IOSR Journal of Electronics & Communication Engineering (IOSR-JECE)
ISSN : 2278-2834, ISBN : 2278-8735, PP : 46-49
www.iosrjournals.org

STACKED MULTIBAND MICROSTRIP ANTENNA

Mahadik Shamala R.[1], Bombale Uttam L.[2]
[1] Department of Electronics and Communication, Dr.J J Magdum College of Engineering, Jaysingpur , India
[2] Department of Technology, Shivaji University, Kolhapur, Maharashtra, India

ABSTRACT *: In microstrip antenna research a new trend is found where the researchers improve antenna characteristics by introducing different structures within the antenna geometry. With the development of computational electromagnetic new approaches of analysis has become another branch of activity. This paper presents a design of stacked patch configuration of microstrip multiband antenna, which is suitable for various wireless applications. The proposed wideband stacked antenna is designed on the FR4 substrate, and simulated on Zeland IE3D software. The antenna parameters such as VSWR, return losses, impedance bandwidth and radiation characteristics such as radiation efficiency, gain and radiation patterns have been discussed.*

Key Words*- microstrip antenna, multiband, stacked patch, wideband.*

I. INTRODUCTION

Antenna is transition structure between free space and guided device (coaxial line or a hollow pipe (waveguide)).

With the rapid growth of the wireless mobile communication technology, steadily increasing number of users and the constant need for higher and higher data rates, this leads to an increasing number of emerging wireless communication standards. A few standards are : (GSM;890-960 MHz), (DCS; 1710-1880 MHz),(PCS; 1850-1990 MHz), (UMTS; 1920-2170 MHz).WCDMA, Bluetooth, and WLAN (802.11a, b, g . .)etc

So the future technology needs a compact, wide band and multi band, with high efficiency antenna, for avoiding the use of two antennas. Microstrip patch antenna is good for the future technology, with advantages such as low weight, low profile planar configuration, low fabrication costs, At the same time some disadvantages such as small bandwidth and poor radiation efficiency resulting from surface wave excitation and conductor and dielectric losses

Most current multiband antenna designs used for mobile devices can be categorized into three types: planar inverted-F antennas (PIFAs), monopole antennas and slot-type antennas. In general, Different design techniques have been applied to provide multiple band operation and performance enhancement and are,

1] Achieved :- with reactively loading
- using two different coaxial stubs
- with monolithic reactive loading
- with modified circular disc by adding additional strips
- by patch trimming with a rectangular notch
- by adding shorting pins

(for closely spaced bands having frequency ratios up to 1.5:1)

2] based on the ”window” concept having frequency band separation of 2:1 or 4:1
- windows were cut in a low frequency patch radiators to accommodate high frequency patch antennas.
- the multiple layers which consisting of two or more metallic patches supported by one or more dielectric layers

II. DESIGN MICROSTRIP PATCH ANTENNA

To implement multi band characteristics of micro strip antennas, various methods are being used. One of the methods is to provide two rectangular patches designed for specific frequency. The normal design of rectangular patch as per the literature is used to design the rectangular patches. One resonant frequency is fixed at 900 MHz which is a frequency for mobile communication and the other frequency is fixed at which is frequency of WLAN. The rectangular patches are designed for the above mentioned frequencies. The following Steps are to be followed in designing a rectangular patch

Step1: Calculation of the width (W):

$$W = \frac{v_o}{2f_r}\sqrt{\frac{2}{\varepsilon_r + 1}}$$

(1)

Step2: Calculation of Effective dielectric constant:

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

(2)

Step 3: Calculation of Effective length (Leff):

$$L_{eff} = \frac{v_o}{2f_0\sqrt{\varepsilon_{reff}}}$$

(3)

Step 4: Calculation of Length extension (ΔL):

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

(6)

Step 5: Calculation of actual length of the patch (L):

L=Leff -2ΔL

Step 6: Calculation of ground plane dimensions (Lg and Wg):

Lg=6h+L

Wg=6h+W

where,

'L' is the length of patch,

'W' is the width of the patch,

'h' is the height of the substrate,

'εr' is the relative permittivity of substrate,

'εreff' is the effective relative permittivity of patch,

'vo' is the velocity of EM wave,

'Leff' is the effective length of patch

'fo' is the resonant frequency.

The transmission line model is applicable to infinite ground planes only. However, for practical considerations, it is essential to have a finite ground plane. Similar results for finite and infinite ground plane can be obtained if the size of the ground plane is greater than the patch dimensions by approximately six times the substrate thickness all around the periphery. Hence, the ground plane dimensions are given in step 6.

III. ANTENNA STRUCTURE

The geometry and detailed dimensions of the proposed antenna is depicted in figure. 1 and table. 1. The antenna consists of dielectric substrate and a infinite ground plane. The antenna has tow rectangular patches 70mm X 100mm X3.2mm and two slots at the bottom and top of the rectangular patch30mm X5mm and 20mm X5mm respectively. The antenna is fed by coaxial feeding, The shorting pins support the stacked patch with the slot at height of 3.2 mm above the ground plane. The relative dielectric constant of the FR4 layer is 4.4 and the height (h) is 3.2mm. Bandwith is enhanced due to stacked configuration as shown in figure 3 and 4.

Table 1: Size of antenna

Patch 1		Patch 2	
Length L1	Width W1	Length L2	Width W2
70mm	100mm	40mm	80mm
Slot 1		Slot 2	
Length L1	Width W1	Length L2	Width W2
5mm	30mm	6mm	20mm

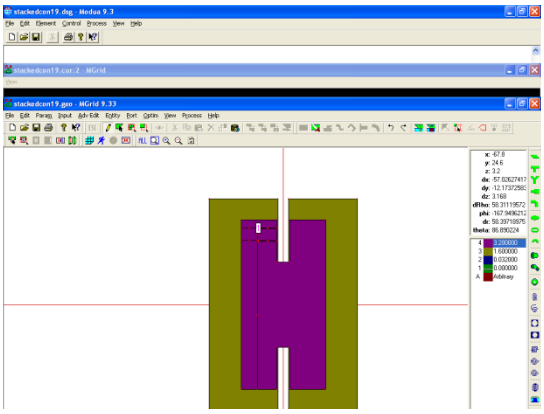

Figure1:Geometry of the proposed patch Antenna with shorting pin and slot

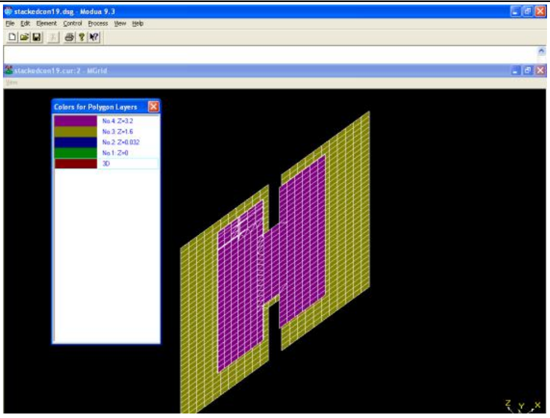

Figure2: Antenna structure

IV. ANTENNA PERFORMANCE

The performance parameters are as shown in following figures

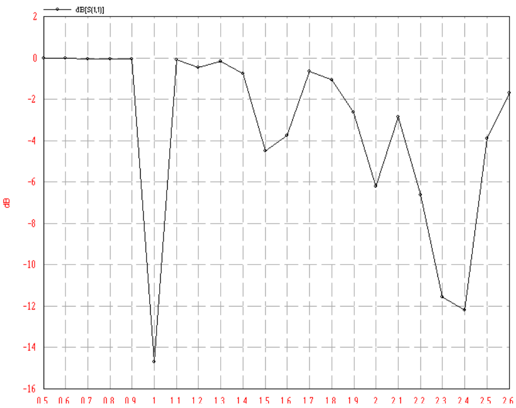

Figure3: Return loss

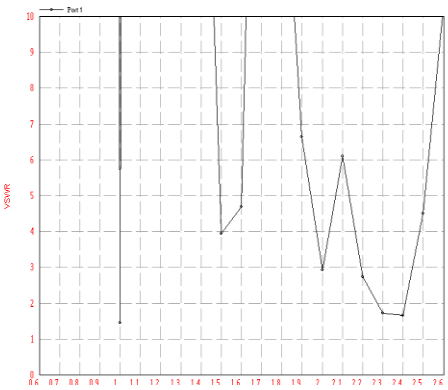

Figure4: VSWR

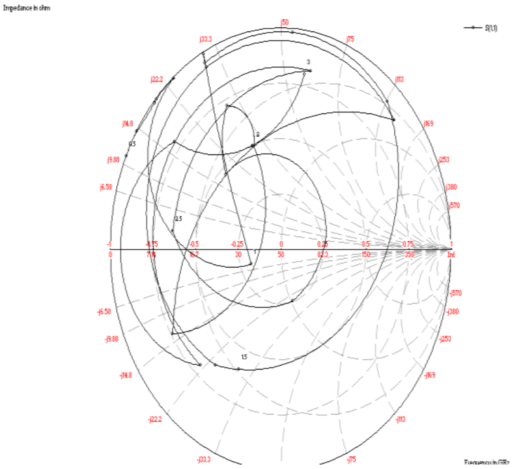

Figure5: Impedance chart

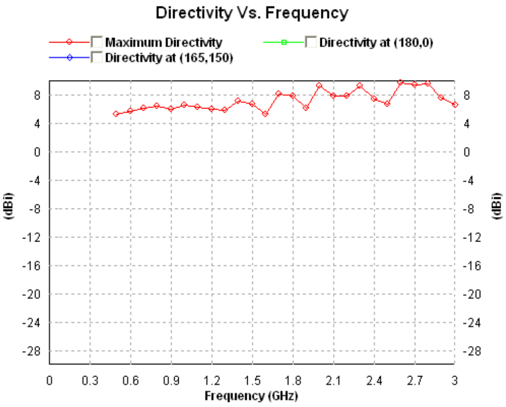

Figure6: Directivity

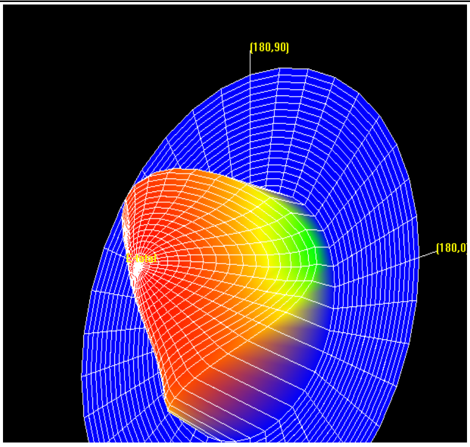

Figure7: Antenna 3D structure

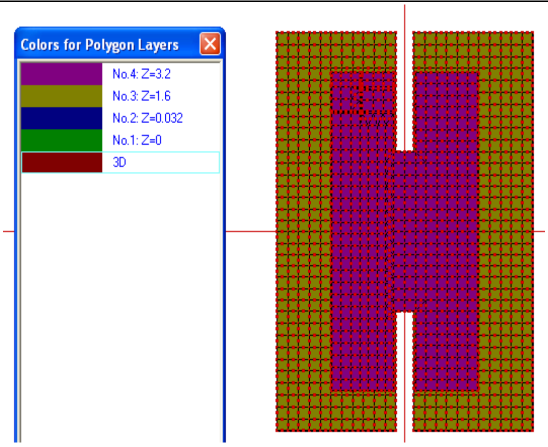

Figure8: Meshing structure

V. CONCLUSION

A small multi-band compact antenna with shorting pin and slot on the top and bottom patch using coaxial feeding is presented for 1, 2.4 GHz application. Result shows BW at 1GHz is 60MHz and at 2.4GHz it is 160MHz . This antenna has a very simple structure printed on a very cheap FR4 substrate for commercial purposes. Wideband has achieved by using a slot on the patches. The antenna characteristic are satisfactory for most of the wireless system.

REFERENCES

[1] Microstrip Patch Antenna Bandwidth Enhancement Using AMC/EBG Structures R. C. Hadarig, M. E. de Cos, and F. Las-Heras Hindawi Publishing Corporation International Journal of Antennas and Propagation Volume 2012, Article ID 843754, 6 pages doi:10.1155/2012/84375.

[2] A Compact Planar Multiband Antenna For Integrated Mobile Devices, W.-J. Liao, S.-H. Chang, and L.-K. Li Progress In Electromagnetics Research, Vol.10,1{16, 2010

[3] Antenna System For Multi-Band Satellite Communications, Mark D. Cavalier, Overwatch Systems, Ltd Tomorrow's Communications Today! ©1997 IEEE

[4] Integration of Simple Antennas to Multiband Receivers using a Novel Multiplexer Design Methodology, S.M. Shajedul Hasan, , and Steven W. Ellingson Ieee Transactions On Antenna & Propagation, Vol. Xx, No. Xx, Xxxx 2011

[5] Multi-Band Active Integrated Antenna Using Clapp Oscillator Circuit Seunggun Baek, Gang-Sik Lee, Kyunghaeng Lee, Yong Jee, The 6th International Conference on Telecommunication Systems, Services, and Applications 2011

[6] Multiband LNA Design and RF-Sampling Front-Ends for Flexible Wireless Receivers, Stefan Andersson, ISBN 91-85523-22-4 ,ISSN 0345-7524

[7] Dual-Frequency Broadband-Stacked Microstrip Antenna Using a Reactive Loading and a Fractal-Shaped Radiating Edge, J. Anguera, C. Puente, C. Borja, , and J. Soler, Ieee Antennas And Wireless Propagation Letters, Vol. 6, 2007

[8] PIFA With a Meandered and Folded Patch for the Dual-Band Mobile Phone Application,Hong-Twu Chen, Kin-Lu Wong, and Tzung-Wern Chiou, Ieee Transactions On Antennas And Propagation, Vol. 51, No. 9, September 2003