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A Compact Double-T Monopole Antenna for Dual Wideband Wireless Communications Systems

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Abstract: *- This work carries a dual band monopole antenna design specially meant for wireless applications. The proposed antenna consists of a rectangular patch monopole in which a slot is cut in order to obtain a dual band operation and size reduction. The antenna operates in frequency band 2.3 to 3.4 GHz and 4.95 to 5.85 GHz. These bands are now widely used in wireless communications. This miniaturized dual band monopole antenna proves to be an effective option for wireless devices to communicate with the outside world. We present a novel compact printed dual wideband double-T antenna, which consists of two stacked T-shaped monopoles.*
Keywords: *-Dual Band, Directivity, Monopole Antenna, Size Reduction.*

I. Introduction

Advancement of antenna design is a fundamental part of any wireless system due to growth of wireless communication & information transfer using handsets & personal communication system devices. It is necessary at the same time that the system must radiate low power and provide reliable communication in terms of voice as well as data. Service providers & users demand wireless units with antennas which are compact and small. Additionally it should be cost effective for manufacturability and easy to integrate with wireless communication system. The electrical characteristics that should be considered while designing the antenna include operating frequency, VSWR, return loss (input impedance, bandwidth, gain directivity & radiation pattern.

These design criteria has led antenna designers to consider a wide variety of antenna structures to meet the often conflicting needs for wireless systems. Due to increased usage in residential and office areas, these systems are required to be low profile, low cost as well as highly effective and efficient. The increasing popularity of indoor wireless network capable of high-speed transfer rate is prompting for the development of efficient broadband antennas. A key requirement of a WLAN and WiMax systems are that it should be low profile, where it is almost invisible to the user. For this reason the monopole antennas are the only choice available for use due to their small area and the ability to be designed to blend with surroundings. Another important thing to look to is the cost and in this sense also monopole antenna is the only option. Monopole is a type of the radio antenna formed by replacing one half of a dipole antenna with a ground plane at right angles to the remaining half.

Printed monopoles have been recently proposed as suitable contenders with many variations suggested for dualband operation [1]**.** In order to satisfy the IEEE 802.11 WLAN standards in the 2.4 GHz (2400–2484 MHz) and 5.2GHz (5150–5350 MHz) bands, dual-band operations of the printed monopole antennas are required [2]. Also the dual-band printed dipole antennas are investigated [3].This paper contains such a monopole antenna design that effectively covers bands 2.3 to 3.4 GHz and 4.95 to 5.85 GHz that is used now-a-days for wireless applications. We present a novel compact printed dual wideband double-T antenna, which consists of two stacked T-shaped monopoles.

II. Related Work

Many antennas are available for wireless applications. Dual band monopole antennas have been reported [4]-[8] but these however offer a narrow impedance bandwidth characteristic. Wideband Printed Monopole Antenna [9] was introduced by Chien-Yuan Pan, Tzyy-Sheng Horng, Wen-Shan Chen, and Chien-Hsiang Huang for WLAN/WiMAX Applications in 2007. The proposed monopole wideband antenna operating in dual band satisfied not only the wireless local area network (WLAN) applications; also accomplish the worldwide interoperability for microwave access applications (WiMax).

III. Design Procedure

The proposed antenna is formed on two stacked T-shaped monopoles, which are operating both at quarter wavelength, and are printed in the front of FR4 substrate of thickness 0.8mm and relative permittivity 4.4. The substrate has a length L_s =25 mm and the width W_s =20 mm. The dimensions of the partial conducting ground plane are 20×10 mm^2. The excitation is launched through a 50Ω microstrip feedline, which has the

length ($L+h_2$) =14 mm and the width w_f =1.5 mm, where h_2 denotes the distance between the feed point of first T-arm radiator and the ground plane. The second Term radiator element is placed at h_1 =10.5*mm* away partial ground plane. The two arms are connected by vertical strip with width of w=1.5 mm. The two portions of the first T-arm are not equal (L_{21} =5.5 mm and L_{22} =6 mm), but the second T-arm is symmetrical (L_1 =7.75mm). The width of the two T-arms are the same W_1 =W_2 =3.5 mm.

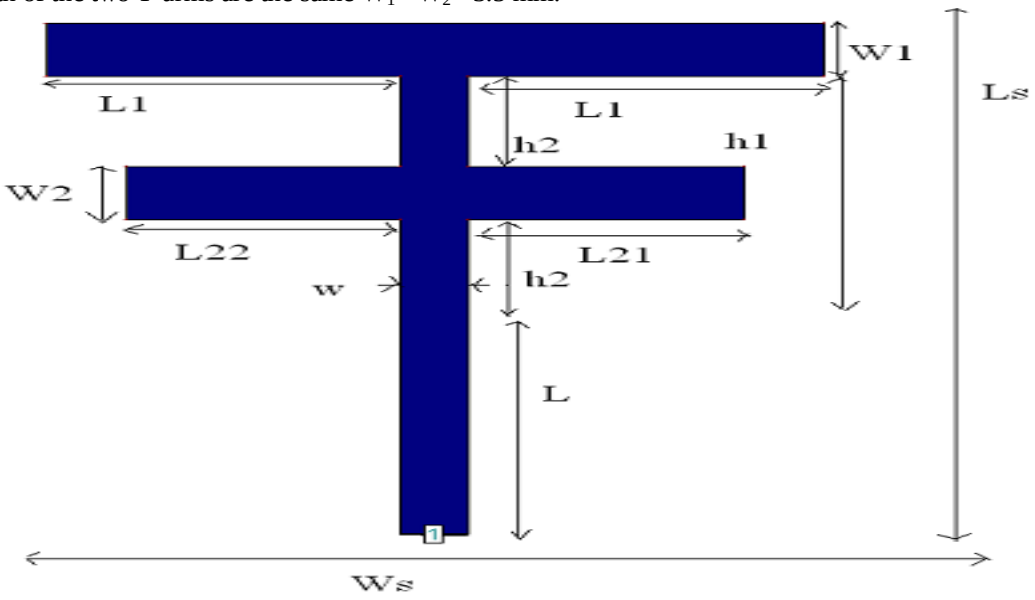

Fig.1. geometry of the proposed antenna

IV. Simulation Results of The Miniaturized Monopole Antenna

The proposed antenna operates at the dual wideband from 2300 to 3400 MHz and 4950 to 5850 MHz shown in fig.2, which satisfies the IEEE 802.11 WLAN standards in the 2.4 GHz (2400–2484 MHz), IEEE 802.11a (5150–5350 MHz, 5725–5825 MHz) and HiperLAN/2 (5470–5725) bands (2).

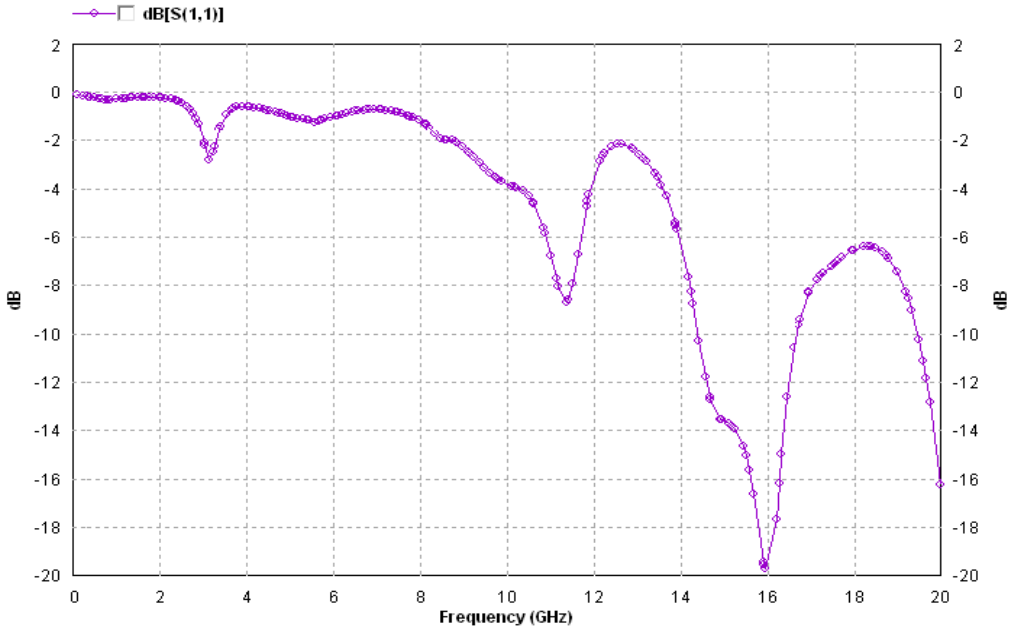

Fig.*2.* Simulated return loss (IE3D)

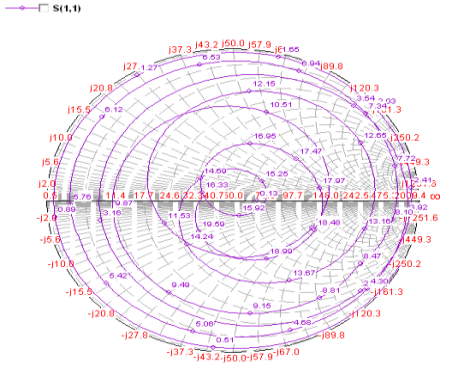

Fig.3. Smith Chart.

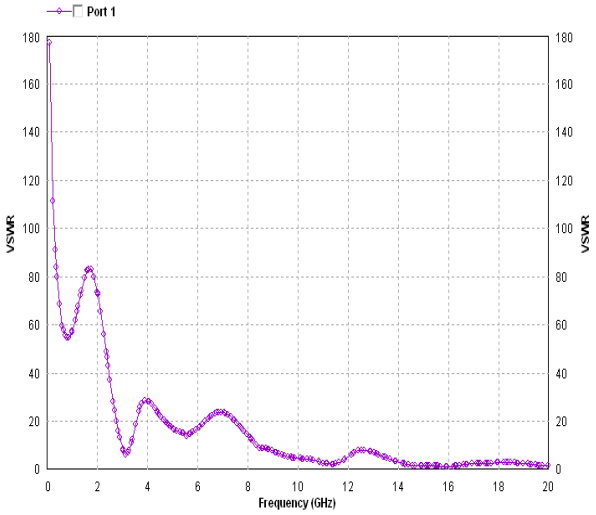

Fig.4. radiation pattern

V. Conclusion

A novel compact double-T monopole antenna for dual wideband wireless communications systems has been designed. The simulation result obtained by IE-3D shows good agreement with the measured results. It is shown that the proposed antenna covers two wideband from 2.3 to 3.4 GHz and 4.95 to 5.85 GHz. The simulated radiation patterns at 2.7 and 5.4 GHz were presented. Similarly to the conventional monopole antenna, the radiation patterns of the proposed dual wideband antenna are nearly omni-directional over the operating bandwidth (H-plane).

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