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A SURVEY ON COMPACT MULTIBAND SLOTTED PLANAR MONOPOLE ANTENNA WITH BRANCH LINES FOR WIRELESS COMMUNICATION

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ABSTRACT:

An explosive growth of the wireless radio communication systems is currently observed in the microwave band. In the short range communications or contactless identification systems, multiband antenna has been playing a very important role for wireless service requirements. Multiband antennas may have lower-than-average gains or be physically large in comparison to single-band antennas in order to accommodate the multiple bands. The wires at the center of the feed of simple multiband antennas are separated vertically by a small amount, and the ends are separated by a few inches. These simple dimensions make it possible to cut antenna lengths for given frequencies and eliminate the need for pruning. Wireless local area network (WLAN) and Worldwide Interoperability for Microwave Access (WiMAX) have been widely applied in mobile devices such as handheld computers and intelligent phones. These two techniques have been widely considered as a cost-effective, viable, and high-speed data connectivity solution, enabling user mobility. Microstrip patch antennas are popular in wireless communication, because they have some advantages due to their conformal and simple planar structure. They allow all the advantages of printed -circuit technology. There are varieties of patch structures available but the rectangular, circular and triangular shapes are most frequently used.

A single antenna cannot operate at all of these frequency bands, as a result multiband and wideband antennas are essential to provide multifunctional operations for mobile communication. Recent trend in multiband antenna designs used in mobile devices can be categorized into three types: slot - type antennas, monopoles antennas and planar inverted-F antennas (PIFA).In this literature survey paper we are discussing multiband antenna with compact feature having slotted planar monopole antenna with branch lines.

KEYWORDS: Antenna, Microstrip antenna, Monopole antenna, Multiband antenna, compact multiband, wireless applications.

I. INTRODUCTION:

In recent years, several reports have appeared about the development of low-profile multiband antennas. However, most of them are relatively large and/or do not provide desired bandwidths. One method of improving the bandwidth and reducing the size is to use a planar monopole antenna with slots on the patch and ground plane. There are many reported antenna designs for wireless systems such as coplanar waveguide (CPW)-fed monopole antenna with embedded slots, meandered split-ring slot, and slot monopole antenna with rectangular parasitic elements.

However, most of these antennas are designed for either single or dual-band operation. These antennas are expected to have effective broadband matching, a proper antenna gain, and consistent radiation patterns throughout the designated frequency bands. For size reduction and bandwidth improvement monopole antenna is designed to generate multiple resonant modes. Current trend in multi-band antenna designs used in mobile devices can be categorized into three types: slot-type antennas, monopole antennas and planar inverted-F antennas (PIFA).Slot antenna can also be operated as a quarter-wavelength resonant structure, when a slot is cut at the edge of ground plane. Multiple resonant modes are achieved through different slots of various geometric cuts onto the radiator and ground plane. Antenna size is decreased and its bandwidth is increased through employing capacitive and inductive loading/de-loading techniques. The third group, monopole antennas are also operated as a quarter-wavelength resonant structures. The planar monopole has a capability to provide a wide impedance bandwidth. There are several techniques which facilitate multiband operation. The multiband antenna covers all popular cellular and internet communication bands: LTE 750, GSM 850 (824-960 MHz), GSM 900 (880-960 MHz), DCS (1710-1880 MHz), UMTS-2110 (2110-2200 MHz), 2.4 GHz WLAN (2400-2480 MHz), ISM/Bluetooth (2400-2480 MHz), WiMAX (2500-2690 MHz & 3400-3600 MHz) and Ultra Wideband (3.1-10.6 GHz). The planar monopole has a wider input impedance bandwidth and can easily cope with the

PCB fabrication process. Multiband operation can be facilitated via several techniques.

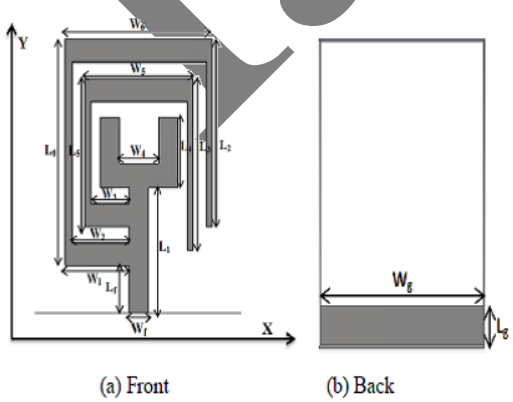
The development of antenna for wireless communication requires an antenna with more than one operating frequency. This is due to many reasons, primarily because of various wireless communication systems and many telecommunication operators use various frequencies. Therefore one antenna that has multiband characteristic is more desirable than having one antenna for each frequency band. As the use of the mobile phone is increased, the research on the health risk due to the electromagnetic (EM) fields generated from wireless terminals is widely in progress. Many factors may affect the EM interaction while using cellular handset in close proximity to head and hand. One of the most widely used parameters for the evaluation of exposure is SAR, specific absorption rate. Therefore, some regulations and standards have been issued to limit the radiation exposure from the mobile handsets not only to decrease the SAR but also to increase the antenna systems efficiency.

II. METHODOLOGY:

The example is taken from the reference paper [11], [12]. The covered antenna is a planar printed antenna with compact dimensions of (23x31x1.5) mm3. The antenna can be easily integrated in small and sleek mobile device. Fig. 1 shows the geometry of the proposed antenna. All the labelled dimensions are tabulated in Table I. The antenna is fabricated over FR4 substrate (εr=4.5) with 1.5 mm thickness and loss tangent of 0.025.

TABLE I : Antenna Dimensions IN mm

Parameter	L1	L2	L3	L4	L5	L6	Lf	Lg
Value	14	23	21	7	18	25	6	6
Parameter	W1	W2	W3	W4	W5	W6	Wf	Wg
Value	10	9	6	6	17	23	2.8	23



(a) Front (b) Back

Fig.1 Geometrical details of the antenna

The antenna is composed of a planar U-shaped monopole and two branch lines. The first branch line acts as a monopole radiator at the 900 MHz and at the same time acts as a cavity resonator fed by the U-shaped monopole that radiates in the upper frequency bands. The two branch lines increase the path over which the surface current flows and that eventually results in lowering the resonant frequency. The electrical length of the first line with 62 mm is optimized to resonate at 900MHz (872-976 MHz), while the electrical length of the second line is optimized to resonate at 700MHz (674-750 MHz) with length 82 mm.

III. METHOD AND COMPARISON:

The some of the authors contributed on the multiband antenna and also for the planar with microstrip lines. The survey can be discussed like below.

Jen Yea Jan et al. [13] proposed a microstrip fed dual band planar monopole antenna with shorted parasitic inverted L wire for 2.4/5.2/5.8 WLAN bands. In this design inverted L shaped monopole is the exciting element and which controls the higher frequency. Another shorted inverted L shaped parasitic strip etched nearer to the monopole controls the lower frequency.

Wong et al. [14] presented a low-profile planar monopole antenna for multiband operation of mobile handsets. The proposed antenna has a planar rectangular radiating patch in which a folded slit is inserted at the patch's bottom edge. The folded slit separates the rectangular patch into two sub patches, one smaller inner sub patch encircled by the larger outer one. The proposed antenna is then operated with the inner sub-patch resonating as a quarter-wavelength structure and the outer one resonating as both a quarter-wavelength and a half-wavelength structure.

A multiband folded planar monopole antenna has been proposed for mobile handset by Shun-Yun Lin [15]. This paper introduces a folded planar monopole antenna, which has a very low profile of about one twentieth of the wavelength of the lowest operating frequency. The effect is achieved by using a bended rectangular radiating patch and an inverted L-shaped ground plane.

In another attempt Ching Yuan Chiu et al. [16] proposed a shorted, folded planar monopole antenna for dual-band mobile phone. The antenna is fabricated from stamping a single metal plate, which is then folded onto a foam base. The antenna has two separate branches of different sizes: the larger one supports a longer resonant path (path1) for generating a lower mode for GSM operation, while the smaller one provides a shorter resonant path (path2) for generating a higher mode for DCS operation.

IV. CONCLUSION:

A compact planar monopole antenna for mobile phone achieving a wide impedance bandwidth has been discussed. This paper presents a survey of the different structures used to realize multiple frequency or wideband operation in either a single-element patch antenna or a multi- element scheme. However, a closer study reveals that some of these examples create problems in the design or manufacturing stage, along with an increase in size or degradation in any of the other characteristics. By introducing slots in the patch, the multiple -frequency operation can be achieved in a single-element patch antenna.

REFERENCES:

1) Sesia, S., I. Tou¨k, and M. Baker, LT | *The UMTS Long Term Evolution: From Theory to Practice,* Wiley, Chichester, U.K., 2009.
2) Bhatti, R. A., S. Yi, and S. Park, *Compact antenna array with port decoupling for LTE-standardized mobile phones,"* IEEE Antennas and Wireless Propagation Letters, Vol. 8, 1430{1433, 2009.
3) Young, C. W., Y. B. Jung, and C. W. Jung, *Octaband internal antenna for 4G mobile handset"* IEEE Antennas and Wireless Propagation Letters, Vol. 10, 817{819, 2011.
4) Wong, K. L. and W. Y. Chen, *Small-size printed loop-type antenna integrated with two stacked coupled-fed shorted strip monopoles for eight-band LTE/GSM/UMTS operation in the mobile,*" Microwave and Optical Technology Letters, Vol. 52, No. 7, 1471{1476, Jul. 2010.
5) Guo, Q., S. Member, R. Mittra, L. Fellow, F. Lei, Z. Li, J. Ju, and J. Byun, *Interaction between internal antenna and external antenna of mobile phone and hand e®ec,"* IEEE Trans. Antenna and Propag., Vol. 61, No. 2, Feb. 2013.
6) 3GPP, \3rd generation partnership project; Technical speciation group radio access network; *Evolved universal terrestrial radio access (E-UTRA); User equipment (UE) radio transmission and reception (Release 10),"* 3GPP TS36.101 V10.4.0, Table 5.5-1 E-UTRA, Sep. 2011.
7) IEEE C95.1-2005, \IEEE standards for *safety levels with respect to human exposure to radio frequency electromagnetic elds, 3 kHz to 300 GHz,"* Institute of Electrical and Electronics Engineers, New York, NY, 2005.
8) International Non-Ionizing Radiation Committee of the International Radiation Protection Association, *Guidelines on limits on exposure to radio frequency electromagnetic fields in the frequency range from 100 kHz to 300 GHz,"* Health Physics, Vol. 54, No. 1, 115{123, 1988.
9) Gabriel, S., R. W. Lau, and C. Gabriel, "*The dielectric properties of biological tissues II Measurements in the frequency range 10 Hz to 20 GHz,"* Phys. Med. Biol., Vol. 41, 2251{2269,1996.
10) Gabriel, C., *Tissue equivalent material for hand phantoms,"* Phys. Med. Biol., Vol. 52, 4205{4210, 2007.
11) Na. Nanthini, V. Dinesh, J. Vijayalakshmi, K. T. Dhivya,"*A Survey on Design of Multiband Monopole Antenna for Wireless Applications"*, International Journal on Recent and Innovation Trends in Computing and Communication,2013.
12) Mahdi Moosazadeh and Sergey Kharkovsky, "*Compact and Small Planar Monopole Antenna With Symmetrical L- and U-Shaped Slots for WLAN/WiMAX Applications"*, IEEE ANTENNAS AND WIRELESS PROPAGATION LETTERS, VOL. 13, 2014.
13) Jen Yea Jan and Liang Chih Tseng, *Small Planar Monopole Antenna With a Shorted Parasitic Inverted-L Wire for Wireless Communications in the 2.4, 5.2, and 5.8-GHz Bands, IEEE Transactions on Antennas and Propagation,* Vol. 52, No. 7, pp.1903-1905, July 2004.
14) Kin Lu Wong, Gwo Yun Lee, and Tzung Wern Chiou, *"A Low-Profile PlanarMonopole Antenna for Multiband Operation of Mobile Handsets"*, IEEE Transactions on Antennas and Propagation, Vol. 51, No. 1, pp.121-125, January 2003.
15) Shun Yun Lin, *Multiband Folded Planar Monopole Antenna for Mobile Handset*, IEEE Transactions on Antennas and Propagation, Vol. 52, No. 7, pp. 1790-1794, July 2004
16) W.C. Liu and C.F. Hsu, *Dual-band CPW-fed Y-shaped monopole antenna for PCS/WLAN applications*, IEEE Electronics Letters, Vol. 41 No., pp. 390-391, March 2005.