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A Parametric Analysis of Various Antenna Design Techniques

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Abstract: *The parametric study of various antenna design techniques. A small modification in structure may result in shift in frequency and shift in return losses. Changing electrical length change the parameters of the antenna. The antenna is of microstrip structure which operates at GSM. The antenna parameters such as directivity, VSWR, return loss, radiation pattern, gain changes in the antenna when various electrical length changing techniques were used. The dimensions of the antenna is 26*27*mm^2 *This antenna gives better parameter results with vswr 1.81 and return loss of -12.09db, but the critical frequency of antenna is 1.99GHz. This antenna is designed for GSM , 1.8 GHz frequency. The expected* $\frac{\lambda}{2}$ *antenna size is 80 mm.But we have achieved as size reduction of 67.5%. for GSM applications*

Keywords: *Criticalfrequency, GSM, Microstrip Antenna, Returnloss, VSWR*

I. Introduction

Antenna is an important tool for communication engineering. An antenna is a structure usually made from a good conducting material that has been designed to radiate or receive electromagnetic energy in an efficient manner. Antennas are connecting links between the transmitter and free space or free space and the receiver. An antenna or aerial may also be viewed as a transducer used in matching the transmission line or waveguide to the surrounding medium or vice versa.A Microstrip patch antenna consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side.

II. Microstrip Antenna

Microstrip is a type of electrical transmission line which can be fabricated using Printed circuit board technology.It is used to convey microwave-frequency signals is shown in fig 1.1

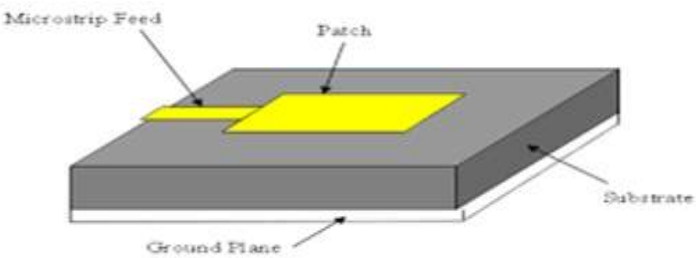


Fig.1Microstrip antenna.

III. Antenna Design

DESIGN 1

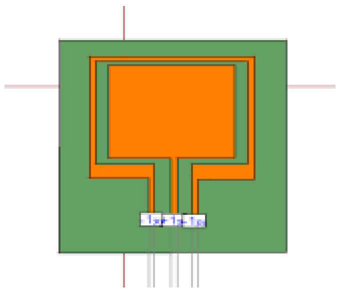


Fig.2 Square Patch in CPW Slot

This antenna is designed with 26*27 mm^2. A CPW feed is used .The antenna is designed with FR4 substrate of dielectric constant of 4.4, and thickness of an antenna is 1.6 mm^2.

A square patch of 20*20 mm^2 is introduced in the CPW slot.The feed line is of 1mm thickness and 15 mm length. This Antenna shows a better performance with good VSWR & Return loss. But the frequency is 5.99 GHz.

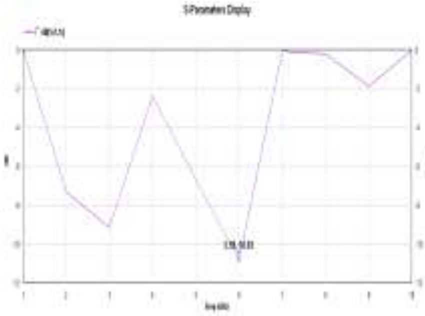


Fig.2(a) Return loss

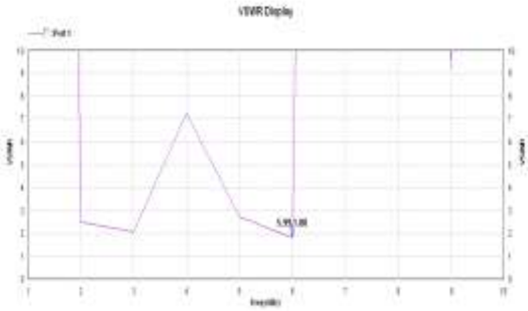


Fig.2(b) VSWR

The simulation results with vswr 1.80 and return loss of -10.83db, but the critical frequency of antenna is 5.99GHz.

DESIGN 3

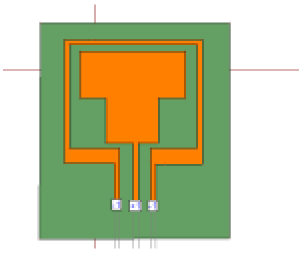


Fig.3Merging of rectangle with square

Merging of rectangle of dimensions 20*10mm^2 with square 10*10mm^2 is introduced in the CPW slot.The feed line is of 1mm thickness and 15 mm length.This Antenna shows a better performance with good VSWR & Return loss. But the frequency is 2.99 GHz.

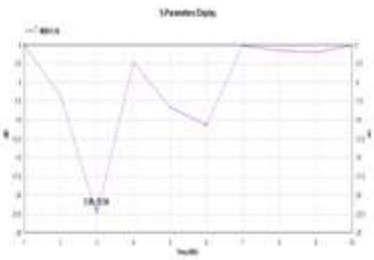


Fig.3(a)Return loss

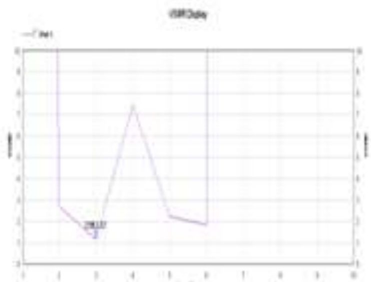


Fig.3(b) VSWR

Simulation results with vswr 1.17 and return loss of -22.50db, but the critical frequency of antenna is 2.99GHz.

DESIGN 3

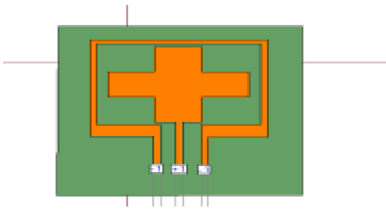


Fig.4 Cross patch

A cross patch is formed by merging of squares of dimensions 6.9*6.9 mm^2 is introduced in the CPW slot.The feed line is of 1mm thickness and 15 mm length.This Antenna shows a better performance with good VSWR & Return loss. But the frequency is 2.99 GHz.

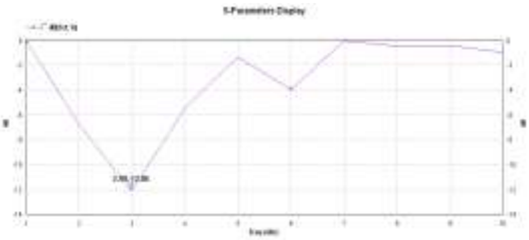


Fig 4(a) Return loss

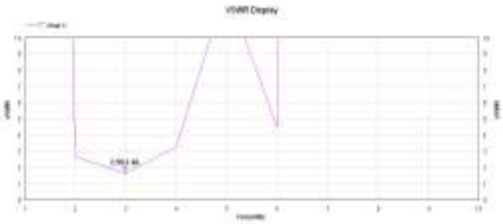


Fig 4(b)VSWR

Simulation results with vswr 1.66 and return loss of -12.05db, but the critical frequency of antenna is 2.99GHz.

DESIGN 4

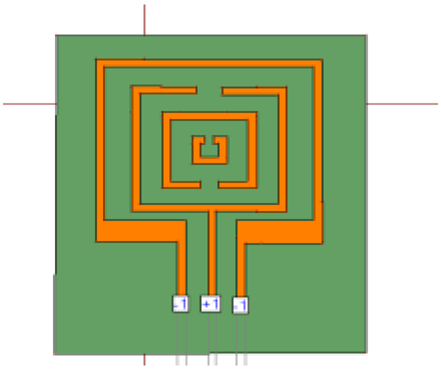


Fig.5 Split ring in CPW slot

A Split ring is introduced in the CPW slot.The feed line is of 1mm thickness and 15 mm length.This Antenna shows a better performance with good VSWR & Return loss. But the frequency is 1.99 GHz.

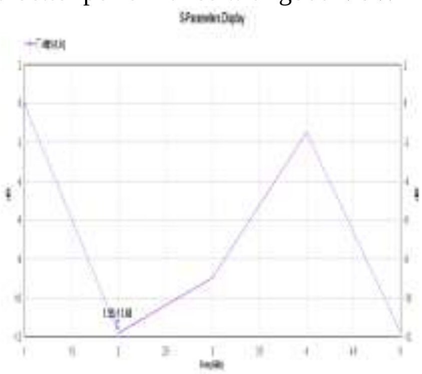


Fig 5(a) Return loss

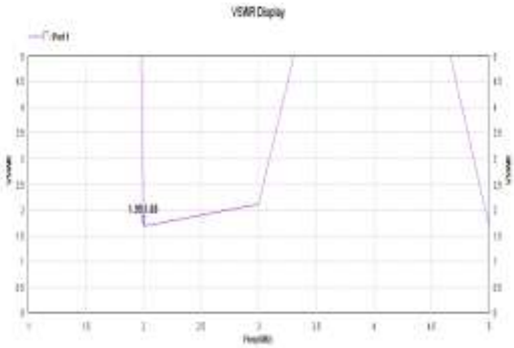


Fig 5(b)VSWR

Simulation results with vswr 1.69 and return loss of -11.68db, but the critical frequency of antenna is 1.99GHz.

DESIGN 5

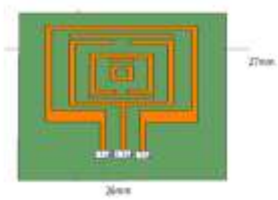


Fig.6Split ring resonator antenna with stub on either sides

A Split ring resonator antenna is introduced in the CPW slot,with the stub on either sides.The feed line is of 1mm thickness and 15 mm length.This Antenna shows a better performance with good VSWR & Return loss. But the frequency is 1.99 GHz.

This antenna is designed for GSM (ie) 1.8 GHz frequency.The expected $\frac{\lambda}{2}$ antenna size is 80 mm.But we have achieved as size reduction of 67.5%

f =1.8 GHz

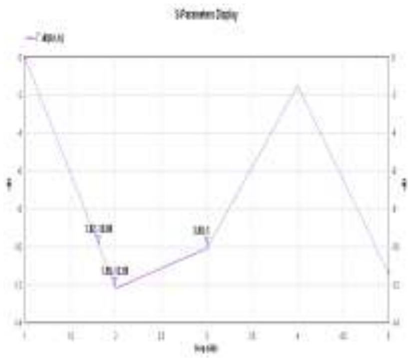
c =3*$10^8 m/s$

$\lambda = \frac{c}{f}$

λ =3*$10^8 m/s$/1.8 GHz

λ =0.16

Thus $\frac{\lambda}{2} = 80mm$



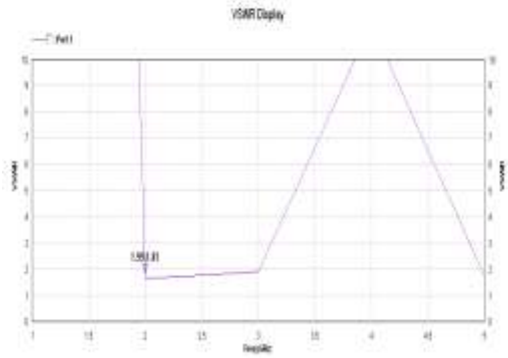


Fig 6(a) Return loss **Fig6(b) VSWR**

Simulation results with vswr 1.81 and return loss of -12.09db, but the critical frequency of antenna is 1.99GHz.

IV. Conclusion

The structure of "Split ring resonator antenna" shaped patch antenna was designed and simulated using IE3D software. The simulated result analysis was compared with the measurement results as discussed earlier. For, Split ring resonator patch antenna, the simulated bandwidth obtained was 1.18GHz and it is matched with the measured result. The fabricated antenna resonates at 1.99 GHz with a return loss of -12.49 dB. Thus the microstrip patch antenna was designed which gives satisfied results.This antenna is used for GSM applications.

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