Design of Key Shaped Slotted PIFA Antenna for Wireless Applications

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Abstract-*To introduce the concept of key shaped slot in*
PIFA antenna for wireless applications and to obtain multiband frequencies. The antenna resonates at various frequencies which can be used for various applications in the latest wireless devices. Currently there is a need for multiband antennas in order to minimize the active profile. The concept is to increase the number of frequencies on a single active plane and to increase the bandwidth. The numbers of frequencies of the antenna are increased using slots which also improve VSWR & return losses. The CAD FEKO software has been used to simulate the antenna.

Keywords-*PIFA- Planar Inverted F-Antenna, VSWR- Voltage Standing Wave Ratio.*

I. INTRODUCTION

Nowadays, modern wireless communication technologies are in the process of rapid development. Multi-system applications have been used explosively. Owing to this, it has been a necessity to design antennas with the characteristics of multiband and wideband for mobile terminals. At present, planar inverted-F antenna (PIFA) is being adopted extensively as handset antennas because of its advantages of compact structure, low profile, easy fabrication, low manufacturing cost and easy integration with portable devices. However, a major disadvantage of the PIFA antenna is its narrow impedance bandwidth. Traditionally used external antennas such as monopoles and helical antennas increase the size of the handset. They are easily broken or there is a possibility of bending. These antennas also have a significant effect on the human body because they are not easy to shield. PIFA antenna is a recent antenna used in mobile technology.

At present, Planar Inverted F-Antennas (PIFA) have attracted much interest due to their small size and appreciable electrical characteristics compatible with existing specification, making it a promising candidate for internal antennas.

Presently, wider bandwidth is required for the increasing demand of modern wireless communication system applications. Generally each antenna performs its function at a single frequency, so different antennas that are needed for different applications will cause a limited space and place problem. New wireless applications requiring operation in more than one frequency band are emerging. Dual-band and tri-band phones have gained popularity because of the multiple frequency bands used for wireless applications. One prominent application is to include Bluetooth, operating band at 2.4 GHz, for short-range wireless use.

In our present work we focus on generation of multi frequency which yields increases the bandwidth and size reduction of antenna. Modern personal communication handsets are required to support various global cellular standards and services with enhanced functionality and improved performance without compromising on their weight, volume, and compactness. Because of severe space constraints, it is not feasible to accommodate a separate antenna for each application in the handset.

1.1 PIFA Structure

Low profile antennas such as PIFAs are widely used in mobile phones. The handset size is limited by battery and size of the antenna. But these antennas suffer from a problem that is common to all electrically small antennas. They have limited bandwidth for a given size. This is a constant challenge for antenna designers, since higher degrees of global operation are sought, which, in turn, requires operation within continually more frequency bands.

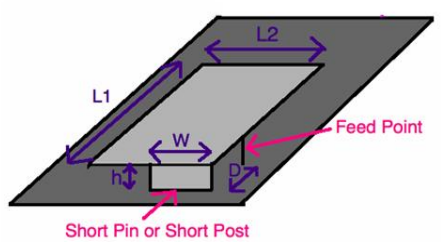

Fig 1.1 Key Shaped PIFA Antenna

It is highly demanded that with multiband performance, the antenna structure should remain compact and its overall volume should not go beyond the acceptable range. Antenna size reduction is generally achieved using shorting pins, stubs, reactive loading and meandering, or folding the resonating antenna sections in a compact configuration. In this article, we propose a PIFA-based internal multiband antenna that can support the following eight frequency bands: GSM (global system for mobile communications, 860–980 MHz), DCS (digital communication system, 1710–1880 MHz), PCS (personal communication services, 1880– 1990 MHz), UMTS (universal mobile telecommunications system, 1.9 –2.17 GHz), Wi-Fi (2300–2390 MHz), Bluetooth (2400–2480 MHz), S-DMB (satellite-digital multimedia broadcasting, 2630– 2655 MHz), and WLAN (wireless local area network, 5000–6000 MHz).

A stub is a length of transmission line or waveguide that is connected at one end only. The free end of the stub is either left open-circuit or (especially in the case of waveguides) short-circuited. Neglecting transmission line losses, the input impedance of the stub is purely reactive; either capacitive or inductive, depending on the electrical length of the stub, and on whether it is open or short circuit. Stubs may thus be considered to be frequency-dependent capacitors and frequency-dependent inductors.

A ground plane is an electrically conductive surface usually connected to electrical ground. The term has two different meanings in separate areas of electrical engineering. In antenna theory, a ground plane is a conducting surface large in comparison to the wavelength, such as the Earth, which is connected to the transmitter's ground wire and serves as a reflecting surface for radio waves. In printed circuit boards, a ground plane is a large area of copper foil on the board which is connected to the power supply ground terminal and serves as a return path for current from different components on the board.

II. ANTENNA DESIGN

2.1 Antenna Configuration And Design Procedure

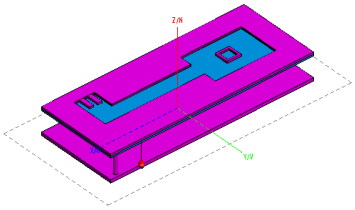

Fig 2.1 Key Shaped PIFA Antenna

Initially a ground plane is created and the dimensions are given and it is swept to a height of 0.5mm.Then we create a stub on the top of the ground plane. Stub has an reactive property and it is mainly used in antenna impedance matching circuits. Now a feed is created. Feed is a component which feeds the radio wave to the antenna structure. It acts as an driven element. On the top of the feed we have substrate. Usually roger is used as a substrate. On the top of the substrate copper material is patched .so, we have designed the key shape on the top of the substrate and it has been slotted. The dimensions for the key are as follows W=40mm, D=40mm, H=0.2 mm. and the parameters u= 10mm,v=0mm,N=3.8mm.

2.2 Simulation And Result

Key shaped slot has been simulated by feeding the frequency up to 0.5 to 12 GHz. Excitation to the antenna is feeded through the wire by creating the port. The excitation given to a feed will be a voltage source.

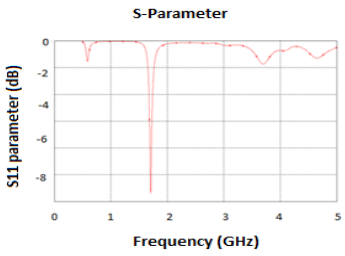

Fig 2.2.1 S Parameter Output

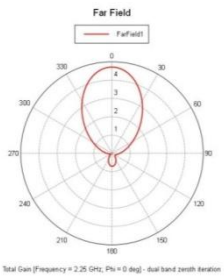

Fig 2.2.2 Gain For Key Shaped PIFA

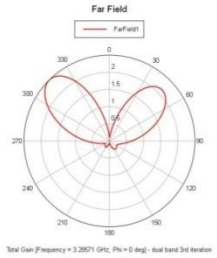

Fig 2.2.3 Directivity For Key Shaped PIFA

III. CONCLUSION

A slotted key PIFA antenna has been designed for the various wireless applications. The proposed antenna has very low profile and a compact structure which meets the bandwidth required for the wireless applications .The antenna is used to improve the bandwidth at both low and high frequencies without increasing the volume of the antenna. Results show that the bandwidth and as the consequence the total efficiency is improved. This antenna radiates similar radiation pattern at all frequencies. Such type of antenna is very useful for the wireless applications.

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