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DESIGN OF RECTANGULAR MICRO-STRIP PATCH ANTENNA FOR 916 MHZ

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ABSTRACT

In this Project we are designed a Micro-strip Patch Antenna at a unique Frequency which is 916 MHz. We used RT-Duroid as a substrate having dielectric constant 10.2 and thickness 1.9mm.Rectangular Patch and Ground both of copper material. We used line feed method. DGS (Defected ground surface) is used for miniaturization of Antenna. This particular frequency is mainly used in Missile communication Purposes. For designing of Antenna we used CST (computer simulation technology) Software. For low frequency application this is very useful. In CST tool first of all we have make Ground and Substrate which is double in width and length as compare to Patch width and length which is mounted on substrate. Line feeding technique is used in fed connection. For simulation in CST we have used discrete port and time domain solver for less time consuming. After that we have analyzed all the parameters as like radiation pattern, S11.After doing lot of iteration we miniaturized the antenna at some extent.

INTRODUCTION

This is the world of wireless communication systems, in this world RMPA plays a very important role. In spite of having a lot of advantages (low profile, low cost and Omni directional radiation patterns etc.). In high performance aircraft, satellite & missile application, where size, weight, ease of installation really matters in that case patch antenna is very useful. With the rapid development in wireless communications, much effort has been devoted to reduce the size of Micro-strip antennas. In this way, several methods have been proposed recently such as using a dielectric substrate of high permittivity, Defected Micro-strip Structure (DMS), Defected Ground Structure (DGS) at the ground plane or a combination of them. Mainly DGS is a periodic or non-periodic cascaded defect configuration etched in the ground plane of a planar transmission line. The defect geometry is easy to implement and does not need a large area. These features enable such structures to acquire a great relevance in microwave circuit design. In particular, DGS is employed to design Micro-strip antennas for different applications, as for instance, cross polarization, mutual coupling reduction in antenna arrays and harmonic suppression. Moreover, DGS has been widely used in the development of miniaturized antennas. When DGS is introduced in a Micro-strip antenna, the defect geometry etched in the ground plane disturbs its current distribution. This disturbance affects the transmission line characteristics, such as the line capacitance and inductance. In other words, introducing DGS in a Micro-strip antenna can result in an increase of the effective capacitance and inductance which influences the input impedance and current flow of the antenna and thus reducing its size with respect to a given resonance frequency. In this paper, we use DGS to design a miniaturized Micro-strip antenna as compared with a conventional one which is resonating on 916 MHz.

Fig.1: Defected ground structure

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DESIGN CONSIDERATIONS

The RMPA parameters are calculated from the formulas given below. Desired Parametric Analysis.

2.1 Length=

$$W = \frac{1}{2f_r\sqrt{\mu_0\varepsilon_0}}\sqrt{\frac{2}{\varepsilon_r + 1}} = \frac{C}{2f_r}\sqrt{\frac{2}{\varepsilon_r + 1}}$$

Where

c = free space velocity of light

εr = Dielectric constant of substrate

2.2 The effective dielectric constant of the rectangular Micro-strip patch antenna.

$$\varepsilon_{eff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left(\frac{1}{\sqrt{1 + \frac{12h}{w}}}\right)$$

2.3 The actual length of the Patch (L).

$$L = L_{eff} - 2 \quad (3)$$

Where

$$Leff = \frac{c}{2f_r\sqrt{\varepsilon_{eff}}}$$

2.4 Calculation of Length Extension

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

ANALYSIS OF RECTANGULAR MICRO-STRIP PATCH ANTENNA STRUCTURE WITH SIMULATED RESULTS

The Rectangular Micro-strip Patch Antenna is designed on RTDUROID-R03010 (Lossy) substrate. The parameter specifications of rectangular Micro-strip patch antenna are mentioned in table 1. These are calculated from the above discussed formulae.

S. No	Parameters	Dimension
1.	Dielectric Constant (εr)	10.2
2.	Loss Tangent (tan∂)	0.0022
3.	Thickness (h)	1.9mm
4.	Operating Frequency	916 MHz
5.	Length	60mm
6.	Width	102.4mm

Dimensional view of a rectangular Micro-strip patch antenna (RMPA), with a Micro-strip feed line is shown in Fig.2.

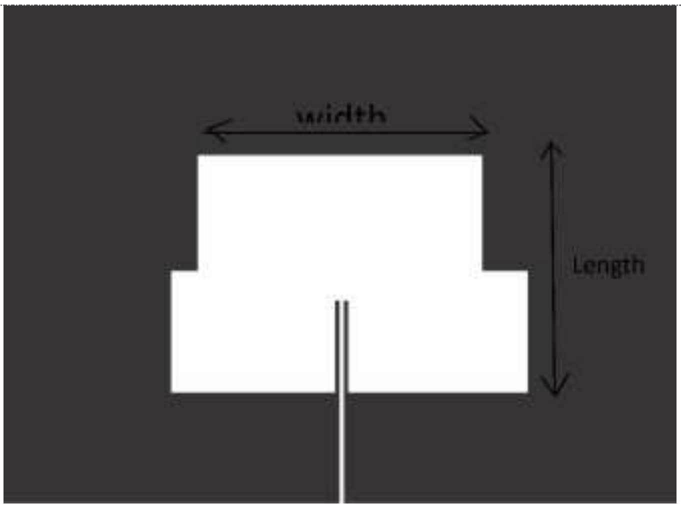

Fig.2: Rectangular patch antenna at 916 MHz

Return loss and Impedance Bandwidth of Rectangular Micro-strip Patch Antenna is shown in Fig.3

4. Simulation Results

Return loss and Impedance Bandwidth of Rectangular Micro-strip Patch Antenna is shown in Fig.2

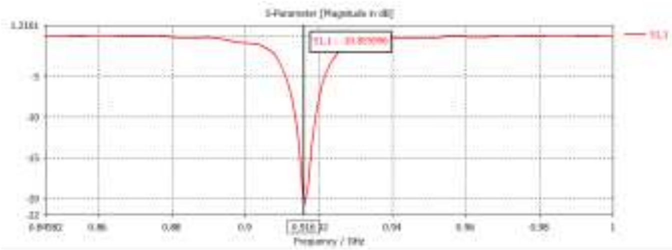

Fig.3: Return loss i.e. s11and Impedance Bandwidth.

Fig.4:VSWR

CONCLUSION

In proposed antenna impedance matching is enhanced using inset slot feed. Concept of defective ground is introduced for isotropically radiation of antenna.

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