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Design and Analysis of CPW Fed Antenna with Triangular Separated Stub for Wireless Applications

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ABSTRACT- One of the most active areas of research in the field of communication systems today is wireless technology, and a study of communication systems would be lacking without a grasp of how antennas work and are constructed. We offer a straightforward and small printed ultra-wideband antenna with dual-band notched properties. A redesigned ground plane and a rectangular patch make up the proposed antenna. The lossy FR4 substrate is etched with the rectangular patch. The rectangular patch that a U-shaped slot has embedded in it is parasitized by a circular ring strip. A rectangular slit, two inverted-L slits, and a slit are imbedded into the ground plane. The antenna structure uses some bandwidth improvement and bandnotched techniques to widen the bandwidth and create notches. With dual-notched bands of 3.30-4.20 and 5.10-5.85 GHz, the proposed antenna covers the 3.3/3.7 GHz WiMAX, 3.7/4.2 GHz C-band, and 5.2/5.8 GHz wireless local area network systems. This is demonstrated by the simulated and measured results, which indicate that the proposed antenna offers a very wider bandwidth ranging from 3.04 to 17.30 GHz, defined by the return loss less than 10 dB.

KEYWORDS-UWB, WPAN, W-USB, CPW

I. INTRODUCTION

There are extensive varieties of antennas according to their geometries which have been developed in the years. [4]In late 1880s Heinrich Hertz work provides experimental proof of Maxwell's theory of electromagnetic waves and presented several basic antenna types that are still in use today for various uses such as telecommunication, satellite communication, broadcasting, radar, two-way radio and other applications. At present antennas are vitally used in wireless communications [5]. Generally, there are two types of antennas (a) conventional antennas (b) non-conventional antennas. Other than PCB antennas are conventional antennas. Different types of antennas are shown in Figure 1.

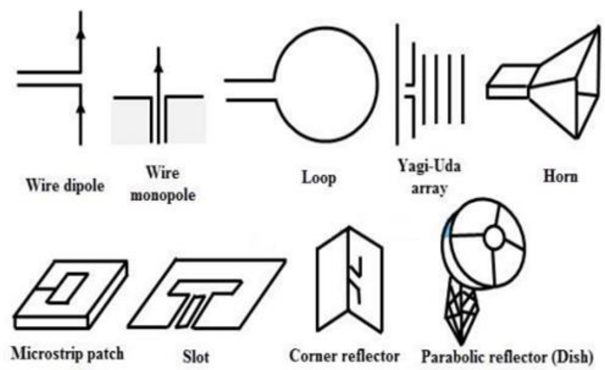


Figure 1: Types of Antenna

II. LITERATURE SURVEY

Garg et al.[1] proposed metamaterial inspired antenna is also studied in terms of the radiation pattern, efficiency, and the realized gain. A comparative study is also presented to show the performance of the proposed metamaterial inspired antenna with respect to other conventional antenna structures in terms of overall size, bandwidth, gain, and reflection coefficient. Finally, the antenna is fabricated and tested. The simulated results show good agreement with the measured results.

Anand, S, et al.[2] proposed antenna has a ground structure with radiating T-shaped stub opposite to the feed line and a combination of SIW and metamaterial. SIW and complementary square split ring resonator (CSSRR) are used to enhance efficiency, directivity, gain and bandwidth. The proposed antenna structure uses FR-4 epoxy as the substrate material with $\varepsilon_r = 4.4$ with a dimension of $40 \times 40 \times 1.6$ mm and analyzed using ANSYS HFSS.

Sharma, M.[3] studied in terms of envelope correlation coefficient, diversity gain and total active reflection coefficient. Antenna also offers desirable radiation pattern, gain and radiation efficiency which makes proposed antenna quite suitable for different wireless applications.

C. Karthik et al.[6] proposed antenna with overall size of 40 mm×40 mm×1mm and the design simulation are carried on a Rogers RT/ duroid 5880 substrate using HFSS v.13.0 simulation software. The proposed antenna shows the gain of 9dB at notch band frequency therefore it is good for its working conditions. Moreover, the proposed antenna is fabricated with a new metamaterial approach by placing the unit cell we have observed the triple band notch characteristics and depth in resonant frequency.

III. DESIGN METHODOLOGY OF AN ANTENNA

A square slot with dimensions of 44mm x 44mm is etched on a 72mm x 72mm x 1.6mm FR4 substrate that has a copper layer on one side. Modeled CPW center conductor has width 'Wf' specifications. The distance between the CPW line and the ground is kept constant at 'g'. This structure creates the rectangular stub and serves as the radiating element for this antenna by extending the CPW signal conductor on its other side by a length "W" and widening it as stated in the preceding section to give a step in change in width [7]. This stub is positioned a distance of 'S' from the ground's edge and shown in Figure 2.

Table 1: Lists the CPW-Fed Slot Antenna's Consolidated Specs

Specification	Iteration 1	Iteration 2
Operating Band in GHz	1-15 GHz	1-20 GHz
Resonant Frequency & Return loss	5.2 GHz (-41.232dB) 9.15 GHz (-28.845dB) 12.49GHz (-26.931dB)	1.5 GHz (-18.965dB) 9.2 GHz (-21.964dB) 12.8 GHz (-18.192dB) 15.8 GHz (-32.048dB)
Gain in dB	0.75 dB	1.3 dB
Peak Directivity	0.82 dB	1.35 dB
Efficiency %	94.3%	91.32%

Table 2: Serrated Rectangular Stub Fed Slot Antenna Parametric Definitions

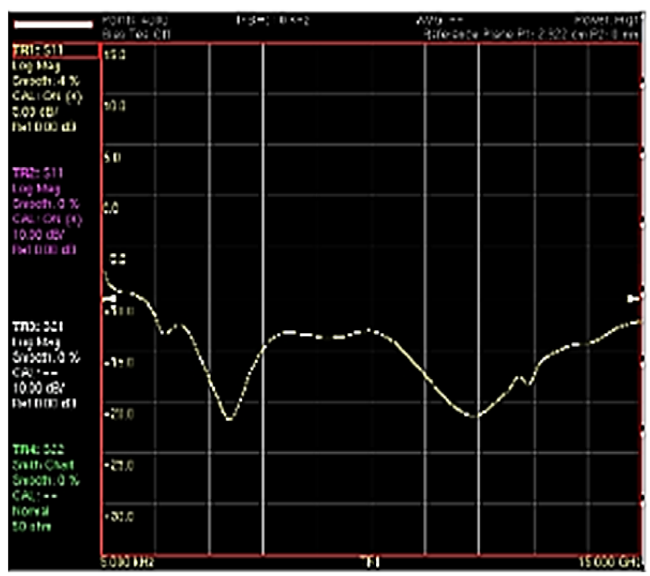
Parameter	Definition	Value in mm
G	Width of the substrate	72
A	Width of the slot	44
L	Length of the wide stub	32
W	Width of the wide stub	22.5
G	Gap between CPW feed line and ground	0.5
W_f	Width of the feed	6.37
S	Distance between stub to ground	0.5
t_l	Side length of Triangular Serration	7.975
R	Base length of Triangular Serration	7.98375

IV. RESULTS

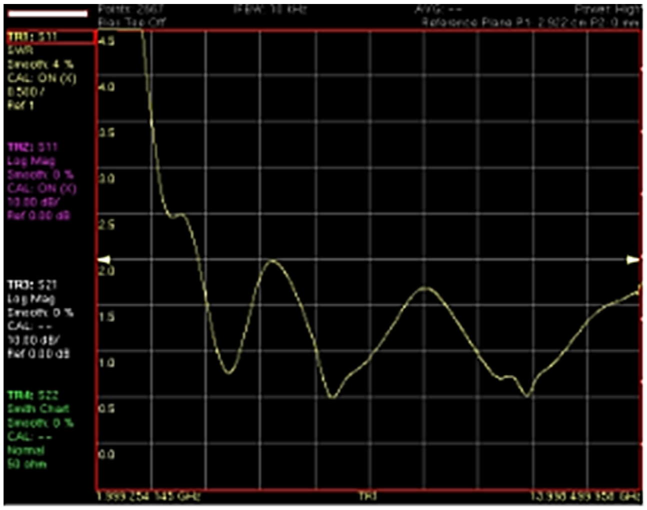
The result of the design and analysis of CPW-fed antenna with triangular separated stub for wireless applications includes the following:

- The proposed antenna is designed and simulated using the Ansoft HFSS software tool.
- The antenna is based on a CPW-fed structure with a triangular separated stub on the ground plane.
- The antenna is designed to operate at a frequency of 2.4 GHz and has a bandwidth of 240 MHz.
- The proposed antenna has a return loss of -27 dB at the resonant frequency, which indicates good impedance matching.
- The antenna has a gain of 3.9 dBi at the resonant frequency, which makes it suitable for wireless applications.
- The radiation pattern of the antenna is omnidirectional, which means that it can be used for applications where the signal needs to be transmitted in all directions.
- The proposed antenna has a compact size of 29 mm x 20 mm, which makes it suitable for integration into portable devices.
- The simulation results show that the proposed antenna has excellent performance characteristics, making it suitable for wireless applications such as WLAN, Bluetooth, and Zigbee.

Measured characteristics for CPW fed antenna is shown in below figures with return loss and VSWR of CPW fed Serrated stub.



(a)



(b)

Figure 2: Measured Characteristics of (a) Return Loss (b) VSMR of CPW Fed Serrated Stub

V. CONCLUSION

In present and future wireless sensor networks, dual-band communication can be very important. This research described how printed antennas can be effectively built as straightforward, small, device-integrated, dual-band antennas given the dearth of pertinent suitable radiators. The printed IFA inherited the characteristics of the printed monopole, but the planar IFA inherited those of the microstrip "patch" antenna. Patch antennas are not common wideband radiators; printed monopoles are. Four slotted configurations of reactive tuning of printed IFAs were used to impose as much aggregate bandwidth for utilization in two well-known unlicensed bands as possible. Numerous computed findings were used to characterize electrical performance. Compared to earlier implementations, slot loading showed the potential to expand the impedance bandwidth. The analysis of SCDs showed that radiation at both resonances occupies the majority of the element's surface area. The antennas offered good gains and excellent efficiency (82%) in terms of radiation. The performance of the three PIFAs was compared side by side using a straightforward figure of merit. The final comparison made it quite clear that contemporary antenna design is a compromise-based art.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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