

# Computational Analysis of Return Loss for S-shape Microstrip Antenna

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## Abstract

A survey of S-shape microstrip antenna elements is presented, with emphasis on theoretical and practical design techniques. Available substrate materials are reviewed along with the relation between dielectric constant tolerance and resonant frequency of microstrip patches. The S-shape antenna is first studied by a modal-expansion (cavity) technique and then is fully analyzed with wave equations. This paper presents the analysis of the electric magnetic wave equation with the help of the numerical method. And results expressed that there is no energy loss in the propagation of wave.

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*Index terms*— S-shape antenna, Return loss.

## 1 Introduction

Microstrip antennas are being increasingly used for aerospace applications because of their low weight, low volume and conformal nature. The most commonly used microstrip antennas are rectangular and circular disc antennas. However, other microstrip antennas are also being considered, depending on the application [1].

## 2 Fig.1 : Microstrip antenna configuration

In order to meet the requirement for mobile or personal communication systems, microstrip antennas with reduced size and broadband operation are of particular interest. Among various feeding mechanisms, Author : M.Tech student, Kanpur Institute of Technology, India. E-mail : nigamroli29@gmail.com Author : Assistant Professor, Department of Electronics & Communication, Kanpur Institute of Technology, India. E-mail : sanjaykr\_04@rediffmail.com the compact broadband microstrip antennas directly matched to a 50 coaxial line is also of importance, for its usefulness in integration with microwave integrated circuits. For this purpose, we present in this paper several related designs of microstrip antennas to broaden the operating bandwidth and reduce the overall size of the antenna. Here we discuss the S-shaped patch antenna. The S-shaped patch antenna reported here has a size about half that of the rectangular patch, with larger beamwidth but smaller bandwidth [2] shown in Fig. ??.

## 3 II.

## 4 Mathematical Analysis of S-Shape Antenna

Fig. ?? : S-shape microstrip antenna with coaxial feed Fig. ?? shows the geometry and co-ordinate system of the S-shape microstrip antenna. The width and length of the S-shape patch are  $W$  and  $L$ , respectively. The relative dielectric constant and the thickness of the substrate are  $r$  and  $h$ , respectively. The antenna is excited at  $(x,y)$  by a coaxial feeder through the dielectric substrate. The electromagnetic fields in the  $x,y,z$  direction are denoted by  $(E_x, E_y, E_z)$  &  $(H_x, H_y, H_z)$  [3]. The electromagnetic fields within the cavity are divided into three regions by the boundaries through the feed point, as in Fig. ?. Moreover, as the antenna cavity is bounded on the side by the admittance wall, the electric field within the cavity is expanded in terms of the antenna parameters [5].

## 7 CONCLUSION

41 The electric field is expressed as  $E_x = E_0 \cos(\beta z) \cos(\beta y) \cos(\beta x)$  In region 1 ( $-W/2 < X < +W/2$ ,  
42  $-[L-(L_1+L_2)] < Y < L_1$ ,  $0 < Z < h$ )  $E_x = 0$  (1)(2)

43 (3) Fig. 1: Geometry of S-shape antenna In region 2 ( $W/2 < X < [W/2 + (W - 2W_1)]$ ,  $-L_3 < Y <$   
44  $(L_3 + [L - (L_1 + L_2)])$ ,  $0 < Z < h$ )  $E_x = E_0 \cos(\beta z) \cos(\beta y) \cos(\beta x)$  (4)  $E_y = 0$  (5)  $E_z = 0$  (6) In region 3 ( $[W/2 + (W - 2W_1)$   
45  $< X < W/2 + (W - 2W_1) + W_1]$ ,  $-L_3 < Y < L_3 + [L_3 - (L_3 + L_1)]$ ,  $0 < Z < h$ )  $E_x = 0$  (7)  $E_y = E_0 \cos(\beta z)$   
46  $E_z = 0$  (9)

47 And the magnetic field is expressed as

48 In region 1  $H_x = H_0 \cos(\beta z) \cos(\beta y) \cos(\beta x)$  (10)  $H_y = 0$  (11)  $H_z = 0$  (12)

49 Total electric field of S-shape antenna is presented by these equations which are expressed below [6] shape S X  
50  $E = E_0 \cos(\beta z) \cos(\beta y) \cos(\beta x)$  (13) shape S Y  $E = E_0 \cos(\beta z) \cos(\beta y) \cos(\beta x)$  (14) shape S Z  
51  $E = 0$  (15)

52 and magnetic field is shape S X  $H = H_0 \cos(\beta z) \cos(\beta y) \cos(\beta x)$  (16) shape S Y  $H =$   
53  $0$  (17) shape S Z  $H = 0$  (18)

## 5 III. Simulation Results and Discussion

54 As the design process goes the calculation of the parameters are done above and with the dimensions the S-shape  
55 patch antenna has been designed by the coaxial feeding techniques. Here, we take the coaxial feed technique in  
56 practice and the results are as shown below, A Matlab program has been compiled in order to produce the design  
57 and the responses for the S-shape microstrip patch antenna and its design. The table 1 below gives the possible  
58 parameters for the design of the microstrip patch antenna which will be used in the software for the results to  
59 examine. The width and the length of the patch have been rounded up to the close integer value.

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61 May The IE3D software has been compiled which gives us the following interface width ( $W$ ) = 46.51mm length  
62 ( $L$ ) = 36.26mm. and measured result is -15.96db at 2.2GHz resonating frequency. At the operating frequency  
63 2.1GHz the simulation result is -11.21db and the measured result is -10.73db. So that results presented that  
64 return loss are decreases without losses.  $E_x = 0$  (1)  $E_y = E_0 \cos(\beta z) \cos(\beta y) \cos(\beta x)$  (2)  $E_z = 0$  (3)  
65 Region 1 Region 2 Region 3 Y Z X Region 1 Region 2 Region 3  
66 IV.

## 7 Conclusion

69 The aim of this paper is to design a S-shape patch Microstrip antenna and to study the responses and electric and  
70 magnetic formulas are varies according to the boundry conditions. In this paper an antenna has been designed  
71 by the co-axial feeding technique.

72 Having gone through the results it happened to be a bit difficult to decide the optimized design of the antenna,  
73 as there are different aspects that are involved in the design of patch antenna. It is good to see that the return  
74 loss has a negative value in all the cases which states that the losses are minimum during the transmission. In  
75 the design the Return Loss is -15.78dB in co-axial feed line technique for the simulated by the IE3D. But for the  
experimental design the Return Loss is -13.11dB in coaxial feed line. <sup>1</sup>



Figure 1: Computational

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Figure 2: Fig. 4 :

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Parameter	Value
Dielectric constant of the substrate	4.2
Center Frequency	2.1GHz
Loss tangent	0.2

Figure 3: Table 1 :



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