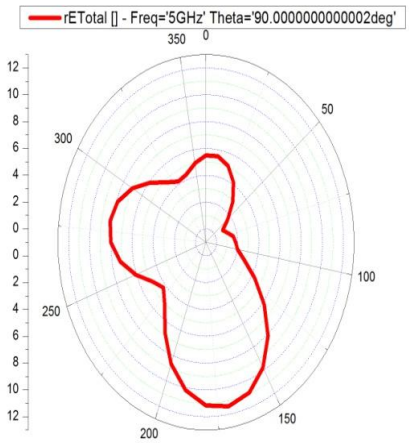
b) Voltage Standing wave Ratio



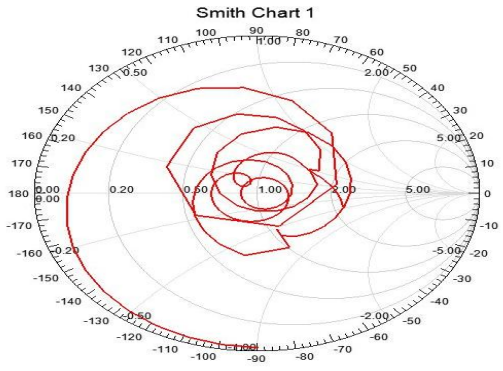
c) Gain in dB



a) E-Plane



b) H- Plane



c) Smith chart

Figure .2. Simulation results of the Proposed UWB antenna

Table 1: Comparison between Proposed Integrated triple notches band compact UWB Antenna with Existing Designs

Design	Size (mm^3)	Operating Band (GHz)	Band Notch1 (GHz)	Band Notch2 (GHz)	Band Notch3 (GHz)
[1]	21 × 14×0.8	3–12	3.2–3.65	5–5.62	7.85–8.45
[2]	12 × 19 ×1.6	2.9–12	3.3–3.8	5.1–5.82	7.25–7.75
[3]	26×27.3× 0.8	3-11	3.3-3.7	5.15-5.82	-
[4]	12× 18× 0.8	3.02-13.86	3.38-4.31	5.1-5.95	-
[5]	20 ×27 × 1	2.89 -11.52	3.4-3.69	5.15-5.82	-
[6]	30 × 35 × 0.8	2.8 - 11.0	3.3-4.0	5.05–5.90	-
[8]	25× 29 × 0.8	3.1-10.6	3.3-3.7	5.15-5.82	7.25-7.75
[9]	23 ×28 × 0.8	3.1-10.6	At 3.5	At 5.8	-
[10]	24 × 28 × 1.6	2.91–11.4	3.3–3.73	5.2–5.98	-
Proposed Antenna	30 × 26× 1.6	2.9–14.5	3.1–3.8	4.8–6	6.5-7.5

From Table 1 show that the proposed triple notched band antenna is compact structure, due to the Defective Ground structure and impedance matching between Rectangular patch and feeding line. The proposed Integrated triple notched band compact UWB antenna exhibits a wide impedance bandwidth from 2.9 – 14.5 GHz.

From Fig.2c, Integrated Triple notched band UWB antenna has a gain of 4.35dB depends on the Rectangular patch and microstrip feedline.

IV. CONCLUSION

The proposed compact UWB antenna with integrated notched band exhibits Triple notch band characteristics and removes interference from existing wireless communication networks WiMax, WLAN and X band. Triple band notches are attained by cutting U slot and pair of rectangular slots on the Rectangular radiating patch with partial DGS. From the return loss simulated results of the proposed antenna impedance bandwidth covers from 2.9-14.5 GHz, with the return losses near WiMax, WLAN and X Band only -4.5 dB, -5.3 dB and -5.6 dB respectively and also provides gain of 4.35dB. Integrated triple notch band compact UWB antenna is suitable for UWB Applications.

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