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Design of Microstrip Wideband/Dual Band Antenna for Wireless Applications

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***Abstract* -**This paper presents a Microstrip Antenna for Dual band/Wide Band frequency for cover a large bandwidth of 300 MHz and 2GHzforthe resonance frequency of 5.8 GHz and 8.1 GHz respectively. and its wide application like WLAN, Medical Application, radar imaging technology, Satellite communications etc..The gain and directivity of the proposed antenna are presented at different frequencies of covered band .for HFSS is used to design and simulation of antenna**.**

Keywords— Microstrip Transmission Line, Dual band/Ultra Wide Band, Planar Antenna.

I. INTRODUCTION

Application of ultra-wideband (UWB) technology on wireless communication system has increased considerably inLast seven years. Because the UWB technology has great potential in the development of various modern wireless communication systems, the U.S Federal Communication Commission (FCC) authorized the unlicensed use of the ultra wide band(3.1-10.6 GHz) frequency spectrum for indoor and hand-held wireless communication since early February 2002[3]. To meet the variety of applications in UWB communication systems, many researchers around the world have been aroused on the design, research and development ofUWB filter and antenna[4-5].

In this paper we present a wide-band packaged antenna that can support the IEEE 802.11a wireless local-area network bands (5–6 GHz) and X-band(8 –12 GHz). The configuration is similar to those presented in [10] and [11]. In [10] only a single band folded design was presented for Bluetooth application (2.4–2.485 GHz, 3.5% bandwidth).No method of wide-band/dual-band operation was described. In contrast we present a wide-band/dual-band folded design. Our proposed packaged design can either be used as a wide-band antenna that can provide bandwidths in excess of 10% within 2:1 voltage standing-wave ratio (VSWR) or be used for dual-band operation where the bands are separated by 300MHz (5.7-6GHz) to 2 GHz(7.6-9.6) in the 5–10 GHz band. This latter property has been exploited to present a design that satisfies the ISM BAND-2 and X-BAND. The wide-band/dual-band operation has been achieved through Microstrip coupling between a folded radiator and an extended PCB (printed circuit board) ground plane. The dimensions of the extended PCB ground plane have been appropriately adjusted to ensure the desired coupling. This coupling mechanism is similar to those presented in our prior work [12], [13].The proposed antenna has been simulated for current distribution,

UWB is a Radio Frequency (RF) technology that transmits binary data, using low energy andextremely short duration impulses or bursts (in the order of picoseconds) over a wide spectrum of frequencies. It delivers data over 15 to100 meters and does not require a dedicated radio frequency so is also known as carrier-free, impulse or base-band radio. People commonly refer to UWB as available spectrum rather than as a technology 7500 MHz of unlicensed spectrum, in the 3.1-10.6 GHz band, is currently available in the US for any Communication system that occupies more than 500MHz. fig.1 the data rates of ultra wide antenna is very high but cover distance is less in meter.[6]

The proposed antenna is formed by a on one side of a PCB and a strip is the connected of the PCB as fig 2. The strip is connected to the front structure with a metal strip on the side or via through the PCB. The antenna has a low profile and can be easily embedded into the display of a laptop computer. This simple structure made from common materials is very cost effective. The impedance and radiation performance of the antenna integrated into the lossy display of a laptop are taken into account. The SWR, maximum and average gain as well as radiation patterns of the proposed antenna are examined experimentally.

The simulated -10 db at 5.7 to 6 GHz with dual band of 300 MHz and large band at 7.6 to 9.6 GHz with 2GHz large bandwidth.Low dielectric constant substrates are generally preferred for maximum radiation.Main purpose of this antenna to use one antenna for many application likeWLAN, Medical Application, radar imaging technology, PC Peripherals, Wireless USB etc..,which is the cost effective to deign one antenna for all application.

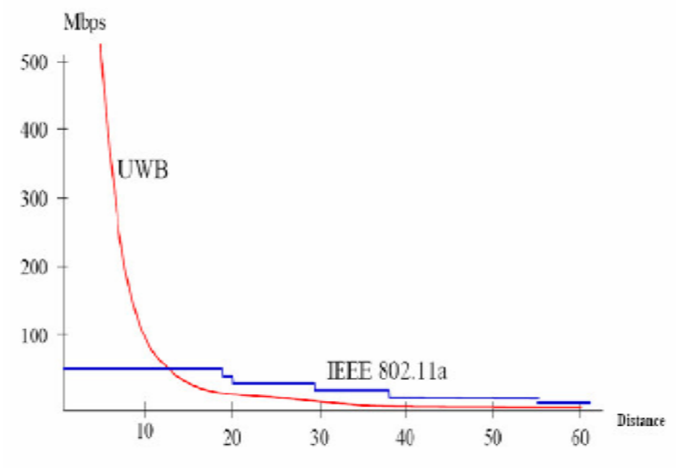

Fig.1 UWB Data Rates

ANTENNA DESIGN CONFIGURATION

In the design of this type of antennas, the width 'W' and Length 'L' of the patch of the antenna plays a crucial role in determining the resonant frequency of the system. For Microstrip antennas, the width (W) and length (L) of the radiating patch and the effective permittivity of the Microstrip structure (εr)which support the operation at the required resonant frequency or (the free-space wavelength (λ_0)) can be designed as follows, using the formulas given as [4-8].

$$W = \frac{\lambda_0}{2fo * \sqrt{\frac{\varepsilon_r + 1}{2}}} \tag{1}$$

$$L = \frac{\lambda_0}{2\sqrt{\varepsilon_e}} - 2\Delta L \tag{2}$$

$$\Delta L = 0.412t \frac{(\varepsilon_e + 0.3)(\frac{W}{t} + 0.264)}{(\varepsilon_e - 0.258)(\frac{W}{t} + 0.8)} \tag{3}$$

$$\varepsilon_e = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2\sqrt{1 + 12\frac{t}{W}}} \tag{4}$$

where
εe = Effective dielectric constant
εr = Dielectric constant of substrate
h = Height of dielectric substrate
W = Width of the patch

The dimensions of the patch along its length have now been extended on each end by a distance△L, which is given empirically by (Ramesh et al, 2001):
In the design of this type of antennas, the width 'W' andLength 'L' plays a crucial role in determining the resonant frequency of the system. The starting values of these parameters are calculated by using the equations given in [9-10] for the substrate height (h), dielectric constant (εr) and for the lower frequency. The designed values of the antenna are optimized with HFSS tool. The optimization was performed for the best impedance bandwidth.
Fig 2.Shows the structure of Dual/Wide band planer antenna. The antenna consists of rectangular aperture with width 'W' and length 'L' and rectangular patch with height 'H'. In this study, a dielectric substance FR-4with thickness of 1.65mm with a relative permittivity) εr=4.4 chosen as substrate. The CPW feed is designed for 50 Ω characteristic impedance with fixed 8.82 mm feed line length and width is 1.6 mm, 0.035 mm ground gap. By properly adjusting the dimension of the antenna and feeding structure the impedance matching of the proposed antenna is improved that produces wider impedance bandwidth with satisfactory radiation pattern. The wide bandwidth and impedance matching with reduced size of the antenna is achieved by the different surface magnetic currents of the structure.[7]-[8]Fig.2 shows the geometry and configuration of ultra wide-band (UWB) antenna. The design parameters are L=10.6 mm, W=14 mm, H=0.035mm, h=1.6 mm(substrateheight).

MODIFICATION OF ANTENNA STRUCTURE FOR DUAL BAND

The dual band Microstrip antenna (MSA) is realized by cutting the slots of different shapes like, U-slot, V-slot, pair of rectangular slots and step slots, etc [4–8]. The geometry of dual band rectangular Microstrip antenna is shown in fig 2.

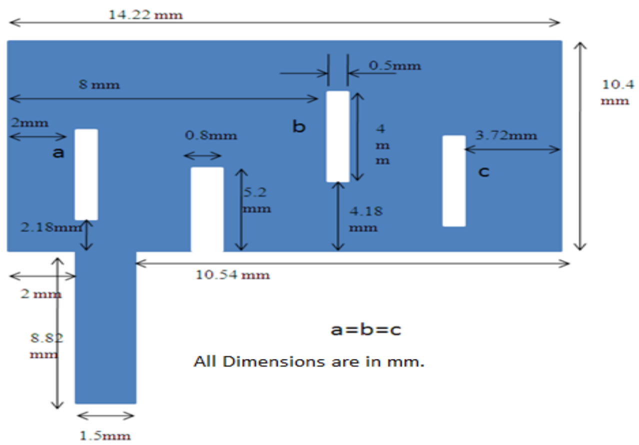

Fig. 2.Geometry and configuration of planer antenna.

SIMULATION RESULTS

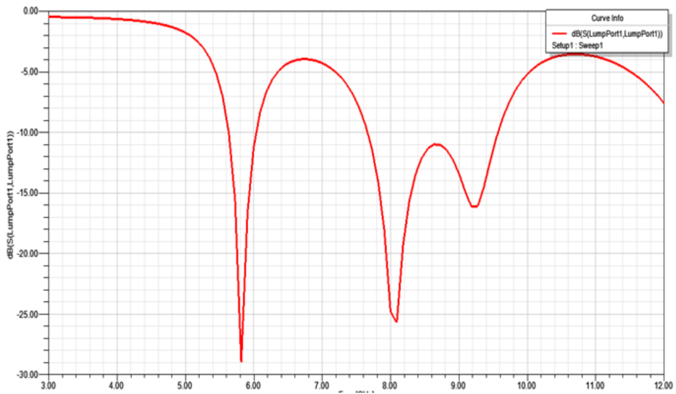

Fig. 3. Return Loss vs. frequency of Proposed planer antenna.

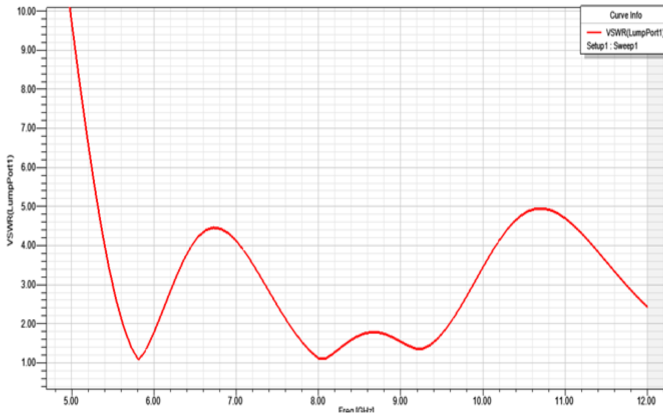

Fig. 4. VSWR vs. frequency of Proposed planer antenna.

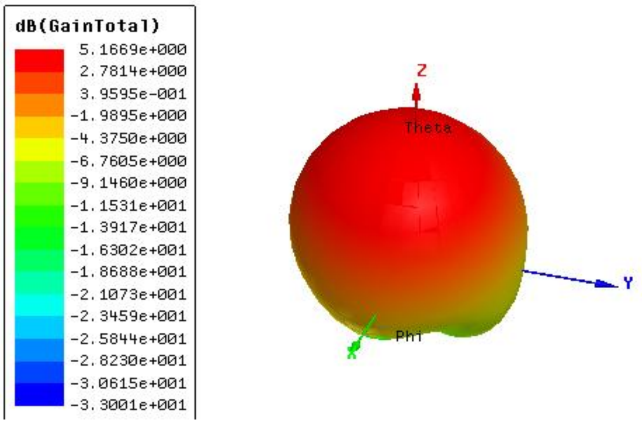

Fig. 5a. Gain vs. frequency of proposed antenna at 5.8 GHz.

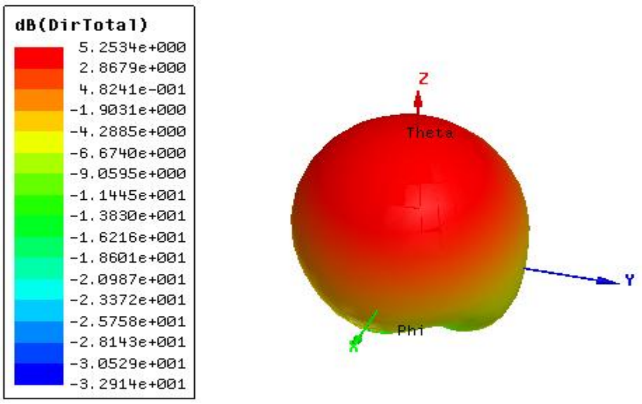

Fig. 5b. Directivity vs. frequency of proposedantenna at 5.8 GHz.

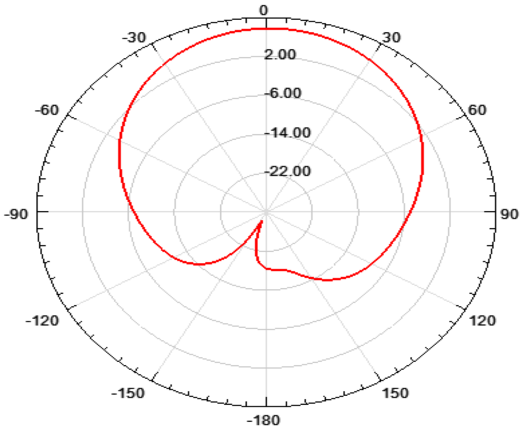

Fig. 6.a.Directivity at 5.8 GHz.

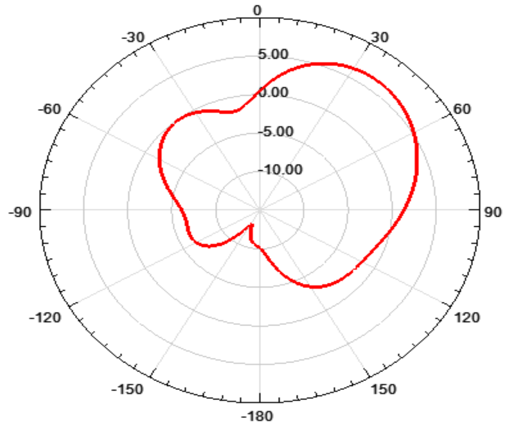

Fig. 6.b .Directivity at 8 GHz.

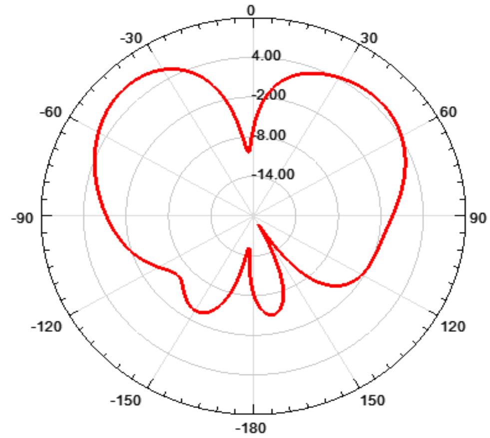

Fig. 6.c .Directivity at 9 GHz.

II.RESULTS AND DISCUSSION

The simulated patch antenna gave a resonant frequency of 5.8 GHz where we find the gain is 5.25db and directivity is 5.18 dbi. here the simulated return loss is -29 dB. And other wide band covers with resonant frequency of 8.1 GHz where simulated return loss is found to be -25 dB fromthe curve shown in fig. 3. It is shown useful return loss Peaks of the dual band patch antenna at 5.8 GHz and 8.1GHz. The directional pattern at the 5.8, 8.1 and 9GHz as shown in fig 6.VSWR is also for both band is between 1 to 2.here in this antenna directivity which is also applicable of good working on WLAN applications.

III.CONCLUSION

This paper investigates a planar band antenna that cover bands300 MHz (5.7 to 6 GHz) and wide band 2GHz (7.6 to 9.2GHz) suitable for, WLAN, and satellite communication, Wi-Fi for laptop applications.UWB and the associated networking protocol efforts are in the early stages of development, and several key deployment scenarios are being defined and evaluated.UWB complements currently deployed wireless networks in the WLAN environment, plus it extends high bit-rate, multimedia connectivity to WPANs supporting PC, CE and cellular devices. This combination will enable true convergence of computers, consumer electronics and mobile communications.

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