International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016 [ICSSCCET 2016]

ISBN	978-81-929866-6-1	**VOL**	02
Website	icssccet.org	**eMail**	icssccet@asdf.res.in
Received	25 – February – 2016	**Accepted**	10 - March – 2016
Article ID	ICSSCCET109	**eAID**	ICSSCCET.2016.109

A Survey of Compact Microstrip Antenna with Defected Ground Structure for Wireless Applications

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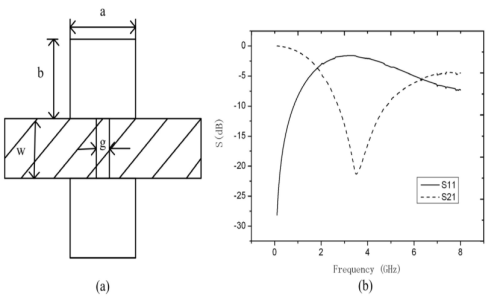
Abstract: *The paper is about the microstrip antenna which consisting of a zigzag shaped slit, Dual T-shaped slits on both sides of a microstrip antenna and circular shaped defected ground plane is optimized. The antenna was capable of generating three separate resonant frequencies to cover both the 3.45/6.28 GHz WLAN bands and the 4.5 GHz WiMAX bands while maintaining a overall size of about 42×30×3.175 mm3. The return loss impedance bandwidth values are analyzed significantly for the resonant frequencies. The designed microstrip antenna is characterized with better radiation pattern and stable gain around 5-7 dBi over the working bands. Here we are using the defected ground structure which is used for the size reduction of the rectangular patch antenna.*

Keywords: *defected ground structure, Impedance bandwidth, Radiation pattern, zigzag slit.*

INTRODUCTION

The most useful methodology for the size reduction of antenna is the defected ground structure which has a equivalent circuit model, Simple structure and to design RF circuit.DGS is an etched periodic or non periodic configuration which defect in ground plane. The disturbance will change the characteristics of transmission line



(a) Defected ground structure (b) simulation of DGS

A Miniaturized multiband frequency antenna can generate the three separate impedance bandwidths to cover all the impedance bandwidth of WLAN and WiMAX. When the RF signal get transmitted through a rectangular patch antenna which is coupled between the top surface of the patch and DGS. In this approach we have been using the advanced design system software which better more

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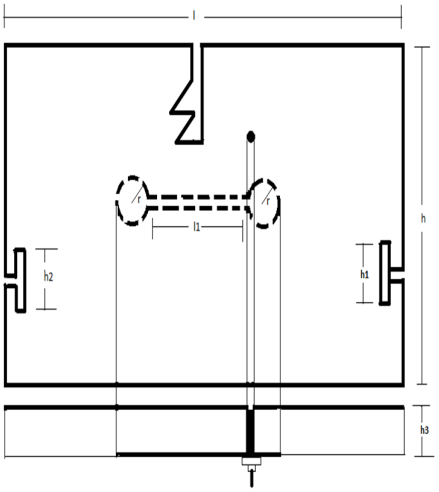
than the Hyper Lynx software which produces the better simulation results. ADS is an electronic design automation software . It provides an integrated design environment to designers of RF electronic products.

The dual T-shaped slits which provides dual band with better impedance characteristics. Miniaturization of antenna which reduces the gain of an antenna. A patch antenna is a wide beam antenna fabricated by etching the antenna element pattern in metallic bonded to an insulating dielectric substrate

Antenna Geometry



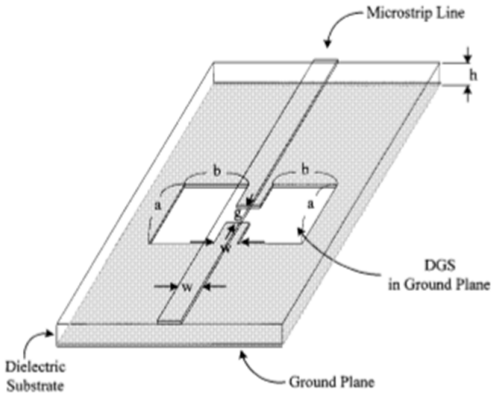


Fig. 1. Three-dimensional view of the proposed DGS unit section, which is etched in the ground plane of a microstrip line.

∑r – relative permittivity
L – Length of the micro strip antenna
h- Height of the antenna
r- Radius of the circular dumbbell shape

A rectangular patch antenna has chosen the dimensions L × H. The T-shaped slits on both sides of the antenna with a length of h1 and h2 and spacing from the edge. The zigzag slits with angles of 250 and 200. The circular dumbbell shaped DGS of radius R on the middle of the antenna.

Design Calculation

The rectangular patch antennas have been analyzed to calculate the antenna parameters such as S parameter, VSWR, axial ratio, bandwidth and operating frequency.

The design of a micro strip antenna has three essential parameters they are:

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1. **Frequency of Operation:** It is used to calculate the resonant frequency of the antenna for various wireless applications.
2. **Dielectric Constant of The Substrate:** The dielectric constant used for our design is Rogers RT/Duroid with relative permittivity of 2.33. A material with high dielectric constant has been selected since it reduces the dimensions of the antenna.
3. **Height of Dielectric Substrate:** The rectangular patch antenna is used in wireless applications, it is necessary that the antenna should not be bulky. Hence it should be in a minimum height.

There are six essential steps for the design process:

1. Calculation of the width (W):

$$W = \frac{C}{2 f_o((\sum r+1)/2)^2}$$

2. Calculation of effective dielectric constant (ϵreff)
3. Calculation of the effective length (Leff):

The effective length is calculated using the known values.

4. Calculation of the length extension (ΔL):

By substituting the known values we can get the length extension value.

5. Calculation actual length of patch (L):

$$L = Leff - 2\Delta L$$

6. Calculation of ground plane dimensions (L h and W h):

$$L_h = 6h+L$$

$$W_h = 6h+W$$

Conclusion

The triband patch antenna with defected ground structure is designed, simulated and tested for various wireless applications. Here we are using the advanced design software rather than the hyper Linux. The difference between the bandwidth at different resonant frequencies is an attractive feature .The proposed microstrip antenna is useful for the wireless application with the effective capacitance and inductance.

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