SLIT LOADED SQUARE MICROSTRIP ANTENNA

WITH CIRCULAR POLARIZATION

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Summary

The circularly polarized microstrip antennas, including single-fed patches [1,2], are widely used as effective radiators in many communication systems. With the help of truncated corners and slits, the linear polarization of square microstrip antenna can be changed to circular polarization with a single feed and w/o using layered structure, which not only reduces the complexity but cost,space also with little sacrifice on the performance.

This paper presents development of such antennae at 2.4 GHZ.The perturbation at the corner and slits split the field into two orthogonal modes, at the cost of reduction of the resonant frequency of the patch slightly[4].These orthogonal modes with equal amplitudes can be excited by adjusting the slit lengths and feed position.. The lowered quality factor of the patch increases the antenna bandwidth and eases the fabrication tolerances. The antennas were developed and tested at 2.4 GHz.The simulated results using IE3D software have also been presented,which are quite encouraging.

II ANTENNA DESIGN

. The proposed antennas are constructed by using the basic design approach described in [1,2]-

Design Formulae:

$$W = \frac{1}{2f_r\sqrt{\mu_0\varepsilon_0}}\sqrt{\frac{2}{\varepsilon_r+1}} = \frac{v_0}{2f_r}\sqrt{\frac{2}{\varepsilon_r+1}} \qquad (1)$$

$v_0 = 3*10^8$ m/sec ,$\mu_0 = 4\pi*10^{-7}$ H/m, $\varepsilon_0 = 8.854*10^{-12}$ F/m. , ε_r=2.33

2.For W/h > 1

$$\varepsilon_{reff} = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left[1+12\frac{h}{W}\right]^{-1/2} \qquad (2)$$

3 ΔL, the extension in length of microstrip antenna for fringing field effect is

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

2. The actual length L of the patch was determined using,

$$L = \frac{1}{2f_r\sqrt{\varepsilon_{reff}}\sqrt{\mu_0\varepsilon_0}} - 2\Delta L \qquad (4)$$

The feed distance x_f has been calculated as using the relation in [5].

III CASE STUDIES FOR DESIGNED ANTENNAS

Three antennas were prepared using analyses in section II and there performance evaluations were done. The dimensions for each antenna are given as follows **:**

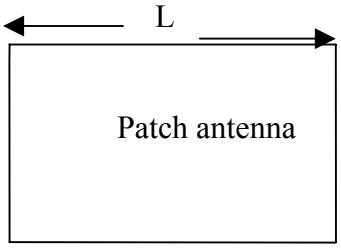

Fig.1:Square microstrip Antenna,L=W=35.5mm with co axial feed of 50 ohms

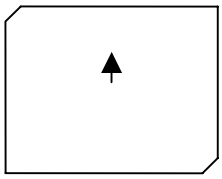

Figure 2: Geometry of square microstrip antenna with corner truncation *L1=50mm, L=35.5mm, ΔL=3.2mm, d=7.15mm,*

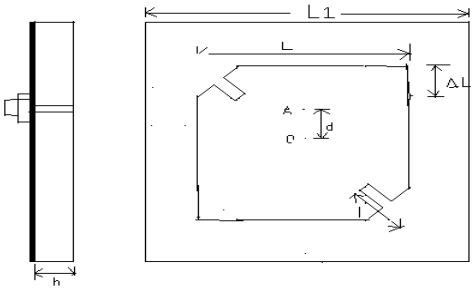

Figure 3: geometry of square microstrip antenna with 2 slits with corner truncation *L1=50mm, L=35.5mm, ΔL=3.2mm, l=10mm, w=1mm, d=7.15mm*

Results: The designs were optimized using Zealand I3D software.It was found that a corner truncation of 4mm is best for radiation efficiency being maximum with axial ratio of 0.3 at 2.422 Ghz,confirming the CP.When slit is added,the optimum length of slit found to be 5 mm,for which the axial ratio is 1.25 db at 2.4225Ghz.Various parameters are given in Table I.

Table I Performance of antennas:

Parameters	Square microstrip antenna	Square microstrip antenna with 2 truncated corners each of 4mm width	Square microstrip antenna with 2 truncated corners and 2 slits each of 5mm length,
resonant freq.	2.425 GHz	2.423 GHz	2.4225 GHz
3 dB bandwidth,	1.6975GHz	2.107GHz	2.1877GHz
Radiation η Antenna η	97 % 95%	96 % 93%	94 % 90%
Gain of antenna, G_T	6.92 dB	6.5 dB	6.3dB
Directivity, D	6.31 dB	6.8 dB	6.9dB
AR	-	0.3 db	1.25dB

V REFERENCES

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