Review of Modified CPW-FED Dual Band Monopole Antenna Using WLAN/WIMAX Application

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Abstract-*A coplanar waveguide (CPW)-fed planar monopole antenna with triple-band operation for WiMAX and WLAN applications is presented. The antenna, which occupies a small size of 25(L)*25(W)*1.6(H) mm^3, is simply composed of a pentagonal radiating patch with two bent slots. By carefully selecting the positions and lengths of these slots, good dual stop band rejection characteristic of the antenna can be obtained so that three operating bands covering 2.14 –3.85 and 5.02–6.09 GHz can be achieved. The measured results also demonstrate that the proposed antenna has good omnidirectional radiation patterns with appreciable gain across the operating bands and is thus suitable to be integrated within the portable devices for WiMAX/WLAN applications.*

Keywords-Microstrip patch antenna, Monopole antenna, Dual band.

I. INTRODUCTION

Ultra-wideband (UWB) communication has attracted much attention and been developed rapidly after the FCC (Federal Communication Commission) open the permit of 2.14 –3.85 and 5.02–6.09 GHz frequency band in February, 2002. For the attractive advantages of low-cost, low-power, high transmission data rates over short distance and co-existing with other narrow communication systems without causing any interference, the UWB is suitable for wireless personal area networks (WPAN)and other applications such as location, positing, and imaging systems. It is well known that the conventional wireless communication systems suffered from channel fading due to multipath environment. The fading of the UWB signal is more serious because of its low transmit power. However, this can be improved by using multiple-input multiple-output (MIMO)technology which is one of the effective ways to reduce multipath phenomenon in complex environment and increase range or capacity of the channel. UWB-MIMO system requires multiple antennas with a wide bandwidth and good isolation performance between antenna ports. Several types of UWB-MIMO antennas have been proposed for the application. A compact diversity UWB antenna is presented, showing good performance but the frequency range is covered from 2.14 –3.85 and 5.02–6.09 GHz. In two kinds of spaced wide slot antennas are proposed, both achieving good impedance bandwidth and isolation. However, they have a large size of 25*25*1.6mm3, which is relatively not easy to be integrated in a portable device.

In this paper, a novel modified CPW-fed antenna is proposed for ultra-wideband and dual-polarization operation. The proposed antenna has a wide right-angled triangle slot and is compound by two monopoles on two right-angled edges of the slot. A metal strip located in the middle of the slot is used to decrease the mutual coupling caused by near-field. Moreover, a right-angled triangle is cut from the top right corner of the ground plane to change the distribution of the ground surface current, and therefore the reflection coefficient and isolation of the two ports are improved. The obtained results show that the proposed antenna can achieve good impedance matching and isolation from 2.14 –3.85 and 5.02–6.09 GHz. The diversity performance in multipath propagation channels is also investigated in terms of envelope correlation coefficient. The result shows the correlation coefficient of the proposed antenna system is very low. The proposed antenna is smaller in size compared to the antenna reported in.

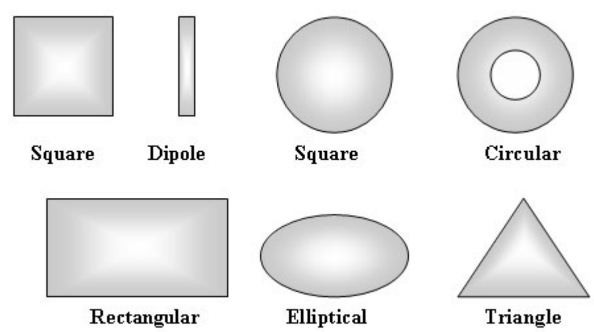


Fig.1 Different Shapes of Patch

II. UWB DEFINITIONS AND ANTENNA PARAMETERS

The radiation of guided waves that the key mechanism for radiation is charge acceleration. The ultra-wide bandwidth radiation is based on a few principles:

- Traveling-wave structures
- frequency-independent antennas (angular constant structures)
- Self-complementary antennas

- Multiple resonance antennas
- Electrically small antennas

In most cases the radiation starts where the electric field connects 180 degree out-of-phase currents with half a wavelength spacing. Many antennas radiate by a combination of two or more of the above principles and can there fore not be simply classified. Themonocone properties can be well approximated by the planar structures like planar monopoles. These are very well suited for short-range communications, as they can easily be integrated with different planar lines and circuits.

In practice from a system point of view, two cases for UWB have to be distinguished:

- Multiple narrow bands, e.g., OFDM (ECMA-368 Standard)
- Pulsed operation (IEEE 802.15.4a)

The first case can usually be treated like the well-known narrow-band operations. The second case needs a closer look. If in a pulsed operation for radar or communications the full FCC bandwidth from 3.1 to 10.6 GHz, i.e., 7.5 GHz, is covered.

III. ANTENNA STRUCTURES

Block Diagram Of Proposed Antenna

The overall dimensions of the antenna are 25(L) × 25(W) mm2. This antenna, will be printed on a 0.8-mm-thick FR4 substrate with a relative permittivity of 4.4 and a loss tangent of 0.02 and can be is realized using a pentagonal radiating patch with two thin bent slots. The radiating patch fed by a 50- coplanar waveguide (CPW) transmission line with a width of 5 mm and a length of 10 mm. To possess a wider impedance bandwidth, in this work a tapered structure between the antenna and the CPW's ground is with an angle of θ1 = 380, to obtain good impedance matching across the operating bands for the antenna. Different from the conventional pentagonal design, here the radiating patch is developed with slanted form at both sides to have a proper spacing to mitigate.the effect caused by the circuit and casing. The pentagonal radiating patch is more suitable to enhance the antenna performance for practical application. The two center-rejected frequencies, f1 and f2, for the stopbands may be empirically approximated by.

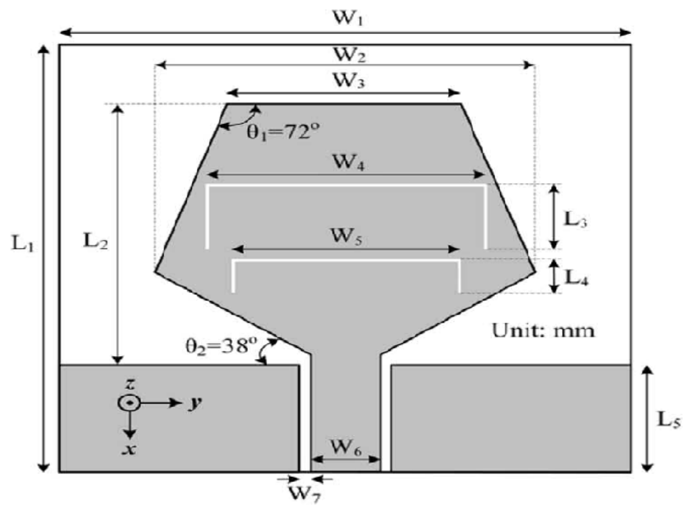


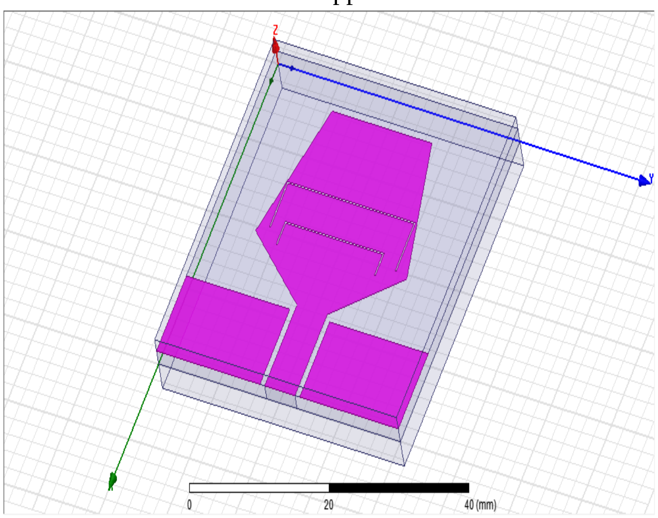
Fig. 2 proposed antenna geometry

Microstrip or patch antennas are becoming increasingly useful because they can be printed directly onto a circuit board. Microstrip antennas are becoming very widespread within the mobile phone market. Patch antennas are low cost, have a low profile and are easily fabricated. Consider the microstrip antenna shown in Fig2. fed by a microstrip transmission line. The patch antenna, microstrip transmission line and ground plane are made of high conductivity metal (typically copper). The patch is of length L, width w, and sitting on top of a substrate (some dielectric circuit board) of thickness h with permittivity εr.

The term "Broadband" has been applied in the past, but has usually described antenna whose radiation and input impedance characteristics were acceptable over a frequency range of 2 or 3:1 before the 1950s. At that time, the bandwidth of the radiation pattern has been the limiting factor since antennas have been developed with an input-impedance that stays relatively constant with a change in frequency. But in the 1950s, a breakthrough in antenna evolution was made which extended the bandwidth to as great as 40:1 or more. The antennas introduced by the breakthrough were referred to as frequency independent, and they had geometries that were specified by angles. These broadband antennas are practically independent of frequency for all frequencies above a certain value as well as impedance.

Fractal antennas are multi-resonant and smaller in size. Qualitatively, multi-band characteristics have been associated with the self-similarity of the geometry and Hausdorff dimensions are associated with size. Research towards quantitative relation between antenna properties and fractal parameters is going on extensively. Any variation of fractal parameters has direct impact on the primary resonant frequency of the antenna, its input resistance at this frequency, and the ratio of the first two resonant frequencies. In other words, these antenna features can be quantitatively linked to the fractal dimension of the geometry. This finding can lead to increased flexibility in designing antennas using these geometries. These results have been experimentally validated.

A fractal antenna's response differs markedly from traditional antenna designs, in that it is capable of operating with good-to-excellent performance at many different frequencies simultaneously. Normally standard antennas have to be "cut" for the frequency for which they are to be used—and thus the standard antennas only work well at that frequency. This makes the fractal antenna an excellent design for wideband and multi-band applications.



Ultra wideband (also known as UWB) is a wireless technology for transmitting large amounts of digital data over a wide spectrum of frequency bands with very low power for a f data over a distance up to 230 feet at very low power (less than 0.5 milliwatts), but has the ability to carry signals through doors and other obstacles that tend to reflect signals at more limited bandwidths and a higher power. Ultra wideband can be compared with another short-distance wireless technology, Bluetooth, which is a standard for connecting handheld wireless devices with other similar devices and with desktop computers.

IV. CONCLUSION

A modified cpw sector-nested fractal antenna has been studied in this seminar. When we combine two techniques: the sector-nested fractal structure and the pentagonal ground plane, the monopole dual band antenna can operate to cover two bands at 2.14 –3.85 and 5.02–6.09 GHz which are required by WLAN/WiMAX systems. It is observe from study that, the antenna has simple structure, thin profile, low cost and significant gain; therefore it can be applied for the electronic protection systems, etc., and will be an attractive candidate for various WLAN/WiMAX applications.

In this seminar a antenna with hexagonal shape & CPW feed can be designed & results are obtained in the form of various antenna performance parameter. The material used for said antenna is FR4, with thickness of 1.6mm. The antenna is operating at a frequency of 1.34 GHz & having total value of gain is 0.2 dB. The gain of antenna may be increases when we use fractal shape antenna.

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