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	ICSSCCET091	**eAID**	ICSSCCET.2016.091

Design and Development of an I-Shaped Microstrip Antenna for Wireless Applications

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Abstract: *The recent shoot up in wireless applications in the last decennium has led to a raise in serried, high gain microstrip antennas. The intention of this paper is to design a serried I-shaped high bandwidth microstrip antenna .The antenna is a modified form of the formal patch antennas, used to broaden the impedance bandwidth. The antenna is designed on a dielectric substrate, backed on a metal board and fed by a coaxial cable. Using Advanced Design System (ADS) package the serried size antenna is simulated. The parameters such as Bandwidth, return loss are enhanced in this I-shaped microstrip antenna. The integrated technique offers the advantages of easiness, low profile, high gain and wide bandwidth antenna.*

Keywords: *Microstrip antenna, Serried size, Wideband, ADS.*

INTRODUCTION

A patch antenna is a narrow band wide beam antenna constructed by etching the antenna element pattern in metal trace adhered to an insulating dielectric substrate and uninterrupted metal layer bonded to the other side of the substrate which forms the ground plane. Common microstrip antenna shapes are square, orthogonal, spherical and elliptical, but any incessant shape is possible. The integral narrow impedance bandwidth is the prima flaw of a microstrip antenna. Techniques for bandwidth improvement have been drastically studied in the past decennium. Current vogue to integrate multiple wireless communication systems into a lone small wireless device, call for and research on small and multiband antennas have increased [6]–[9]. Microstrip antennas are basically favoured over in formal antennas, for many applications including Global Positioning System(GPS),Direct broadcasting Satellite(DBS)System,\Mobile communications, Wi-MAX, Bluetooth, Zig-bee etc. Their vantages are low profile, light weight, cheap, toughness, alleviate assembly using printed circuit technology and conformal mounting structures etc. Nevertheless simple antenna often endure reduced gain, bandwidth and deficient power handling potentiality.

For Wireless communication systems, antenna is one of the deprecative component. An acceptable design of the antenna can unwind the system requisite and enhance the system performance. The geometry of the antenna must be compact to fit small tele- phone handsets, and the electric characteristic should be excellent to meet transceiving capabilities of the antenna under various environments. Numerous studies and research have been notified in the literature oriented towards obtaining microstrip antennas. These antennas can be categorized according to the number of feeds used. These methods extends, operation bandwidth ranges from 30% to 60% have been achieved.

Methodology Adapted

The patch is generally made of conducting material such as microstrip is literally a nonhomogeneous line of two dielectrics, mostly the substrate and air. The medium between the patch and the ground plane is air. Basically, W and L mastery the resonant lengths of x and

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y orthogonal currents excited across the edges of the patch. The merged parallel slots alter the electrical lengths of both currents and hence they have notable outcome on the resonant lengths. The technique used is Defected Ground Structure (DGS),where the ground plane metal of a microstrip (or stripline, or coplanar waveguide)circuit is deliberately modified to improve the performance. The name for DGS technique simply means that a “defect” has been located in the ground plane, which is on the whole reckon to be an approximation of an infinite, perfectly conducting current sink. The basic element of DGS is a resonant gap or slot in the ground metal situated directly under the transmission line and aligned for effective coupling to the line.

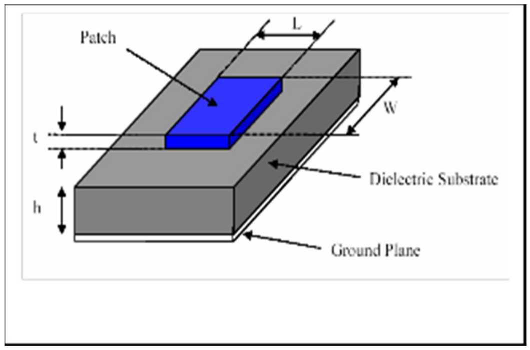

Fig 1: simple microstrip patch antenna

The software we use in the design of I-shaped microstrip antenna is Advanced Design System (ADS). ADS is an electronic design mechanisation software system produced by keysight EEs of EDA, a division of keysight technologies. ADS provides a vast array of simulation modes and framework. It provides an unified design environment to designers of RF electronic products such as mobile phones, pagers, wireless networks, satellite communications, radar systems and high speed data links.

Keysight ADS accompaniment each step of the design process-schematic capture, layout, design rule checking, frequency domain and time domain circuit simulation, and electromagnetic field simulation. Key Benefits of ADS is that it is Complete, integrated set of quick, exact and handy system, circuit & EM simulators enable first-pass design success in a complete desktop flow.

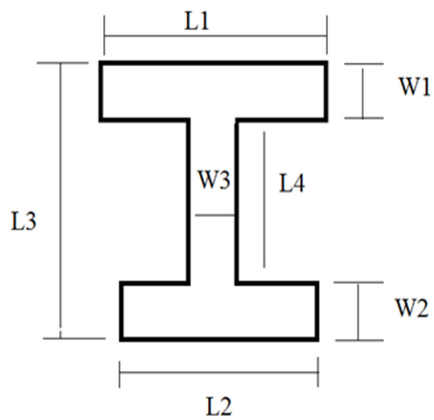

Fig a:I-shaped antenna

Theoritical Analysis

The length of the patch L manages the resonant frequency. Equation (1) below gives the relationship between the resonant frequency and the patch length:

$$f_c \approx \frac{c}{2L\sqrt{\varepsilon_r}} = \frac{1}{2L\sqrt{\varepsilon_0 \varepsilon_r \mu_0}} \quad \ldots 1$$

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The value of (ε_{reff}) is

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

where,

ε_{reff} = Effective dielectric constant

ε_r = Dielectric constant of substrate

h = Height of dielectric substrate

W = Width of the patch

The dimensions of the patch along its length have now been expanded on each end by a distance ΔL.

$$\Delta L = 0.412\frac{\left(\varepsilon_{reff} \pm 0.3\right)\left(\frac{W}{h} + 0.264\right)}{\left(\varepsilon_{reff} - 0.258\right)\left(\frac{W}{h} + 0.8\right)} \qquad (2)$$

The effective length of the patch L_{eff} now becomes:

$$L_{eff} = L + 2\Delta L \qquad (3)$$

For a given resonance frequency f_0, the effective length is

$$L_{eff} = \frac{c}{2f_0\sqrt{\varepsilon_{reff}}} \qquad (4)$$

Conclusion

Simulation results of a I shaped microstrip patch antenna is done. Groovy antenna performance and impedance matching can be taken by aligning the probe position and the attributes of the patch. It can be terminated from the results that the designed antenna has contended functioning and hence can be used for Wireless LAN applications. Microstrip patch antenna can be used as client antenna in computer, A better bandwidth, reduced return loss, high gain etc. can be accomplished by using this model.

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