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Multibanding of microstrip patch antenna by moving patch position

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Abstract: This paper investigate some methods for converting single band antennas to multiband antennas so that all single band antennas convert in multiband antennas and gives multiband facility without increasing the cost of manufacturing. Simulation is performing on Ansoft HFSS and corresponding result are shown by figures. Impedance bandwidth, antenna gain and return loss are observed for the proposed antenna. This proposed patch antenna is suitable for implementing low cost and high stable pattern. Details of the measured and simulated results are presented and discussed.

Index Terms: Micro strip Antenna, Resonant Frequency, Radiation Pattern, Return Losses.

I. INTRODUCTION

In high performance aircraft, spacecraft, satellite, and missile applications where size, weight, cost, performance, ease of installation, low profile, easy integration to circuits, high efficiency antennas may be required. Presently there are many other government and commercial applications, such as mobile radio and wireless communication.[1]To meet these requirements micro strip antenna can be used. There are several types of micro strip antennas (also known as printed antennas) the most common of which is the micro strip patch antenna or patch antenna.

A patch antenna is a narrowband, wide-beam antenna These antennas are low profile, conformal to planar and non-planar surface, simple and inexpensive to manufacture using modern printed circuit technology, mechanically robust when mounted on rigid surface, compatible with MMIC designs and when the particular shape and mode are selected they are very versatile in terms of resonant frequency, polarization, field pattern and impedance. Micro strip antenna consist of a very thin metallic strip (patch) placed a small fraction of a wavelength above a ground plane.

The patch is generally made of conducting material such as copper or gold and can take any possible shape. The radiating patch and the feed lines are usually photo etched on the dielectric substrate. The patch and ground plane are separated by dielectric material. Patch and ground both are fabricated by using conducting material.[2]

However the major disadvantage of the micro strip patch antenna is its inherently narrow impedance bandwidth. Much intensive research has been done in recent years to develop bandwidth enhancement techniques.[9]The most desirable for good antenna performance are thick substrates whose dielectric constant is in the lower end of the range because they provide better efficiency, larger bandwidth, loosely bound fields for radiation into space, but at the expense of larger element size. These techniques includes the utilization of thick substrates with low dialectic constant .The use of electronically thick substrate only result in limited success because a large inductance is introduce by the increased length of the probe feed, resulting few percentage of bandwidth at resonant frequency.

II. ANTENNA DESIGN

The single band rectangular micro strip antenna is shows in figure 2.1. In this the dielectric substrate has two surfaces these surfaces are fully metalized. First surface is known as ground plane and the second surface is known as patch. Copper is used as a coaxial feed. The thickness, height and position of feeding is shown in figure 2.1.

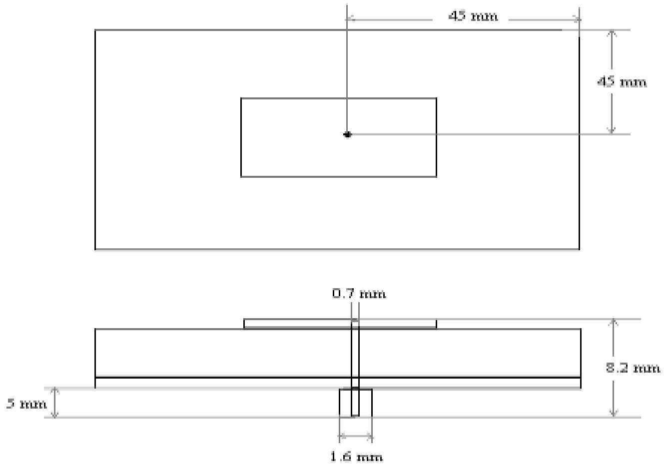

Figure 2.1: Feeding position (Antenna A)

The antenna A is a single band antenna. The feed point of patch antenna is at center (45, 45).

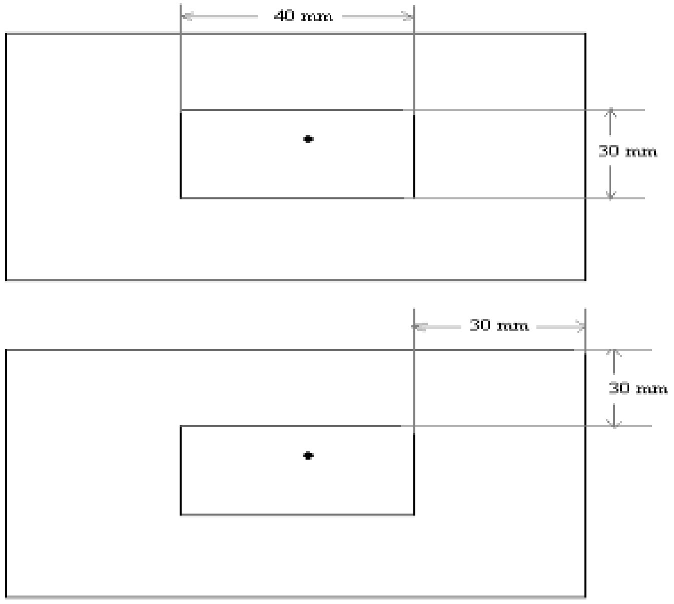

Figure 2.2: Length, width and position of patch (Antenna A)

The Position of patch of antenna A is at center (30 mm, 30 mm). If we move the Patch position 5 mm left from the center (now 30, 25). Then this antenna works on Dual Band. This antenna is known as Antenna "B" shown in figure 2.3. The coaxial feed is used for feeding. The thickness, height and position of feeding are shown in figure 2.3.

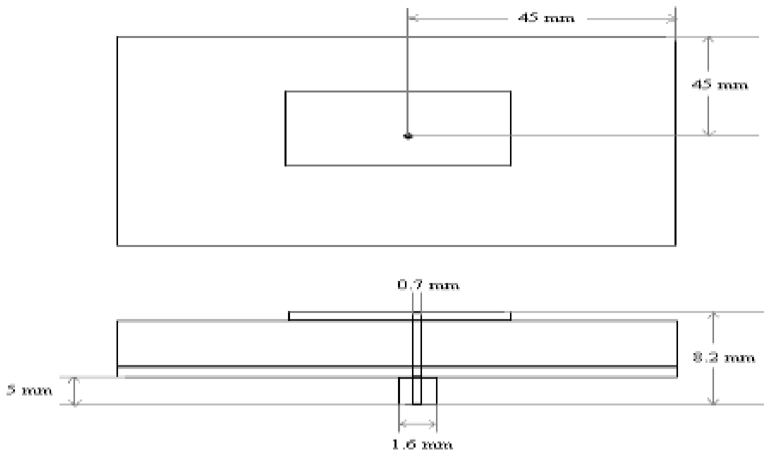

Figure 2.3: Feeding position (Antenna B)

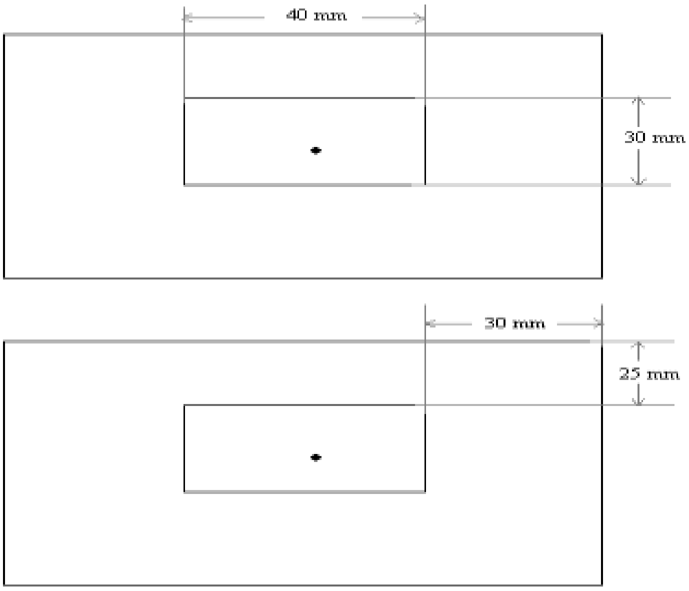

Figure 2.4: Length, width and position of patch (Antenna B)

III. RESULTS AND DISCUSSION

The simulation is done on Ansoft HFSS. Single band microstrip patch antenna simulation model of antenna A is shown in figure 3.1. The coaxial feed used in designed to have a radius of 0.7 mm. The center frequency is selected as the one at which the return loss is minimum.

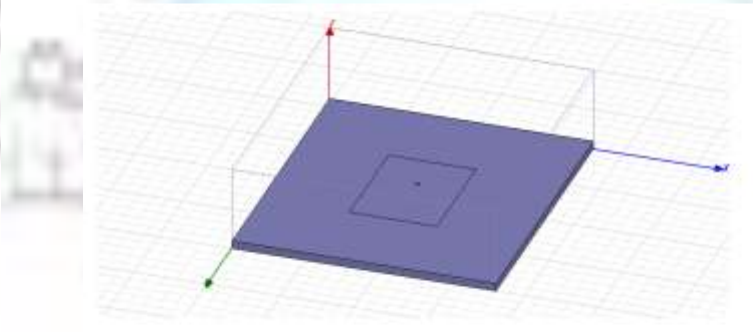

Figure 3.1: simulation model(Antenna A)

Return loss and antenna bandwidth:

The bandwidth of this patch antenna is 50 MHz and a center frequency 2360 MHz is obtained. Figure 3.2 shows the Return loss (in dB) is plotted as a function frequency.

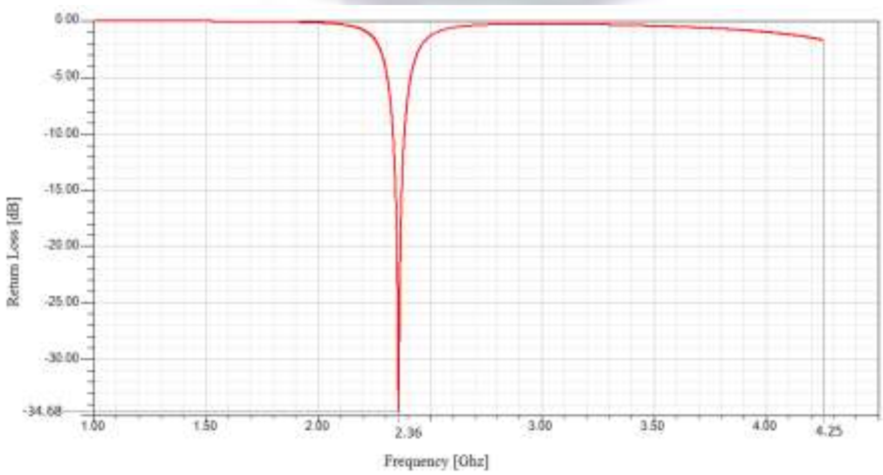

Figure 3.2: Return loss of patch antenna (Antenna A)

VSWR:

Voltage Standing Wave Ratio (VSWR) is an important property of patch antenna. Figure 3.3 shows the VSWR (in dB) is plotted as a function frequency. The VSWR of this antenna at center frequency is 0.33 dB.

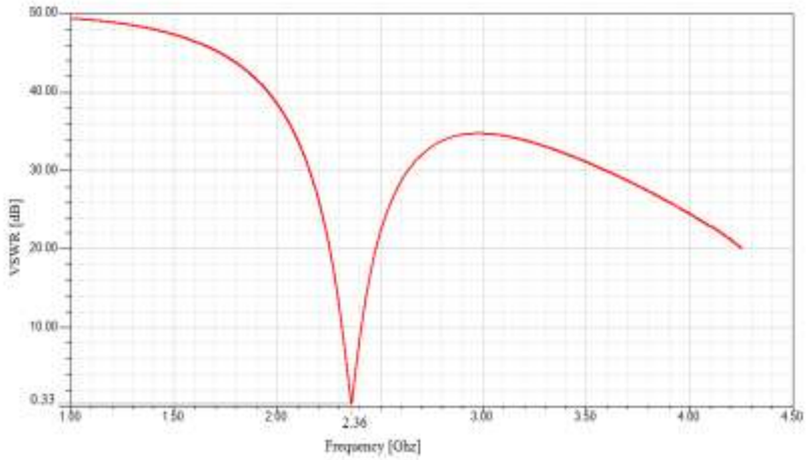

Figure 3.3: VSWR of Patch antenna (Antenna A)

Simulation model of antenna B is shown in figure 3.4.

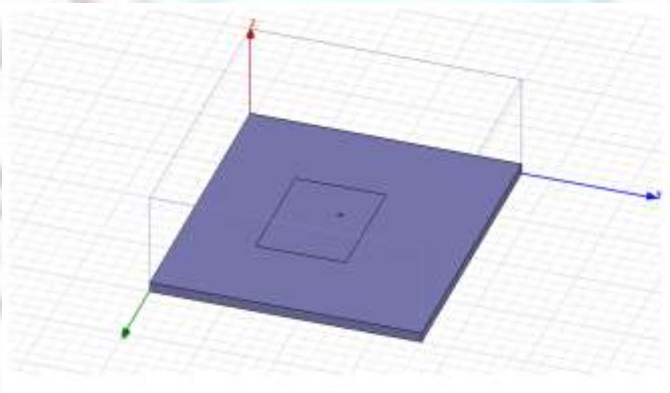

Figure 3.4: Simulation model of patch antenna (Antenna B)

Return loss and antenna bandwidth:

The bandwidth of First Band of this patch antenna is 49 MHz and a center frequency 2360 MHz and bandwidth of Second Band of this patch antenna is 78 MHz and a center frequency 3005 MHz are obtained. Figure 3.5 shows the Return loss (in dB) is plotted as a function frequency.

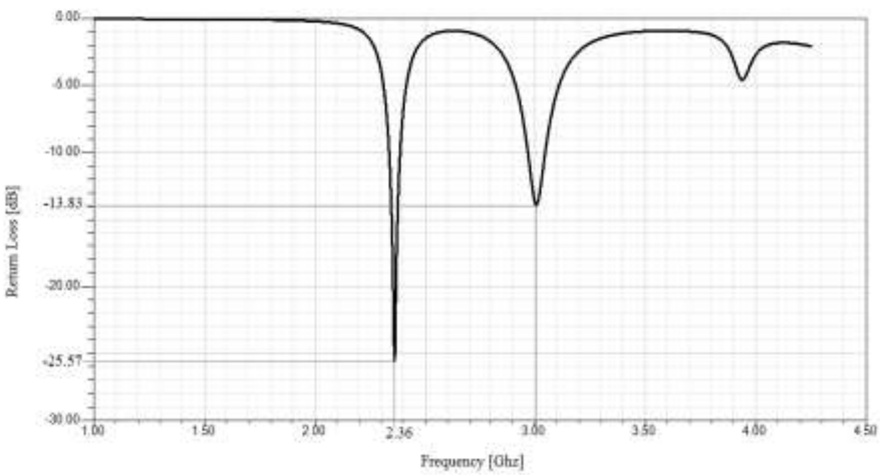

Figure 3.5: Return Loss of patch Antenna (Antenna B)

VSWR:

The VSWR of first band at center frequency is 0.97 dB and VSWR of second band at center frequency is 3.63 dB.

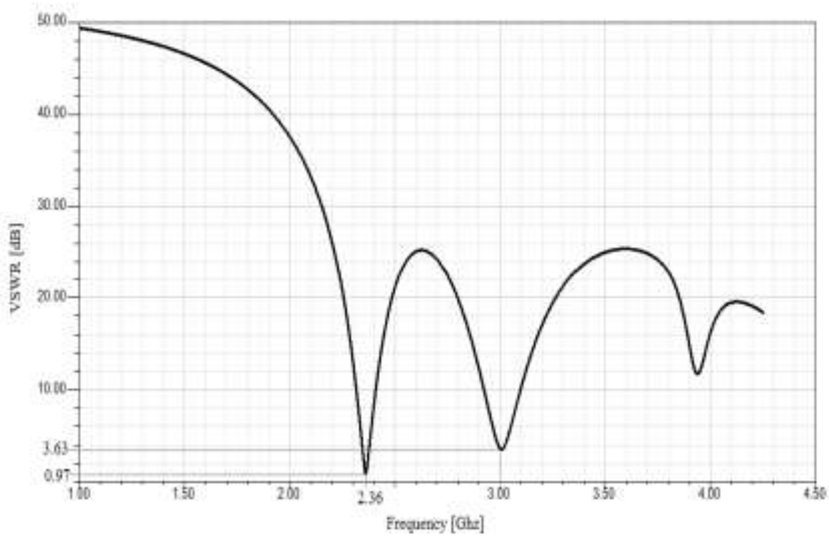

Figure 3.6: VSWR of Patch Antenna (Antenna B)

CONCLUSIONS

For antenna A bandwidth of patch antenna is 50 MHz and a center frequency 2360 MHz is obtained. The VSWR of this antenna at center frequency is 0.33 dB. For antenna B after moving the patch by 5 mm bandwidth of First Band of this patch antenna is 49 MHz and a center frequency 2360 MHz and bandwidth of Second Band of this patch antenna is 78 MHz and a center frequency 3005 MHz are obtained. The VSWR of first band at center frequency is 0.97 dB and VSWR of second band at center frequency is 3.63 dB.

REFERENCES

[1]. James, J.R. and Hall, P.S.: 'Handbook of Microstrip Antennas' (Peter Peregrinus).
[2]. Constantine A. Balanis : 'Antenna Theory, Analysis and Design' (John Wiley & Sons).
[3]. Lu JH, Tang CL, Wong KL, 'Novel dual-frequency and broadband designs of the slot-loaded equilateral Triangular Microstrip Antenna' IEEE Trans. Antennas Propag. 2000;48;1048-54.
[4]. Row JS. 'Dual-frequency triangular planar inverted-f Antenna' IEEE Tran Antennas Propag 2005;53;874-6.
[5]. Kai-Fong Lee, Kwai- Man Luk, Jashwant S. Dahele, 'Characteristics of the Equilateral Triangular Patch Antenna ' IEEE Tran. Antennas Propag.1988;36;1510.
[6]. C. L. Mak, K. M. Luk, K. F. Lee, ' Wideband Triangular Patch Antenna' IEE. Proc. Microwave Antennas Propag. 1999.
[7]. Shan-Cheng Pan and Kin- Lu Wong, ' Dual Frequency Triangular Microstrip Antenna with Shorting Pin' IEEE Tran. Antennas Propag.1997;45;1889.
[8]. D.M. Pozar and D. H. Shaubert, 'Microstrip Antennas : The Analysis and Design of Microstrip Antenna and Array' IEEE Press,Inc., 1980.
[9]. I. J. Bahl and P. Bhartia, 'Microstrip Antennas, Artech House, Dedham, MA, 1980.
[10]. Ansoft Designer, www.ansoft.com.
[11]. IE3D [1] by Zeland software Inc..