Pak. J. Biotechnol. Vol. 13 (special issue on Innovations in information Embedded and Communication Systems) Pp. 85 - 87 (2016)

DESIGN AND DEVELOPMENT OF T-SHAPED ANTENNA FOR VARIOUS APPLICATIONS

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ABSTRACT:

This paper introduces a T Shaped antenna which is designed for tri-band operations for use in various wireless applications. With the development of many different wireless communication standards to design the antenna is an important role of communications. A suitable antenna design technique is as an important role in recent world for the wireless applications such as Global Positioning System (GPS), Worldwide Interoperability for Microwave Access (WIMAX) and Wireless Area Network Standards (WLAN). The antenna should have low profile, light weight and easy to fabricate for broadband characteristics. Also, it should have very good performances in impedance bandwidth, radiation efficiency, gain, return loss and electromagnetic interference. Various design parameters of the proposed tri-band antenna have also been analyzed for proper tri-band operations using slots. CST microwave studio simulation tool is used to obtain the radiation parameters of the proposed antenna. The antenna resonates at a frequency of 10 GHz with a bandwidth of 4500 MHz. A good return loss is obtained with rectangular shaped configuration. The proposed T shaped antenna is also found to operate at 2.65 GHz, 3.65 GHz and 4.65 GHz.

Keywords: T-Shaped, Radiation Pattern, S Parameters

INTRODUCTION

Wireless products in recent days are expected to be small, lightweight and curvy. Designing an integrated antenna with multi-band operation is difficult to satisfy the bandwidth requirements [1]. Optimizing the performance of the integrated antenna for wire-less products is characterized by large bandwidth, unidirectional radiation pattern and low power consumption [2]. Dielectric-loading effects are expected when cellular phones are used in close proximity to human head. An antenna comprising a metal-wire-cutting bended monopole antenna (BMA) fed by mini-coaxial cable along with a thin printed ground-line to operate at hex-band: CDMA, GSM, DCS, PCS, WCDMA, GPS bands [3]. Balance-feed structure of the antenna is provided by a printed thin ground-line that protrudes from ground-plane is like a sleeve-balun for BMA which overcome the inter-action between the antenna and human body [4]. This antenna combines omni-directional; balance-feed structure, broad bandwidth and low profile in an easy to fabricate structure and the design details of the prototype are discussed below.

Antennas can be classified in several ways that include the frequency band of operation, physical structure and electromagnetic design [5]. The antennas most commonly used for base stations, simple and dipole or monopole antenna. Diversity is a technique that improves reception of radio waves with the signals varies with time at the separated locations [6]. An antenna comprised one or more dipole elements in front of a corner reflector are also called the corner reflector antenna. It has high gain and better front to back ratio. Yagi Uda Antenna can be constructed with one or more (reflector and director elements) to support the horizontal or vertical polarization is used for point to point applications [7]. Multiband antennas are designed to operate the VHF and UHF bands. Radars for synthetic aperture imaging (SAR), shuttle imaging and remote sensing operate at X band [8]. It is suitable for such applications micro-strip patch antenna and also requires low profile, light weight and efficient antennas. Microstrip Patch Antenna can provide high gain, wide bandwidth and improved efficiency [9].

The combination of low PA efficiency and continuous PA operation causes the battery to drain quickly and the resulting internal power dissipation can also make the phone overheat [10]. PA runs continuously until the data transmission is complete, which leads to phone heating. Power dissipation was a major problem for the early WCDMA handsets that supported high-speed data-transmission services.

ANTENNA DESIGN

Multipath fading is an effective technique for reducing the electromagnetic interference. Mobile station should have better performance of cost, size, multipath fading decreases, Interference signals suppressed, Cell reliability improved efficiency and data rates. Smart antennas consists of several antennas have improve the wireless system performance, whose signal is processed the spatial domain of the mobile radio communication. The advantages of smart antennas are increase PC Cellular operators, local networks, signal quality increases, Network capacity and coverage. Antenna Array combined with smart antenna system with the help of digital signal processing to transmit and receive in adaptive signals. Such System can automatically change the direction of the radiation pattern for the signal capacity. Multipath signal arises from different direction, whose trans-

mitted signal undergoes reflection from various obstacles at the receiver. Adaptive array antennas and multiple antennas are used to identify the directional of arrival of the signal.

Smart antenna techniques are used as signal processing, RADAR and Cellular systems. The diversity effects are the advantage of smart antenna in the area of digital wireless communication system because both the transmitter and receiver take place. A smart sensor consists of transduction elements, signal conditioning circuits, controller and processor in a single package to advances in complementary metal oxide semiconductor and micro electro mechanical system technologies. RF power Supply is an important role in smart sensors.

The proposed antenna is designed on FR4 substrate having dimensions 80mm*80mm, thickness 1.8mm with suitable frequencies for various applications. The design of various shaped antenna is one of the important steps of the microwave design for modern communication. The numbers of antenna designs like I-shaped antennas, L-shaped antennas and printed monopole antennas have better gained such as size, reduced cost, and fabrication as their advantages. Micro strip based antenna at the various ISM bands 2.65 GHz, 3.65 GHz and 4.65 GHz for various applications. The proposed antenna consists of T-slot which is controlled to operate at different frequency bands like 2.65 GHz, 3.65 GHz and 4.65 GHz.

The Proposed antenna is widely used as a variety of applications such as communication, mobile telephones, radio receivers etc.., The antenna have light weight, low cost, ease of fabrication and testing with the multiband frequencies. The designs of a T-shaped antenna are very important parameters of gain, bandwidth and antenna efficiency on the ground plane. The multiplicity of standards has the exploration of microwave signals in the medical field. The detector development of anti-personnel mines, it requires to use of broadband antenna. Many antennas are used with wide ranger. These antennas are characterized by their frequency independency because of wide bandwidth, constant impedance, over frequency range, maximum gain and good diversity. Good impedance matching and extended band width is achieved by selecting appropriate di-mensions of antenna structure. Printed ground line structure helps to obtain wider impedance band width in lower operating band. Small antenna element enhances the handset antenna's performance and enlarged antenna dimensions increase gain and bandwidth of the system. Hence ground-plane dimension plays key role in determining proper parameters to achieve desired band width of proposed design.

A Multiple ground system can be used for this type of antenna. A number of relatively small radial wire systems are scattered over the ground area in which all significant ground currents occur. These frequencies are usually used for broadcasting purposes. There is an increasing application of technology to health care, due to rapid advances in technology. Due to this the use of antennas of different kinds in the practice of medicine has increased. Most of the medical applications of antennas involve coupling electromagnetic energy into the human body (or) into other biological system. There are two main categories of such applications, namely therapy and diagnostics. The therapy consists of heating tumors by electromag-netic energy alone, or in the combination with either X-ray irradiation. In diagnostics, electromagnetic energy is coupled into and out of the body to monitor various physiological parameters.

High frequency antenna is usually used in this range of frequency for medium, long distance communications and broadcasting. The international broadcasting to specific areas are required, high gain directional antennas are desirable. The antenna gives an increase in gain of about 3dB with very little change in pattern shape in the forward direction are shown in figure 4.UHF communication systems are used in land mobile services, coastwise and inland maritime service. The T shaped antennas as shown in figure 1 are used various frequencies.

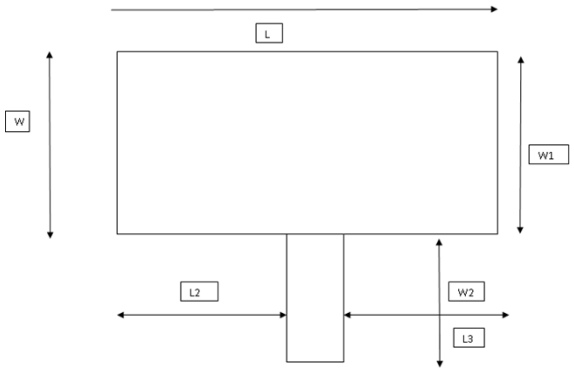

Figure 1: Structure for T Shaped Structure

Table 1: T-Shaped Antenna Parameters

Type	Dimension
L	50MM
L1	20MM
L2	18MM
W	45MM
W1	28MM
W2	6MM

The T-shaped patch antenna has been derived from a rectangular antenna of size 80 mm * 80 mm at lower band frequency around 1.6 GHz. The micro strip feed are used to obtain an impedance of 50 Ω. The proposed antenna using FR-4 substrate with dielectric constant ε_r=4.2 and loss tangent tan Ə=0.01 using CST simulator. The developed antenna can be used for the 4G, WIMAX applications. The proposed antenna slots are provided on the patch to enhance the bandwidth. The adaptive beam forming should have maximized the signal to interference and noise ratio of the received signal with the effects of interference sources.

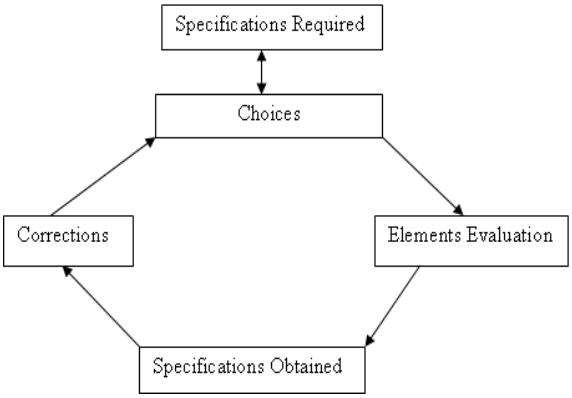

Figure 2: Flowchart of Antenna Design

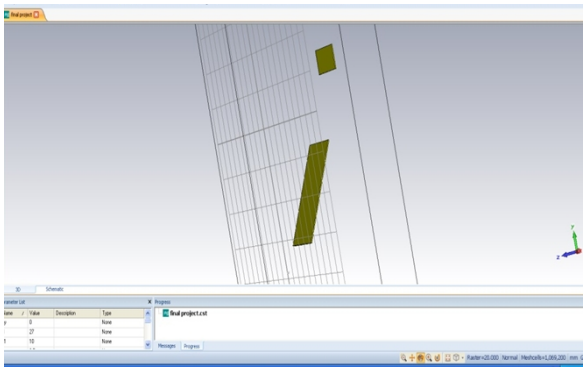

Figure 3 : T- Shaped Structure

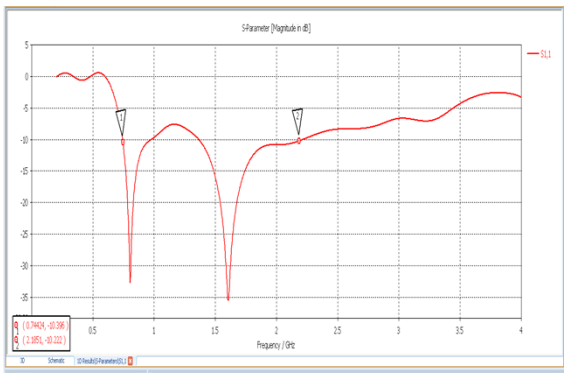

Figure 4 : S-Parameter

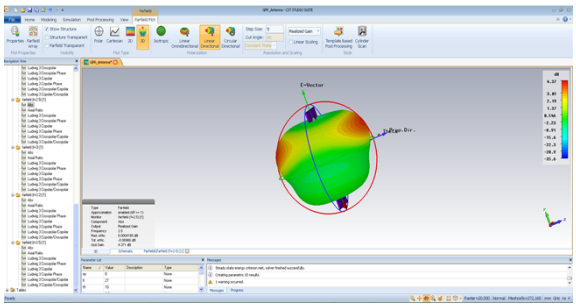

Figure 5 : Radiation Pattern

CONCLUSION

A T-shaped antenna structure was proposed with slots on the patch antenna to achieve dual-band operation to control the current distribution using feed line position. This antenna helps to implement a simple and low profile antenna for practical mobile handsets application. Experimental result shows that the structure offers very broad bandwidth charac-teristics. The balance-feed antenna system can overcome the interaction between human's hand effect and mobile handset is proved. More detail analysis for proposed antenna on mobile handsets such as Specific Absorption Rate (SAR) and Hearing Aid Compatibility (HAC) are the next subjects for research. The antenna design can be embedded within the wireless devices such as the Wi-Fi and WIMAX applications. The size of the proposed antenna is to be reduced and also increased the bandwidth and gain in our future plan.

REFERENCES

[1] Wang, H.L., Y.X. Guo, and W.X. Sheng, Wide-band high-gain 60–GHz LTCC L-probe patch antenna array with a soft surface. IEEE Trans. Antennas Propag. **61**(1): 153–161 (2013).

[2] Chu, H., Y.X. Guo and Z. Wang, 60-GHz LTCC wideband vertical off center dipole antenna and arrays. IEEE Trans. Antennas Propag. **61**(1): 153–161 (2013).

[3] Gong, K., Z. N. Chen, X. Qing, P. Chen and W. Hong, Substrate integrated wave guide cavity-backed wide slot antenna for 60–GHz bands. IEEE Trans. Antennas Propag. **60**(12): 6023–6026 (2012).

[4] Yeap, S.B., Z. N. Chen and X. Qing, Gain-enhanced 60-GHz LTCC antenna array with open air cavities. IEEE Trans. Antennas Propag. **59**(9): 3470–3473 (2011).

[5] She, Y., et al., LTCC oversized rectangular waveguide slot array antenna with air-layer in the radiating part in the millimeter-wave band. IEEE Trans. Antennas Propag. **61**(4): 1777–1783 (2013).

[6] Xu, J., Z. N. Chen, X. Qing and W. Hong, Band width enhancement for a 60 GHz substrate integrated waveguide fed cavity array antenna on LTCC. IEEE Trans. Antennas Propag. **59** (3): 826–832 (2011).

[7] Al-Hasan, M.J., T. A. Denidni and A. R. Sebak, Millimeter-wave EBG-based aperture-coupled dielectric resonator antenna. IEEE Trans. Antennas Propag. **61**(8): 4354–4357 (2013).

[8] Sun, M., Z. N. Chen and X. Qing, Gain enhancement of 60-GHz antipodal tapered slot antenna using zero-index meta material. IEEE Trans. Antennas Propag. **61**(4): 1741–1746 (2013).

[9] Kosta,Y. and S. Kosta, Liquid antenna systems: in Proc. IEEE AP-S Int. Symp. Pp. 2392-2395 (2004).

[10] Chang, C.H. and K.L. Wong, Printed-PIFA for pentaband WWAN operation in the mobile phone. IEEE Antennas Propag. **57**: 1373–1381 (2009).