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Compact UWB Slot Antenna with Dual Band Rejection by using H-Shape Notch

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Abstract: *The main objective is to design a dual band rejection micro strip patch antenna. In this antenna, H- shaped slots are made in the patch to achieve a notched characteristics at two licensed band employed for Wimax and WLAN band. The above mentioned frequency ranges are licensed for WLAN and satellite communication applications. This antenna maintains the Omni-directional radiation patterns and are mostly suited for ultra wide band applications. For wide band operation, the shape of patch has been altered to octagonal just by chamfering the corners of the rectangular patch. The antenna parameters like radiation patterns, VSWR, reflection loss have been described clearly in this section. Radar applications, terrestrial networking and communication, space communications are some of the applications in this ultra wide band frequency range.*

Keywords*: Ultra-wideband antennas, notches band, micro strip antennas.*

I. INRODUCTION

Now a days, ultra-wide band technology has become an emerging topics. The UWB micro strip antennas have become extremely common because of their simple and compact structure, and low cost properties. The Ultra-wide band comprises a frequency range of 3.1 to 10.6 GHZ within which some restricted bands of frequency exists. These reserved frequency bands should not be accessed unless it is licensed by the user. When commercial products are introduced in the market it needs to satisfy certain standards, which includes the restricted use of licensed band to tackle this problem, many antennas with band notch characteristics have been presented. This work presents one of the antenna featuring notched band characteristics at two different frequency bands. This antenna also maintains the Omni-directional radiation patterns with admissible gain and less changes in group delay. This antenna can be a good candidate for UWB applications. Antenna simulations are realized using CST high frequency. The entire dimension of the antenna fills small space. The antenna shape is designed to improve the overall performance and the dimensional efficiency.

II. **LITERATURE REVIEW**

1.'A small wideband micro strip-fed monopole antenna 'Jung, J. W. Choi, and J. Choi.

This paper describes about a novel compact micro strip-fed monopole antenna has been proposed and implemented for ultra-wideband application. The proposed antenna has a simple configuration and is easy to fabricate. To obtain the wide bandwidth, the sizes of notches at the two lower corners of the patch and notch on the truncated ground plane have been optimized by parametric analysis. The designed antenna satisfies the 10 dB return loss requirement from 3.1 to 11 GHz and provides good monopole-like radiation patterns. Experimental results show that the proposed antenna could be a good candidate for hand-held UWB application.

2.'Compact UWB chip antenna design using the coupling Concept' J. N. Lee and J. K. Park.

This paper describes about a compact UWB chip antenna using the coupling concept has been proposed for UWB systems. By using the inclined slot on the rectangular radiating patch, the bandwidth of the proposed antenna has been improved. A parametric investigations of the different azimuth angle and the inclined slot width have also been presented. The measured path loss is almost constant across the frequency band and the group delay variation is less than 2 ns. Good radiation characteristics of quasi-isotropic pattern and gain were obtained over the UWB frequency band, thus indicating that the UWB antenna is suitable for the UWB communication applications.

3. 'Small Printed Ultra-wideband Antenna with Reduced Ground Plane' Z. N. Chen, T.S.P. See, and X. Qing.

This paper describes about a small printed antenna is described with a reduced ground-plane effect for ultra-wideband (UWB) applications. The radiator and ground plane of the antenna are etched onto a piece of printed circuit board (PCB) with an overall size of 25mmtimes25 mmtimes1.5 mm. A notch is cut from the radiator while a strip is asymmetrically attached to the radiator. The simulation and measurement show that the miniaturized antenna achieves a broad operating bandwidth of 2.9-11.6 GHz for a 10-dB return loss. In particular, the ground-plane effect on impedance performance is greatly reduced by cutting the notch from the radiator because the electric currents on the ground plane are significantly suppressed at the lower edge operating frequencies. The antenna features three-dimensional Omni-directional radiation with high radiation efficiency of 79%-95% across the UWB bandwidth. In addition, a parametric study of the geometric and electric parameters of the proposed antenna will be able to provide antenna engineers with more design information.

4.'A Compact Micro strip Slot Triple-Band Antenna for WLAN/WiMAX Applications' Lin Dang ,Zhen Ya Lei, Yong Jun Xie.

This paper describes about a compact triple-band micro strip slot antenna applied to WLAN/WiMAX applications is proposed in this letter. This antenna has a simpler structure than other antennas designed for realizing triple-band characteristics. It is just composed of a micro strip feed line, a substrate, and a ground plane on which some simple slots are etched. Then, to prove the validation of the design, a prototype is fabricated and measured. The experimental data show that the antenna can provide three impedance bandwidths of 600 MHz centered at 2.7 GHz, 430 MHz centered at 3.5 GHz, and 1300 MHz centered at 5.6 GHz.

5. ‘A Micro strip-fed Ultra-Wideband Antenna with Dual Band- Notch Characteristics’ Negin Manshouri, Ayhan Yazgan, Masoud Maleki.

This paper describes about a micro strip-fed ultra-wideband (UWB) antenna with a simple architecture that operates at a frequency range of 3.1-11 GHz is presented. Due to compact and low profile, this type of antenna has an important role in growing applications of commercial and industry. Acceptable return loss level, good radiation pattern characteristics and relatively good gain flatness have been reported according to the measurements and simulated antenna results. The prototype micro strip antenna is fabricated onto an inexpensive FR4 substrate. By embedding a C-slot or split ring resonator (SRR) on the patch, a stop band between 4.8-5.9 GHz where the WLAN standard communication band exists, is obtained. An M-shaped slot or complementary split-ring resonator (CSRR) to achieve another notch at 7.5-8.5 GHz where C-band satellite communication system occupies, is embedded. In this paper, the circular slot is fed by 50 Ω micro strip line. The antenna is simulated using HFSS 13 and CST high frequency simulators.

6. N.ġMohammadian, M.N.ġAzarmanesh, and S.ġSoltani, “Compact Ultra-wideband Slot Antenna Fed by Coplanar Waveguide and Microstrip Line with Triple-band-notched Frequency Function,” *I*ET Microwaves, Antennas and Propagation.

This paper describes about a compact UWB slot antenna fed by CPW and microstrip line with triple-band-rejection characteristics is presented and discussed. A new triple-band-rejection structure using an inverted U-slot is presented. By transforming the CPW feed to microstrip, the bandwidth and radiation characteristics are preserved. The proposed methodology allows designers to choose either of the two most frequently practical feeding networks, and therefore adapt the radiator to any emerging system requirement.

III. ANTENNA DESIGN AND ANTENNA CONFIGURAION

The geometry and configuration of the prototype micro strip antenna is given. The suggested antenna is fabricated on the FR4 substrate with dimensions of 36 mm × 30 mm, thickness of 1.6 mm, and relative permittivity of 4.4. A 50Ω microstrip feed line was designed as 3 mm in width. An octagonal radiating patch was fabricated for satisfying UWB operation and an H-shaped slot was embedded on the structure for achieving dual band-rejected functions.

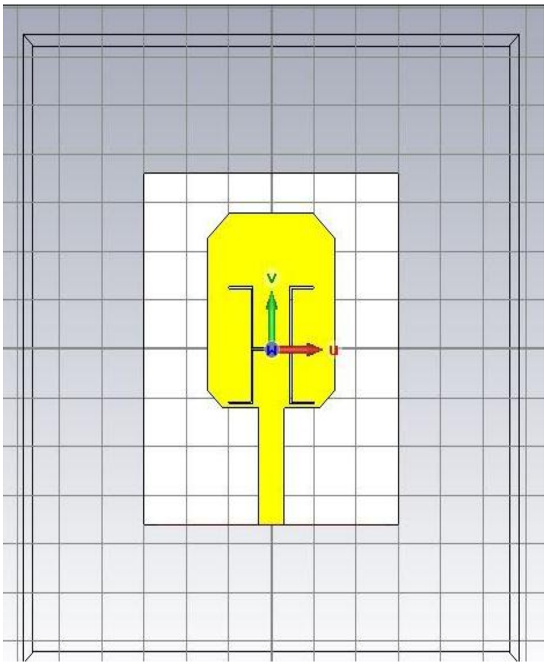

Fig. 1. Geometry of the proposed ultra-wideband antenna with H-shaped slot

1. Good impedance matching can be obtained via tuning the gap between the radiating patch and the ground plane.

2. The reference antenna shows a VSWR ≦ 2 frequency range from 2.88-10.61 GHz, which consists with the UWB (3.1-10.6 GHz) operation.

3. The proposed antenna exhibits two abrupt peaks within VSWR > 2 frequency range from 3.23-4.29 and 5.02-6.11 GHz, respectively.

4. This property reveals the dual band-rejected functions for WiMAX/C-band (3.3-4.2 GHz) and WLAN (5.15-5.825 GHz) bands.

IV. PERFORMANCE ANALYSIS

From the graph it is observed that the frequency range with VSWR less than 2 are usable and the region which has a VSWR value greater than 2 cannot be used. The usable frequency range incorporates different bands leaving the licensed bands. The total band covers from 3 GHz to 10.6 GHz. In this range, the usable range includes three sets of frequency bands. First band is from 3 GHz to 3.4 GHz, the second band is from 4.2 GHz to 5.2 GHz and the third band covers from 5.9 GHz to 10.6 GHz allowing the antenna to work in ultra-wide band frequency range. The neglected bands are from 3.4 GHz to 4.2 GHz which is used for WIMAX and another band from 5.2 GHz to 5.9 GHz which is used for WLAN. Basically for a frequency to be used for communication its VSWR value should be less than two and the frequencies with VSWR greater than two are not acceptable for communication purpose. This antenna has been designed to work in the above mentioned range neglecting their responses at two licensed bands.

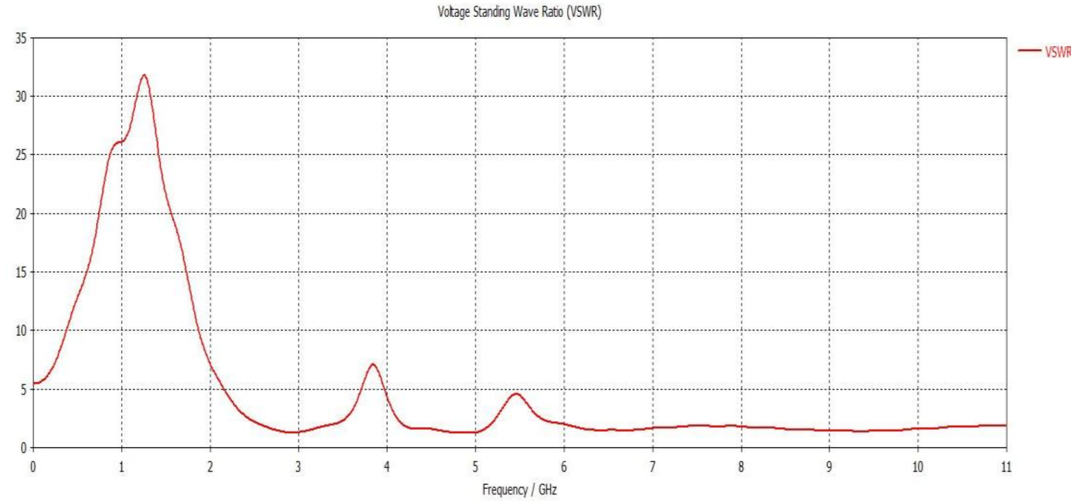

Fig. 2. Simulated VSWR for different values of frequency

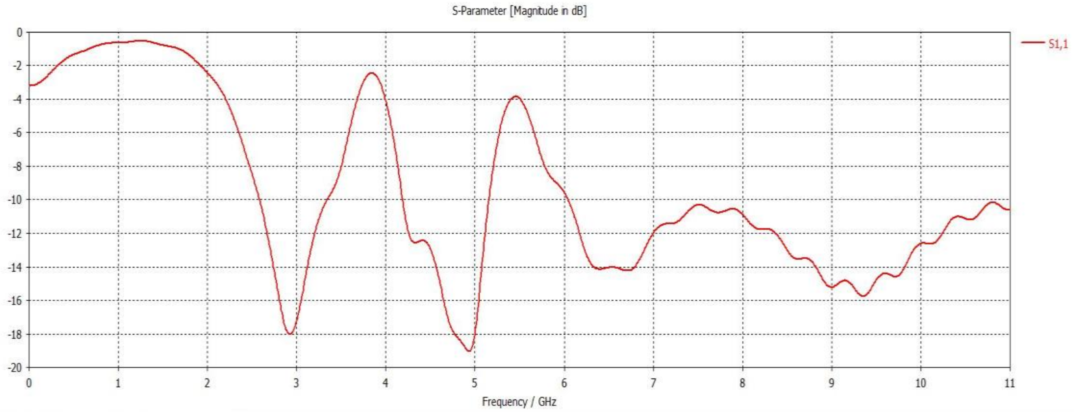

Fig. 3. Simulated and measured VSWR characteristic of the proposed antenna

1. The graphs represents the radiation pattern for the above designed antenna at various frequency ranges.
2. From the graph it is clear that the gain and directivity parameters haven't been achieved as much required.
3. But the response to get two notched characteristics at the two licensed bands has been achieved perfectly.
4. The gain and directivity should be little higher than the achieved one.
5. The optimized value to be achieved should at least be equal to 5.7dbi for good radiation of EM waves.
6. Further, researches can be carried out in order to improve the gain and directivity parameters for good results.
7. Comparative analysis can be made to study the improvement achieved from the basic designs and its corresponding results should be represented for better understanding.

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8. In the field of antenna design the term radiation pattern refers to the directional dependence of the strength of the radio waves from the antenna or the other source.
9. Simulated VSWR for different values of frequency also drawn.
10. Simulated and measured VSWR characteristic of the proposed antenna also obtained

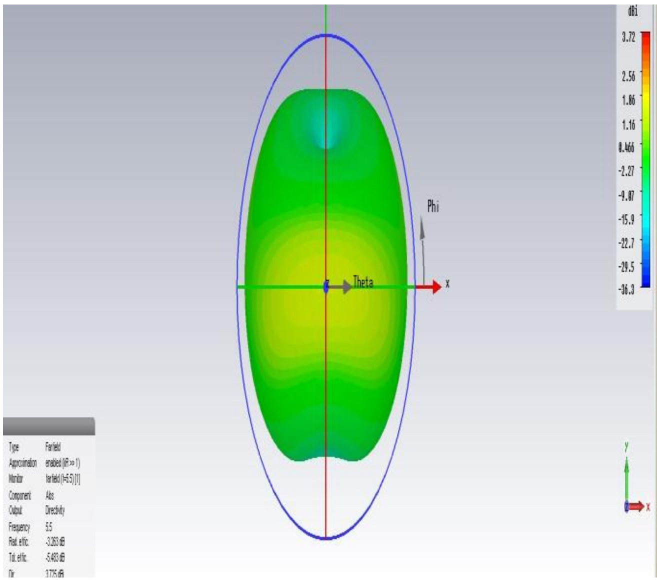

Fig. 4. Measured radiation patterns at 5.5 GHz on the E and H planes.

Type is far field, approximation is enabled, monitor is also far field, component is Abs, Actually we aimed for directivity and frequency but it not gives acquire values. Radiated efficiency is -0.6539 dB, total efficiency is -7.9536 dB.

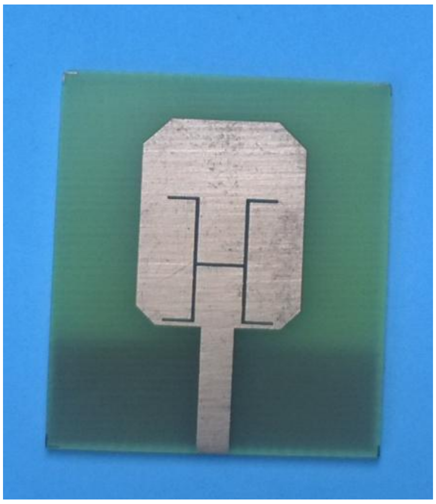

Fig.4. Front View

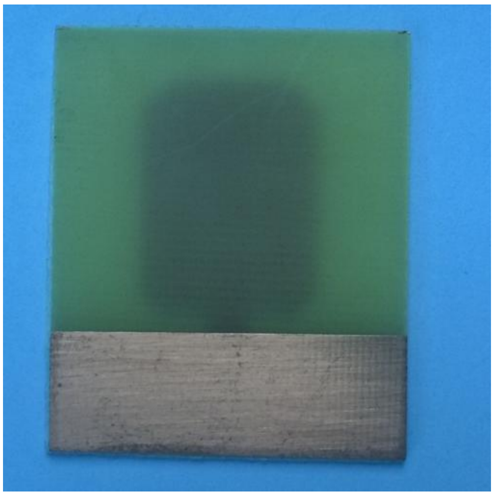

Fig.5. Back View

V. CONCLUSION

In this paper, we have designed and constructed a dual band rejection antenna that demonstrates dual band-notched characteristic at the center frequency of 5 GHz and 6 GHz in the desired UWB band. The planar antenna includes a rectangle shape patch, and a dual-band resonator to make a good notch at 8 GHz of WLAN band, and 9 GHz of X band communications. The proposed antenna exhibits that the experimental results have good agreement with the simulated results. This antenna also maintains the Omni-directional radiation patterns with admissible gain and less changes in group delay. This antenna can be a good candidate for UWB applications.

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