ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 5, Issue 2, February 2016

DESIGN OF PLANNER INVERTED F-ANTENNA FOR DUAL BAND ISM SPECTRUM

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***Abstract*-In this paper, the new configuration for planar inverted-F antenna (PIFA) is proposed for dual band wireless application. To reduce the size of the antenna, folded and shorted structure is used. In the rapid progress of commercial communication applications the development of small integrated antenna has animportant role. Planar inverted-F antennas (PIFAs) are commonly used as handset antennas. It has been shown that the proposed antenna can cover the operating frequencies range of 2.4-2.48 GHz. It is compact, low cost and having better antenna performance in terms of return loss, radiation patterns, VSWR etc. The characteristics of the antenna are simulated using software Ansoft HFSS.**

***Keywords*-PIFA, FR4 dielectric, ISM, HFSS, return loss, gain, VSWR.**

I. INTRODUCTION

PIFAs have features such as small size, light weight, low-profile, simple fabrication and relatively low specific absorption rate(SAR). Due to SAR of energy in the human body, this antenna provides good efficiency.Hence, miniaturized antennas formultiple bands applications has been a brilliant topic inantenna design.These antennas are generally designed to cover one or more wireless communications bands such as GSM,GPS,UTMS,WLAN,etc.
It has been observed that there have been a number of PIFA designs with different configuration to achieve single and multiple operations by using different shapes. In last few years, the demand for compact, smaller in size communication devices has increasing gradually. At current period of time the demand ofWireless local area networks (WLANs) are increasing worldwide, because they provide high speed connectivity and easy access to the networks without required wiring, also Wireless Fidelity (Wi-Fi)-enabled wireless devices such as the laptop, computer, mobile phone, etc.

It can work on single band at a time or dual band simultaneously depending upon the capabilities of individual devices.Dual band antennas allow you to connect wirelessly in harder to reach locations and often use for device such as cellular or dual band wireless access point.

In this paper, a compact dual band PIFA formobile phone applications has been presented. This antenna has a compact structure, performance characteristics, andoperates with only a single coaxial feed.The effects of different feed positions and shorting wall width are studied. The proposed antenna satisfies the return loss, VSWR, gain, etc. The measured reflection coefficient, radiation pattern, VSWR and gain are characterized.

II. DESIGN AND SIMULATIONS

In this paper we will design a dual band PIFA at a resonant frequency ranging from 2.4-2.48GHz. We will employ the following procedure for the dual band PIFA design.The schematic diagram of proposed antenna is shownin Figure-1.The proposed antenna structure includes a radiation patch, a ground plate, a coaxial feed, and a shortingplate. Air is used as dielectric medium between theradiation patch and the ground.

The coaxial feed is referred as the outer conductor of the coaxial cable is connected to the ground plane, and the center conductor is extended up to the patch antenna. The position of the feed can be altered as before to control the input impedance. The coaxial feed introduces an inductance into the feed that may need to be taken into account if the height h gets large. In addition, the probe will also radiate, which can lead to radiation in undesirable directions.

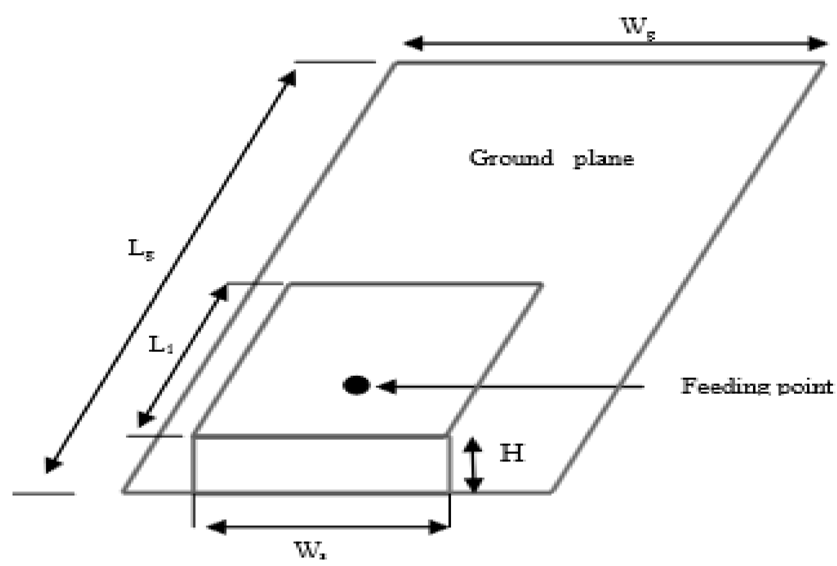

Fig. Basic Structure

Where,

Lg-Length of ground plane.
Wg-Width of ground plane.
L_1-Length of Patch.
W_1-Width of Patch.
H-Distance between Patch and Ground.

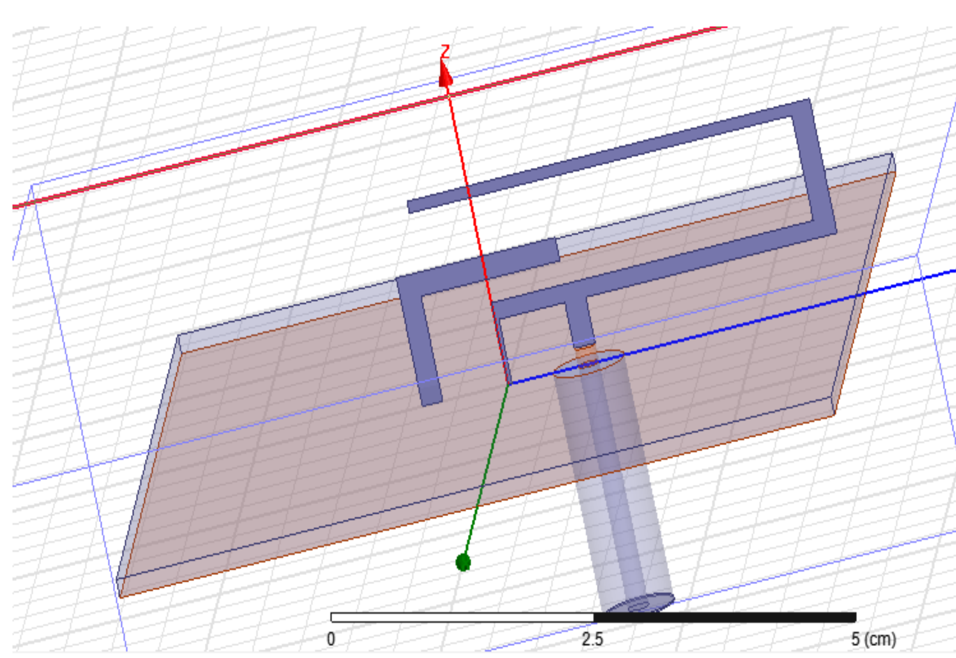

Fig. Simulated Structure

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III.RESULTS

[1] Return Loss:- The amount of power to the lost to the load and does not return as a reflection. Return loss is a convenient way to characterized the input and output of signal source. Return loss is totally depends on reflection coefficient(r). It should be below -10dB for better performance for transmission.The simulated return loss characteristics of the proposed antenna is shown in Fig.below From the graph it can be seen that resonant frequencies achieved are 2.44GHz and 3.06GHz with return loss of -41.31 dB and -20 dB resp.

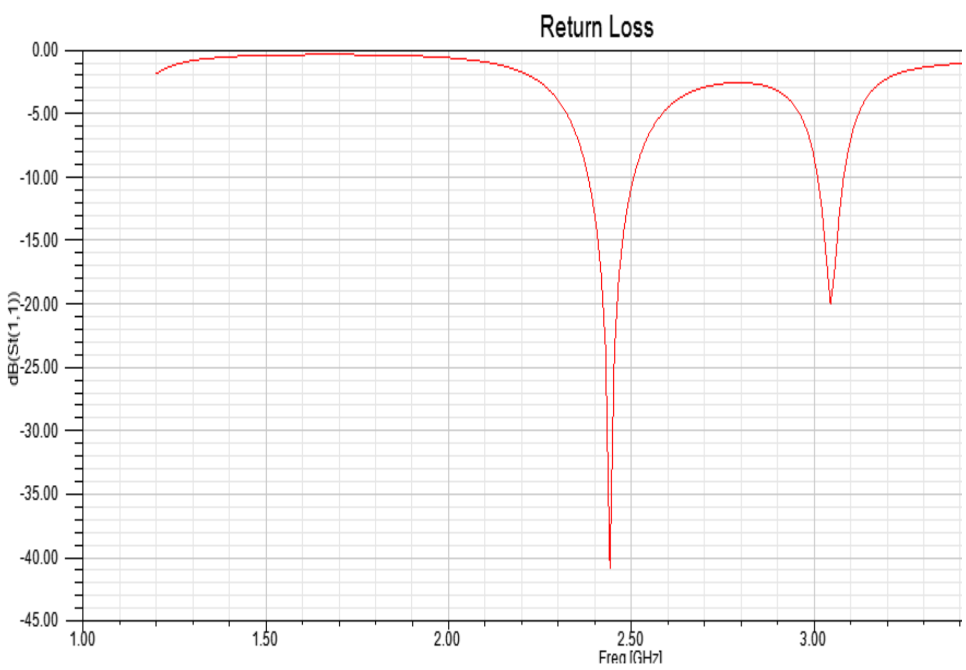

Fig. Return Loss

[2] Input Impedance:-Antenna Impedance is presented as the ratio of voltage to current at the antenna's terminals. Low- and High-Frequency models are presented for transmission lines. The fundamentals of antenna requires that the antenna be "impedance matched" to the transmission line or the antenna will not radiate. Perfect impedance matching for transmission and receiving purpose must be marked at 50Ω.

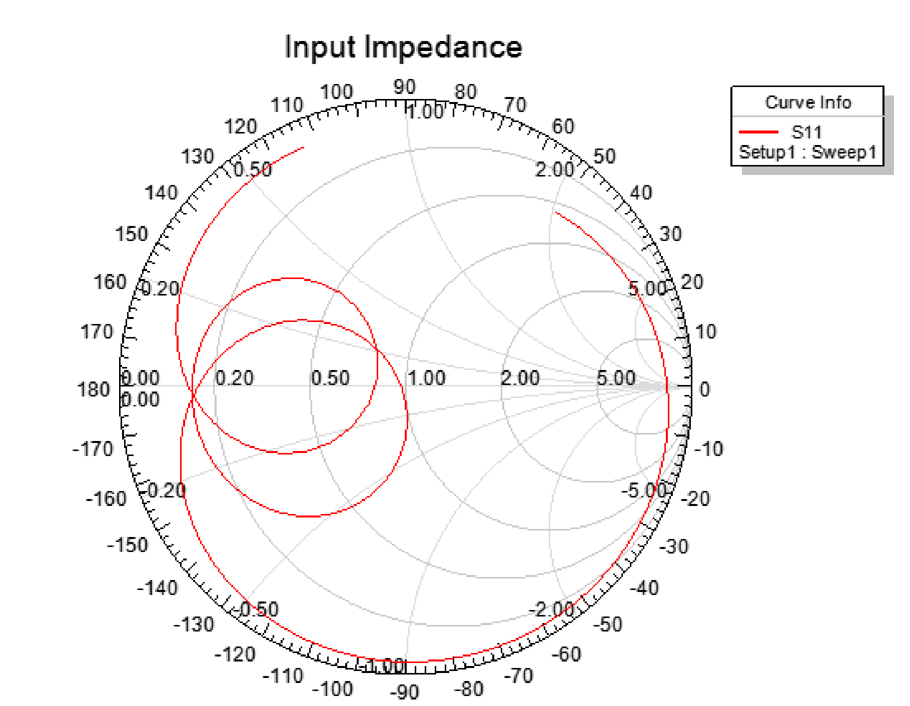

Fig. Input Impedance

[3] 3D and 2DGain:-Antenna Gain is a measure of power radiated in a particular direction (typically the peak direction of radiation).The gain and efficiency are the two important parameters of the antenna. The overall gain of the antenna obtained after simulating the PIFA structure is shown in Fig. below A peak gain of 4.27 dB has been achieved. This value of gain achieved by the proposed structure is moderate value and considered to be good for the overall performance of the antenna.

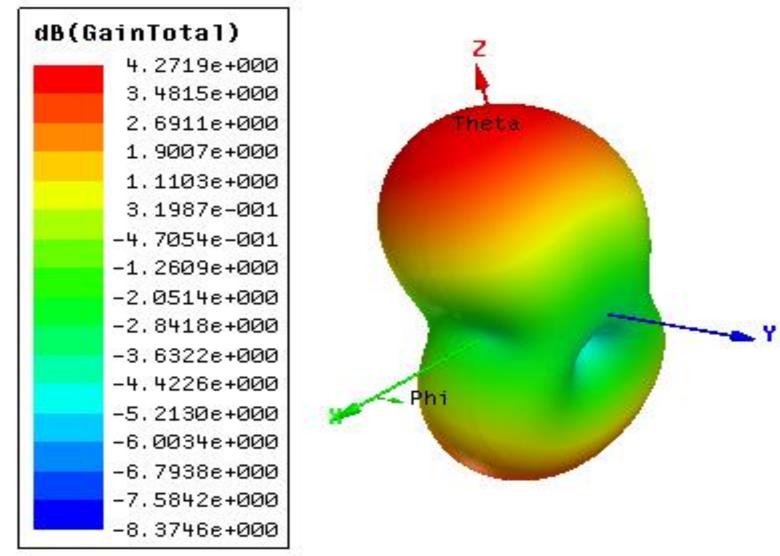

Fig. 3D Gain

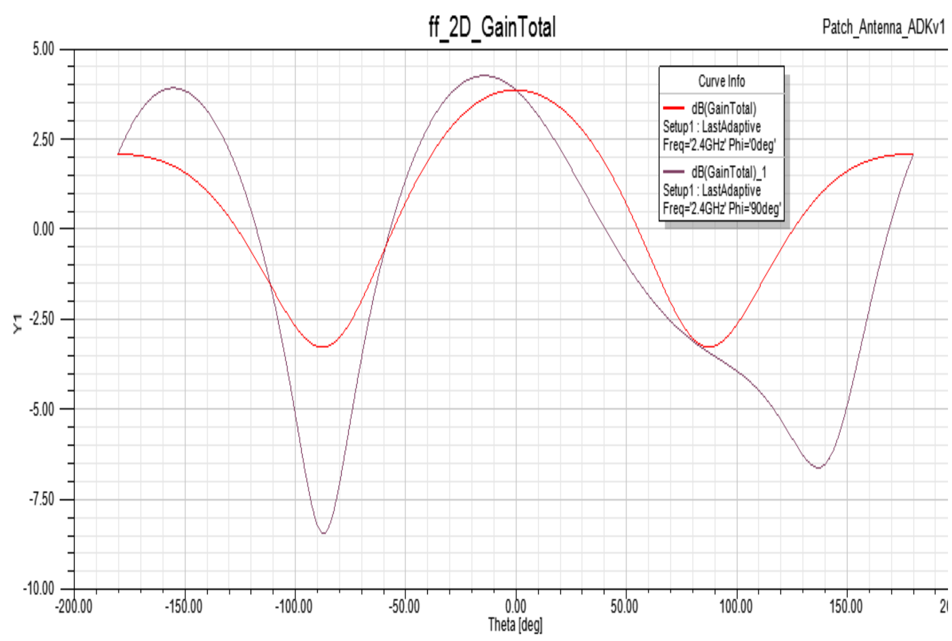

Fig. 2D Gain

[4] VSWR:-Voltage Standing Wave Ratio (VSWR) is a ratio of peak voltage on the minimum amplitude of voltage of standing wave . The VSWR is always a real and positive number for antennas. The smaller the VSWR is, the better the antenna is matched to the transmission line and the more power is delivered to the antenna. It is illustrated in Fig. below that at 2.44 GHz VSWR is 1.0 dB and at 3.06GHz VSWR is 1.4 Db. Also it is observed from the results that at these resonant frequencies the Voltage Standing Wave Ratio is below 2 dB which is desirable for most of the wireless applications.

$$\Gamma = \frac{Vr}{Vf}$$

Vr :- reflected wave

Vf :- forward wave

Γ = -1 negative reflection line is short circuited.

Γ = 0 no reflection line perfectly matched.

Γ = +1 positive reflection line open circuited.

$$\mathrm{VSWR} = \frac{|V_{\max}|}{|V_{\min}|} = \frac{1+|\Gamma|}{1-|\Gamma|}.$$

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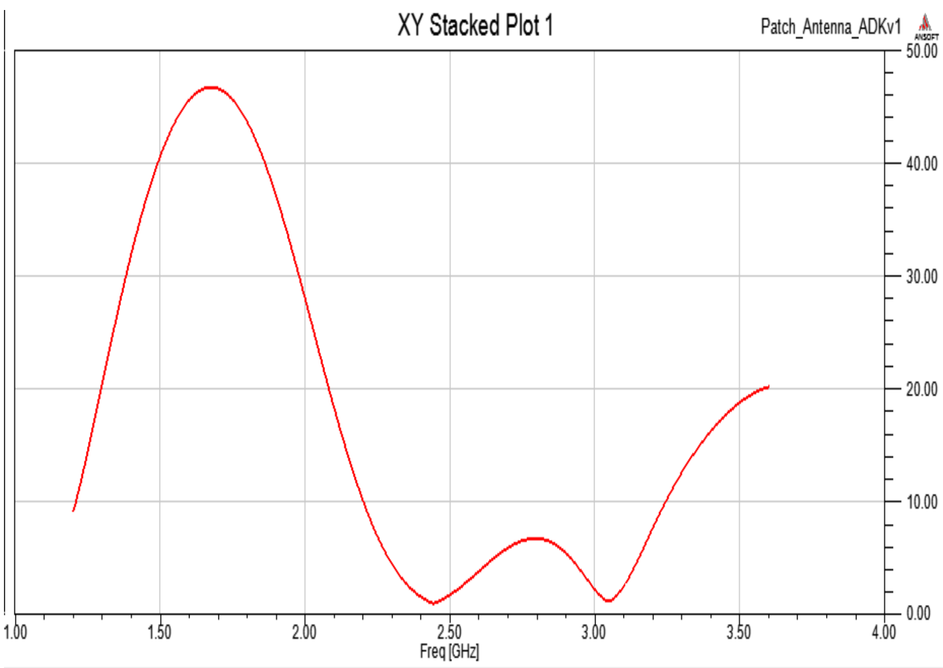
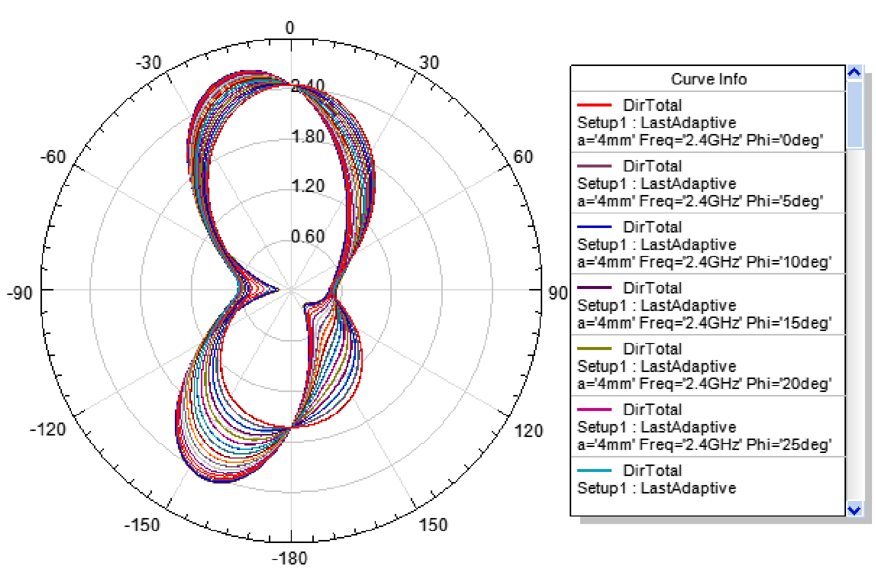


Fig. VSWR

[5] DIRECTIVITY:-Directivity is a fundamental antenna parameter. It is a measure of how 'directional' an antenna's radiation pattern is. An antenna that radiates equally in all directions would have effectively zero directionality, and the directivity of this type of antenna would be 1.

$$D = \frac{1}{\frac{1}{4\pi}\int_0^{2\pi}\int_0^{\pi}|F(\theta,\phi)|^2 \sin\theta d\theta d\phi}$$



[6] Data Table:-

	Freq [GHz]	ActiveVSWR(coax_pin_T1) Setup1 : Sweep1 a='0.2mm'	ActiveVSWR(coax_pin_T1) Setup1 : Sweep1 a='0.4mm'
99	2.381910	1.925595	1.925595
100	2.393970	1.688611	1.688611
101	2.406030	1.479621	1.479621
102	2.418090	1.296351	1.296351
103	2.430151	1.136510	1.136510
104	2.442211	1.007275	1.007275
105	2.454271	1.140120	1.140120
106	2.466332	1.292690	1.292690
107	2.478392	1.460935	1.460935
108	2.490452	1.644786	1.644786
109	2.502513	1.843875	1.843875
110	2.514573	2.057501	2.057501
111	2.526633	2.284631	2.284631
112	2.538693	2.523917	2.523917
113	2.550754	2.773727	2.773727
114	2.562814	3.032182	3.032182
115	2.574874	3.297195	3.297195
116	2.586935	3.566520	3.566520

[7]Terminal VSWR:-Antennas voltage standing wave ratio for terminal is a representation of the VSWR magnitude in the three dimensional structure.it shows that how the transmission signal is sustain in the space according to the resonant frequency for dual band.

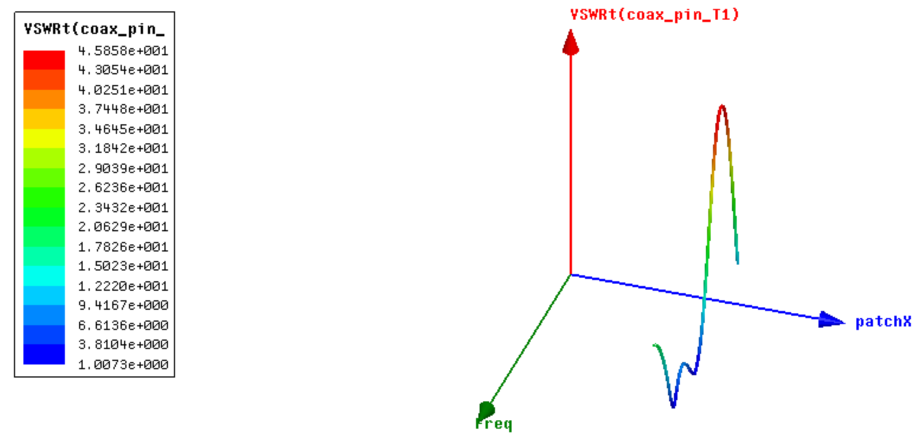


Fig.3D pattern of VSWR

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