International Journal of Engineering and Techniques - Volume 4, Issue 3, May - June 2018

RESEARCH ARTICLE OPEN ACCESS

PIFA Antenna for Wireless Communications

V. Preethi[1] , S.Annapurna Devi[2],

(Assistant Professors, Ece Dept,Aditya College Of Engineering & Technology)

Abstract:

PIFA is abrivation of planar inverted antenna is actually a patch antenna where a shorting pin is introduced. An implantable compact planar inverted antenna designed for wireless telemetry is being proposed for operating in Australian ISM band of 900 MHz and 915-928 MHz IN wireless telemetry pifa antenna was designed and which is explained in this paper..PIFA antenna can also designed for testing antenna inside living body. The PIFA antenna is basically developed from the monopole antenna, Inverted L is realised by folding down the monopole in order to decrease the height of the antenna at the same time maintaining identical resonating length. When feed is applied to the inverted L, the antenna appears as inverted F as shown in figure. Also the addition of a shorting pin between the ground plane and patch planes increases the effective size of the PIFA antenna, thus further reducing the physical dimensions .In this paper i am going to compare it with the two types of feeding techniques i.e. line feeding with coaxial feeding.

Keywords- PIFA, HFSS.

I. INTRODUCTION

Planar Inverted F Antenna (PIFA) is a linear Inverted F antenna (IFA). In order to increase the Bandwidth and resonating frequency, the radiator element is replaced by a plate. PIFA which has reduced backward radiation enhance antenna performance in terms of gain and minimizes the wave produced due to power absorption. It has maximum gain in terms of polarization states like horizontal and also vertical. By chaging the height, length, width of the ground plane the bandwidth can be tuned. To decrease the quality factor and to boost the bandwidth, many slits can inserted in the ground plane. In medical applications, the main aim is to reduce the size of PIFA antenna maximum.

II.EXISTING SYSTEM

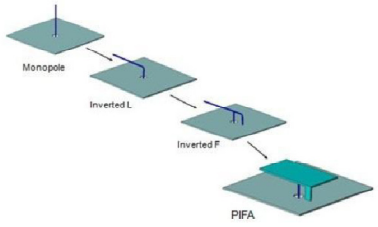

Fig 1:PIFA from monopole

This approach can have an effect on the impedance of the antenna terminals and it can be compensated with capacitive top loading and inductive loading. Equivalent circuit is replaced for the missing antenna height which improves the efficiency and impedance match. At the expense of fine matching and bandwidth, the resonance length can be reduced to less than λ/8 from λ/4 by the capacitive loading in the circuit. To produce a parallel plate capacitor, the capacitive load can be placed by an additional plate which is equivalent to the ground. The geometrical shape of PIFA antenna is shown below in Fig.1.

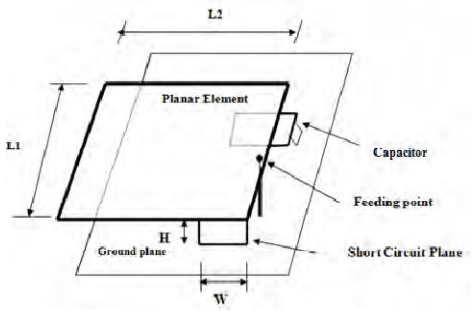

Fig 2: Equivalent circuit of PIFA

The approximate resonant frequency of PIFA is:

$$L1 + L2 = \lambda/4$$

When W/L1=1, $L1 + H = \lambda/4$

When W=0, $L1 + L2 + H = \lambda/4$

Where L1, L2 are the lengths of PIFA and W is width of PIFA ,When the width W decreases, the resonant frequency also decreases. Usually the micro-strip antennas are half wavelength dimensions, where as the PIFA antenna is a quarter-wavelength dimension.Hence it is

suitable for the medical applications .The impedance matching is obtained by reducing the distance between feed and shorting pins. The shorting pin and single feed are placed inside the slot for good impedance matching. The radiation pattern of this antenna is a function of direction in space with the relative distribution of radiated power .Radiation properties are as follows i.e field strength, power flux density, polarization and phase. The quality factor Q is inversely proportional to the impedance bandwidth of antenna.

Q = Energy Stored / Power Lost.... (4)

As shown in Fig. 2, the basic PIFA consists of a DC-shorting plate, a plate at the top of resonating patch, feed wire which feeds the resonating top plate and a ground plane which connects the ground and the top plate. Thus, the Planar Inverted-F Antenna is used in applications which consists a low profile and an omni directional pattern.

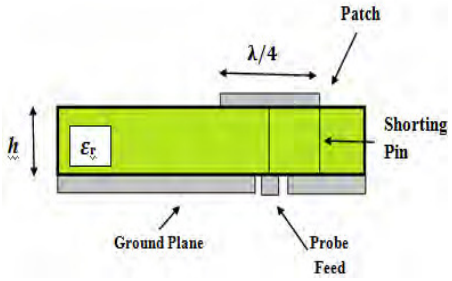

Fig 3. Top View of Pifa Antenna

The feed is placed between the open and short end. The feed location controls the input impedance. In PIFA, a plate forms the shorting pin as shown in Fig .3. Here L1 is the length and L2 is width. The feed is at a distance of D from the shorting pin and height h from the ground. The patch is a dielectric with permittivity **εr.** The distance between the feed and the short pin is adjusted to set the impedance. Based on *W,* the resonant frequency varies. If *W=L2*, the entire width of the patch is equal to the shorting pin. The resonant which has a maximum radiation efficiency when: W=L2=>L1= λ/4 (**Fig 4: Side View of PIFA Antenna**

In general, the PIFA resonant length is

L1+L2-W= λ/4 ..... (6)

When *W=0*,

L1+L2= λ/4..... ... (7)

The relating wavelength, speed of light and permittivity can be defined by:

C = λ/4..... (8)

f = co/ (λ*√ **εr**)..... (9)

Hence f = (3*10^8) / (λ*√ **εr**) (10)

III. PROPOSED SYSTEM

PIFA antenna is designed using HFSS SOFTWARE. The PIFA which we designed has minimum return losses ,and gain is about 2db.Here we designed a an antenna with coaxial feed this antenna has the parameters Substrate dimensions: 30×40 mm,Substrate material FR4 EPOXY have value 4.4 Coaxial feed radius 1.6mm,Patch dimensions : 30×40×2

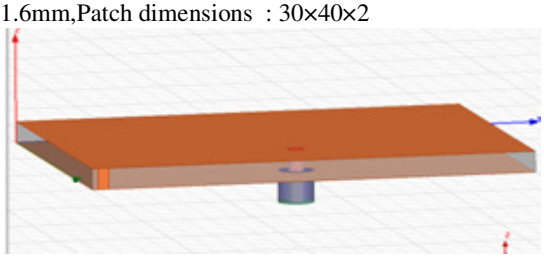

Fig 5: Pifa_Antenna with coaxial feed

3.1 Return Loss:

The lesser return loss the more properly antenna radiating. -10dB value can be considered as the acceptable return loss. For bandwidth calculations -10db is considered as acceptable return loss. The return loss of a PIFA with coaxial feed is -17db at 2.2 khz and -19db at 3.5khz in Fig 6

Fig 6: Return loss of PIFA

3.2 Directivity: Maximum gain in a given direction is called directivity. If antenna efficiency is one directivity and antenna gain are interchangeable. When resonance frequency is 1GHz, a directivity of 1.47dB is achieved as shown in fig 7

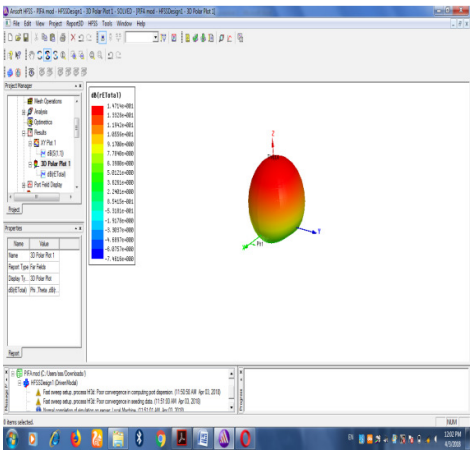

Fig 7: Directivity of PIFA for 1GHz

IV CONCLUSION:

In this Paper, the multi-band Planar Inverted-F antenna for wireless application is proposed. This feed adjusting different positions of the feeding points and source. Also they can achieve higher performance with this adjusting and improvements. antenna has simple structure and design, which make it suitable for implementing as an internal antenna. The bandwidth of antenna covers Wi-Fi/ WLAN applications. And shows better return loss and radiation pattern. Therefore the proposed antenna exhibits the potential for multiband PIFA antenna for wireless applications. The performance of this antenna can be improved by introducing a source in the in the feed line. And by adjusting different positions of the feeding points and source. Also they can achieve higher performance with this adjusting and improvements.

V FUTURE SCOPE:

WIMAX (Worldwide Interoperability for microwave access) technology is considered to be a next generation technology because this technology is aimed at replacing most of the present wireless technologies like Wi-Fi, Bluetooth, microwave and mobile phone technologies. This technology would give rise to a broadband consumer market for wireless digital devices. In this project we have simulated the rectangular patch antenna covering the range frequencies from 1GHz. Similarly we can simulate these microstrip antennas by using different patches with different types of substrate materials (like FR4 epoxy, Gold, Glass etc). It could may result in improvement in return loss, gain and directivity. If we are opting better results beyond that 1GHz frequency range.

REFERENCES

[1] Jui-Han Lu "Broadband Dual-Frequency Operation of Circular Patch Antennas and Arrays with a Pair of L shaped Slots," IEEE Transactions on Antenna and propagation, Vol.51, pp 1018-1023 No.5, May 2003

[2] Jui - Han Lu "Bandwidth Enhancement Design of Single layer Slotted Circular Micro strip Antennas," IEEE Transactions on Antenna and propagation, Vol.51, pp 1126-1129 No.5, May 2003

[3] Y. J Sung and Y.S Kim "Circular Polarized Micro strip Patch Antenna for Broadband and Dual Band Operation" Electronics letters 29th April 2004, Vol.40 no.9

[4] F. Ferrero et al "Dual-Band Circularly Polarized Micro strip Antenna for Satellite Application," IEEE Antenna and Wireless Propagation Letters, Vol.4, 2005.

[5] Microstrip Antenna Design Handbook by BAHL and BHARTIU.

[6] Antenna Theory by Constantine A.BALANIS.

[7] Antenna Theory by J.D.KRASS.

[8] www.Antenna-Theory.com

[9] www.radar-tutorial.org

[10] www.wikipedia.org

[11] www.youtube.com