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Periwinkle Shaped Patch Antenna for UWB Applications

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Abstract- This paper introduces a monopole antenna with radiating patch antenna in the form of periwinkle flowers. This antenna covers the 3.1 to 10.6 GHz frequency range of the UWB working band. Due to the arrangement of the flower's leaves and the partial ground's slots, several notches are produced. The suggested antenna has a modest profile and is 14X14 mm^2. The substrates for this design are Fr-4 and Jeans. It has a reflection coefficient below -10 dB and covers the UWB spectrum. CST Microwave Studio is used to create and simulate the periwinkle flower antenna. It produces good gain (5dBi), VSWR, and impedance bandwidth (80% efficiency). Fractal flower pattern also studied to get the multiple band operation. The wireless applications are the major emphasis of the suggested antenna.

Keywords: Patch Antenna, Periwinkle, UWB ,Wireless.

Introduction

Ultra-wideband (UWB) technology is a very appealing and promising breakthrough in today's wireless communication networks because of its large bandwidth and data rate. Since the Federal Communications Commission (FCC) approved the use of 3.1–10.6 GHz for unlicensed purposes in 2002 [1], UWB technology has grown stronger. At distances between 1 and 10 metres, UWB technology can achieve a maximum data rate of up to Gbps. For instance, Bluetooth technology is capable of transmitting data at a maximum rate of 1 Mbps over a distance of up to 10 metres. The maximum data rate for GSM technology is also 100 Kbps over distances of at least 10 km.

Planar antennas are a great fit for portable devices in wireless communication networks. Utilizing various antenna configurations, they attain UWB performance [2-29]. For UWB applications, an unique parasitic-tuning stub-equipped U-shaped microstrip-patch antenna [2] with dimensions of 24 mm 28 mm 0.787 mm is suggested. With a bandwidth of 2.76 GHz to 12.8 GHz, it reaches its highest peak-gain of 5.3 dBi at 10.2 GHz. A 25 mm 25 mm 1.6 mm small UWB microstrip antenna with CPW feeding is suggested [3]. The references [2-29] show a number of well-performing planar conventional type UWB antennas. While UWB antennas are made to work without deteriorating in any other ways, compactness is a difficult issue. A UWB antenna's small size and reliable UWB present design issues.

Proposed Antenna Design

The proposed compact monopole antenna's design, which combines circular patches and slots, is covered in this section. This antenna has the

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following measurements: 14 mm x 14 mm x 1.6 mm. The structure is depicted in Fig. 1's top view as a periwinkle flower with a leaf patch made up of five erratically shaped petals. In the centre of the flower is a small circle encircled by a series of asymmetrical ovals. The feed is given an H-shaped slot. Additionally, the design of the structure makes use of the notion of a partial ground. To increase the bandwidth, plus sign spaces are put in the partial ground. SRR is built into the substrate's ground area to achieve a reflection coefficient of less than 10 dB. The optimized dimensions are listed in table1.

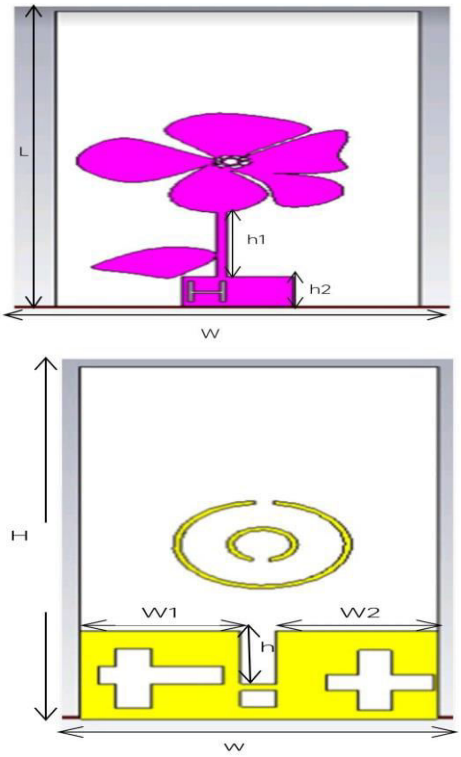

Fig1. Top and bottom views of the antenna

Variables	Sizes(mm)
L	14
W	14
h_1	4
h_2	3.7
H	14
w	14
W_1	6.3
W_2	6.3
h	3.8

Table I. Optimized Dimensions of the periwinkle antenna

Antenna design and simulation using various substrates is done using CST software. To observe the UWB antenna's reflection coefficient characteristics, CST additionally used fractal periwinkle flower shapes. According to Fig. 2, five flowers are created with one petal blending with another.

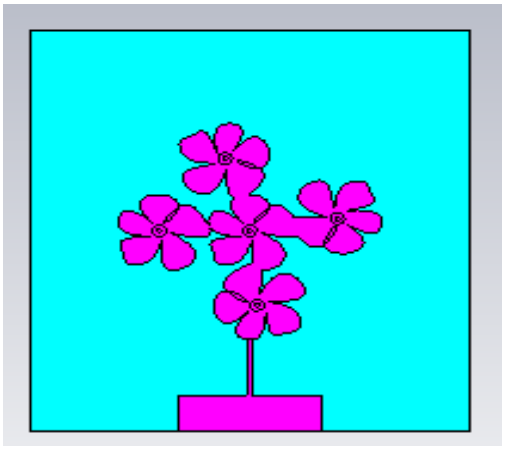

Fig.2. Fractal Periwinkle antenna

Simulation Results and Discussion

Single periwinkle antenna is designed with fr-4 & jeans substrates and simulated using CST software. The S11 parameters of the antenna with two substrates are shown in fig.3. Figure 4 displays the intended antennas' VSWR values, and the value is within acceptable ranges.

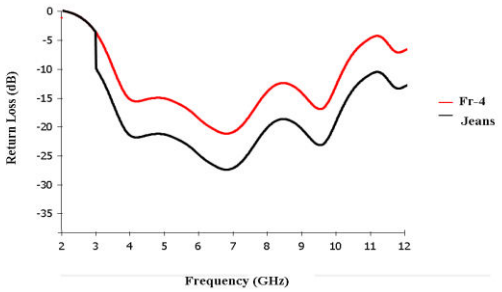

Fig.3. S11 results of the periwinkle antenna

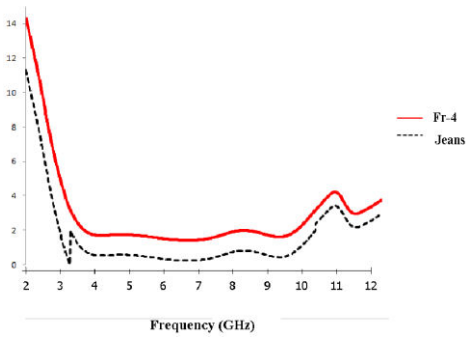

Fig.4. VSWR results of the periwinkle antenna

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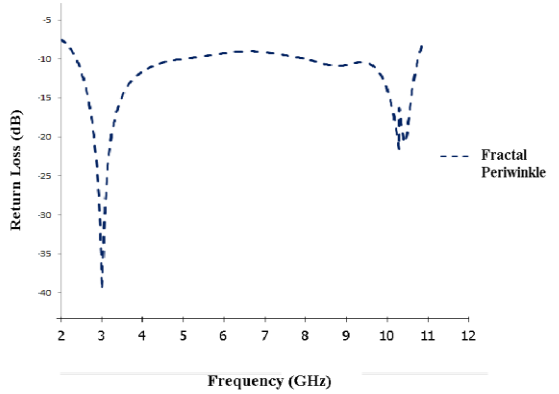

Fig.5. S11 results of the fractal periwinkle antenna

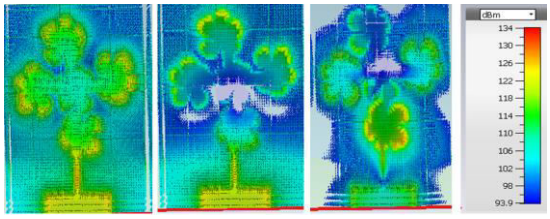

Fig.6. Current density of the fractal periwinkle antenna

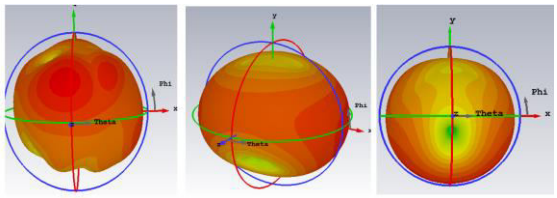

Fig.7. Radiation patterns of periwinkle antennas

The reflection coefficient parameters of the fractal antenna are shown in fig.5. The current density of the antenna at resonant frequencies is shown in figure 6 and radiation pattern of the antenna is presented in figure7. Table II gives other parameter comparison of three models. From table II fractal antenna provides better gain and directivity compare to remaining structures.

Table II. Comparison of various parameters of proposed antennas

Structure	Impedance Bandwidth	Gain	Directiv	Efficiency
Fr4 substra	3.2-10.1	3.95	6.03	67%
Jeans subs	3-10.2	4.50	6.93	75%
Fractal with	2.4-10.6	5.01	7.76	80%

Conclusion

In this paper a periwinkle flower shaped antenna for UWB applications was presented. Two substrates are used to design antenna and two are compared. Fractal antenna with five flowers also designed, simulated and corresponding results are tabulated. The created periwinkle flower-shaped antenna satisfies all necessary standards for Return Loss, Radiation Patterns, and VSWR, as well as the versatility and multitasking needs.

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