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Numerical Analysis of S-Shaped Micro-Strip Patch Antenna Using FDTD

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ABSTRACT

Characteristics of a double sheet that utilizes dual frequency of S-Shaped micro-strip patch antenna FDTD techniques are conveniently used to attain acceptable impedance, depending on the design parameters and technical analysis. Using FDTD techniques, the dielectric constant and substrate height for different antenna parameters were tested. The FDTD approach is used to evaluate the recommended structure on the basis of a differentiation between numerical and experimental testing. The FDTD allows it possible to research and construct the suggested three-dimensional microstrip antenna, and to evaluate related parameters such as gain, VSWR and radiation pattern.
Keywords : Numerical Analysis, S-Shaped, VSWR, Gain and Radiation

1. Introduction

Advanced development of micro-strip patch antennas is used today application such as cellular and portable networking segment for low profile antennas. The antenna is known to provide high efficiency of numerous systems, such as small size, low weight, low cost, better capacity, easier to make [1]-[5]. The ground plane stub is etched instead of the radiating patch on one side of the substrate used and on the other side of the structure, the micro-strip antennas are referred to as patch composites [6]-[9]. The antenna is used for a variety of applications, such as wireless, WSN, MANET, Bluetooth, LTE, radar, satellite and mobile communication. With the micro-strip patch antennas, there are many advantages to optimizing efficacy and low strength. The antennas are usually used with rectangular and circular patches in various configurations, such as C, T, E, H, L, S, U and T shaped [10]-[13].

The major drawback of the antennas is narrow-bandwidth micro-strip. These shortcomings of microstrip antennas have been overcome by the majority of researchers. Using a dielectric constant, the length and width of the proposed system, mostly intended for micro-strip antennas, was measured. The parasite components are used in the context of procedures, from one substrate to another. Different structures in the micro-strip antennas are required to increase the bandwidth [14],

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[15]. The radiating patch is immediately fed to the conducting device. The control between the micro-strip line and the radiating patch is transferred to non-conductive matter.

2. Design of S-Shaped Micro-strip Antenna

Usually Maxwell equation of FDTD system can be calculated. Typically the micro-strip patch is to measure the length and width of the slot by the formula below.

$$W = \frac{V_O}{2 f_r}\sqrt{\frac{2}{\varepsilon_r + 1}} \text{------ (1)}$$

$$\varepsilon_{reff} = \frac{\varepsilon_{r+1}}{2} + \frac{\varepsilon_{r-1}}{2}[1+12\frac{h}{w}]^{-1/2} \text{----------- (2)}$$

$$\Delta L = 0.412h\frac{(\varepsilon_{reff}+0.3)\left(\frac{w}{h}+0.264\right)}{(\varepsilon_{reff}-0.258)\left(\frac{w}{h}+0.8\right)} \text{----------- (3)}$$

$$L = \frac{V_o}{2 f_r\sqrt{\varepsilon_{reff}}} - 2\Delta L \text{------------- (4)}$$

Here W is the width of the patch

vo is the speed of light in a vacuum

Ɛr is the dielectric constant of the substrate

fr is the resonant frequency

Ɛeff is the effective dielectric constant

ΔL is the extension in length

H is the thickness of the substrate

L is the length of the patch

70*45*1.6mm is the dimension of the model antenna for this paper. The proposed ground plane antenna for separate slots is S-shaped for a greater coefficient of reflection. To control the resonant frequencies from 2.5GHz to 5.5GHz with a dielectric constant of 4.2, the suggested antenna design is used. With a thickness of 1.6 mm, the FR4 substrate is used for the recommended framework. The Moment Technique is used to calculate surface currents within a patch antenna. In basic functions, an integral equation is formed and transformed into the form of the matrix. The finite element method is used for breaking finite substrates into amounts. Centered on 2D or 3D views, the FEM scheme may be analyzed with triangles, tetrahedrons, hexagonal, etc.

The finite difference principle is used with electrical and magnetic fields to match smaller units. In this approach, the Maxwell equation for differential form is used in the electrical and magnetic

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fields. The architecture of the proposed framework with several air gap slots is indicated in Figure 1. In Table 1, for various values of the S-slot position, the numerical solution of the proposed structure is obtained. Reflection coefficient, gain, bandwidth and VSWRR also decide the separate parameters.

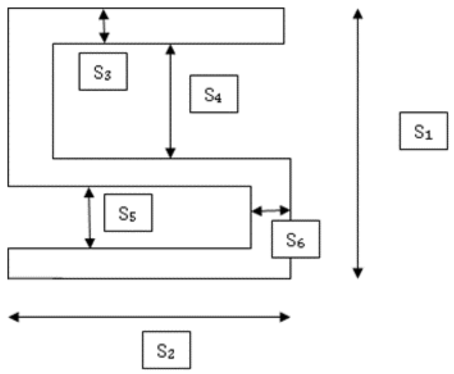

Figure 1. Geometric Dimension of S-Shaped Structure

Table 1. Parameter and Dimension of S-Shaped Structure

Sl. No.	Parameter	Dimension (mm)
1	S_1	20.44
2	S_2	26.56
3	S_3	6.85
4	S_4	10.33
5	S_5	8.85
6	S_6	12.55

3. Results and Discussion

The same criteria are used for evaluating the various S-Shaped structure slots. The coefficient of reflection consists of several wavelengths and different spaces. For separate structures with distinct spaces, the double layer method increased the advantage by about 7.5dB. For deviations from the substrate to the upward and downward direction obtained for the same gain and reflection coefficient, the double S-slot antenna location used is achieved.

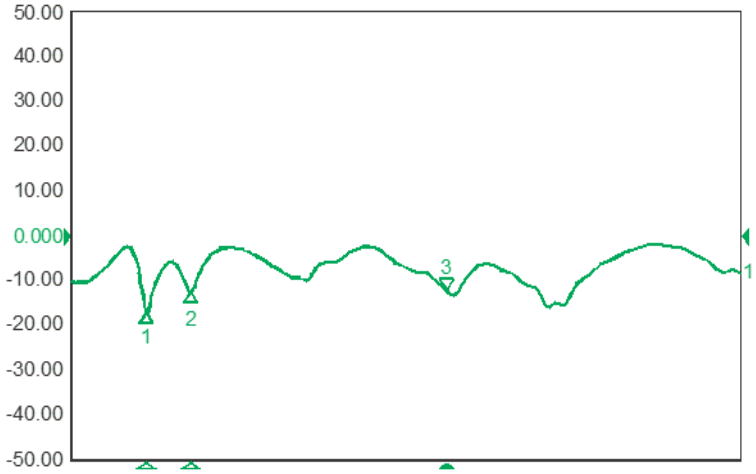

Figure 2. Reflection Coefficient of S-Shaped Structure

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The proposed design is used to track the individual frequencies with substratum thickness variations to maximize bandwidth with triple frequency band with resonating frequencies. A VSWR of less than 2 is produced. The proposed reflectance coefficient of structure in Figure 2 is -20.8dB, -15.68dB and -10.58dB received. In Figure 3, the VSWR obtained for the suggested configuration is 1.8, 1.9 and 2. Figure 4 suggests that 7.45dB, 8.8dB and 10.5dB are the definitions gain obtained from the proposed structure. Variants of the proposed electrical and magnetic plane architectures are as seen in Figure 5.

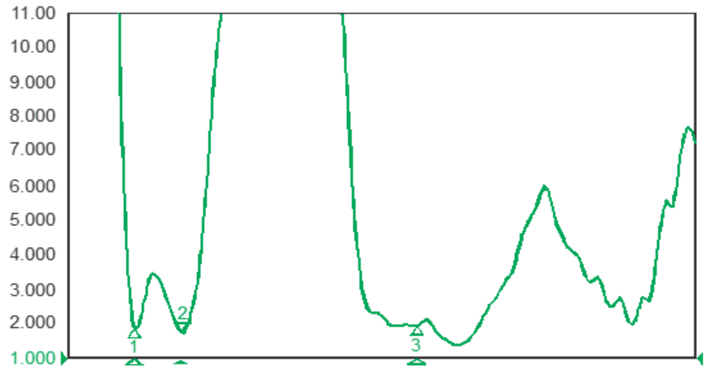

Figure 3. VSWR of S-Shaped Structure

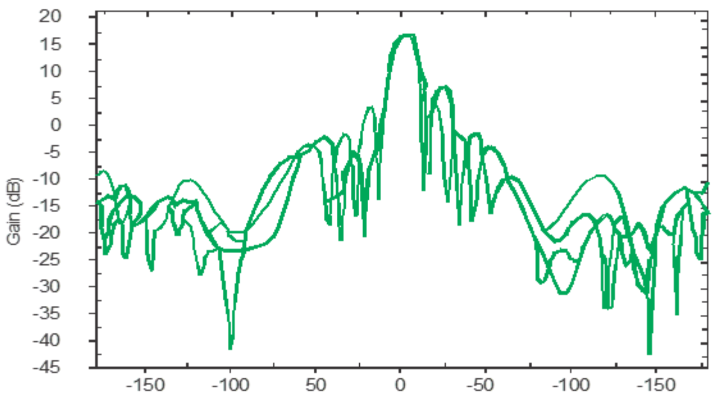

Figure 4. Gain of S-Shaped Structure

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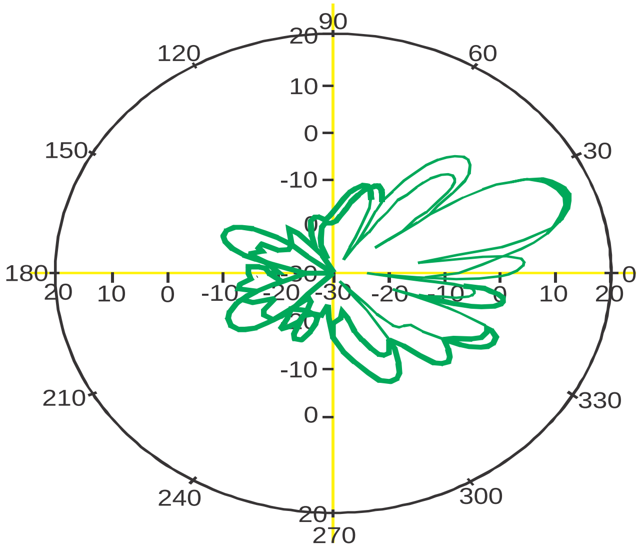

Figure 5. Radiation Pattern of S-Shaped Structure

4. Conclusion

The variations in S-shaped configuration slot locations are concluded in this paper. The parameters are also analyzed and the acquired parameters such as VSWR, Gain, and Radiation Pattern. In this paper, the S-shaped design of multiple slots is proposed. The resonating frequencies are extended and another type of slots further extends the bandwidth. For form, the proposed reflection coefficient is -20.8dB, -15.68dB and -10.58dB obtained. For the proposed setup, the observed VSWR is 1.8, 1.9 and 2. The proposed profit framework is calculated to be 7.45dB, 8.8dB and 10.5dB. For wireless devices, the antenna can be used for multiple slots.

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