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Bndwidth enhancement Technques of the dual band patch antenna

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Abstract
In this paper a new antenna configuration with dual element offering dual band frequency with a controllable of frequency ratio of the two elements and a novel dual microstrip antenna wide bandwidth is presented. Simulations and measurements on the new proposed antenna configuration have provided a useful design for a wideband width MPA of 9% or with a controllable frequency separation of the two frequencies of the dual-element with f_2/f_1 = 1.38:1 for the given construction.

Keywords: Microstrip antenna, wide bandwidth, antenna configuration etc.

Introduction
Over the last 15 years there has been a progressive shift in telecommunications markets, how they are regulated and the attendant implications for the delivery of broadband communications. In recent years there has been an unprecedented growth in the development and deployment of wireless communication systems. The flexibility of wireless communications gives rise to a multitude of poetential applications in our society, which is becoming increasingly dependent on information transmission and processing. The interest in short-range wireless communications is accompanied by an increasing need for higher data rates, as numerous new multimedia broad-bandwidth demanding applications proliferate at a great pace.

In microstrip patch antennas the pattern bandwidth is usually many times larger than the impedance bandwidth and, therefore, the discussion of bandwidth in this paper will concentrate on impedance rather than patterns. Bandwidth enhancement techniques have been found to enhance the bandwidth of patch antennas, either by obtaining a wider bandwidth or performing a dual-band operation. To different radiating element connected together through a matched section and are embedded on a single layer structure. This new structure offers a wide frequency bandwidth of approximately 9%. This is done by controlling the two resonance frequency of the two elements.

Wireless applications have under gone rapid development in recent years. One particular wireless application that has experienced distained is the Wireless Local Area Network (WLAN). This wireless application i.e. selected to be studied is the 2.4GHz to 2.5GHz frequency band which is based on the 802.11 b WLAN standard.

Microstrip Patch Antennas (MPA) are extremely attractive candidates for use in many applications due to their interesting features such as low cost, light weight, thin profile and conformability. On the other side, the greatest disadvantages of MPA is its low bandwidth which can be as low as 1%. The most straight forward way to improve the MPA bandwidth is to increase the patch-ground plane separation by using a thicker substrate [1-4]. Unfortunately the thick substrate will support surface wave modes that will increase mutual coupling in antenna arrays. Mutual coupling will result in serious degradations in impedance mismatch, large radiation loss polarization distortion and scan blindness in phased array antennas.

The main goal of this paper is to present a new antenna configuration with dual-element offering dual-band frequency with a controllable of requency ratio of the two elements. Once the frequency response of the dual-element can be controlled. We can get a wide bandwidth antenna configuration by overlapping the two-element frequency response [5-8].

Finally, the wide-bank antenna performance has been improved by using parasitic elements with one of the two elements.

Dual-bandmicrostrip patch antenna

A novel dual-bank MPA is described where two different radiating elements connected together a matched section and is embedded on a single layer structure as shown in Figure 1. The first element is a rectangular MPA with frequency f_1 controlled by patch dimension L, and W and the second element is a printed dipole with frequency f_2 controlled by the dipole dimensions L_d and W_d. The structure is fed by a coaxial probe through the dipole elements which is direct coupled to the MPA by a quarter wave length matched section with width Wm, and length Lm. The computer simulation is done using, the commercial software HFSS version 8.0 with the fixed design. Structure parameters given in Table 1 for a resonant frequency f_1 of the rectangular MPA at 10 GHz. The simulated results are given in Table 2 which shows that as the dipole length L_d increases, its resonant frequency f_2 get closer to the MPA resonant frequency f_1 slightly decrease in the later resonant frequency. The simulated results of S_{11} for the antenna shown in Figure 1 are given in Figure 2 for only three values of LD (20, 24 and 28 mm).

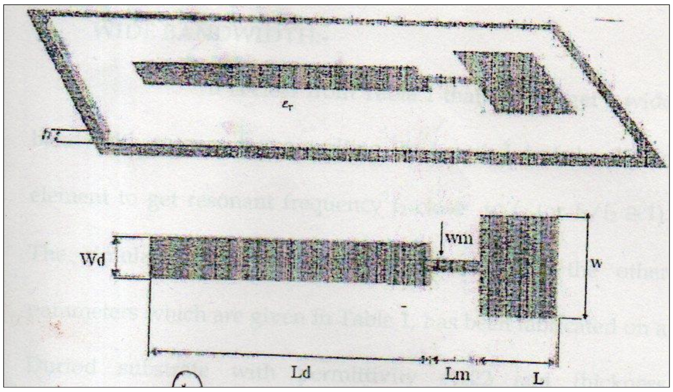

Fig 1: Configuration f the dual band MPA

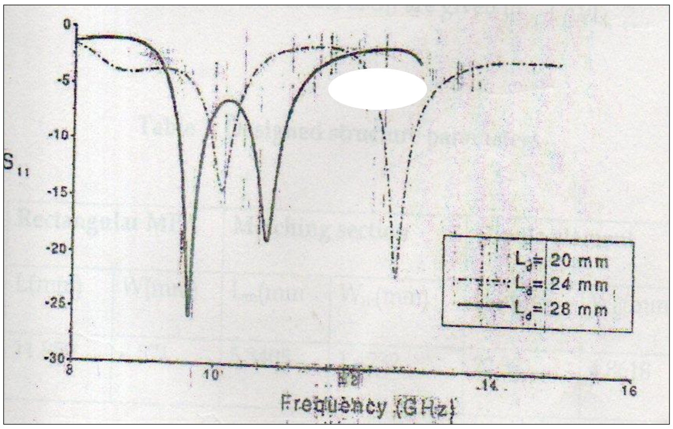

Fig 2: Simulated S11 for the antenna shown in Fig. 1 with different dipole lengths L_d.

Optimizing the dual-band antenna for a wide bandwidth

It is clear from Table 1 that we can get a wide bandwidth antenna by controlling the length Ld of the dipole element to get resonant frequency f_2 close to f_1 (or $f_1/f_2 \cong 1$). The simulated dual-MPA with L_d = 32mm, and the other parameters which are given in Table 1, has been fabricated on a Duriod substrate with permittivity = 2.22 and thickness h = 1.587 mm with copper cladding of thickness = 0.017mm. The measured and simulated results of S_{11} are given in Table 2.

Table 1: Designed structure parameters

Rectangular MPA		Matching section		Dipole element	
L(mm)	W(mm)	L_m(mm)	W_m(mm)	L_d(mm)	W_d(mm)
11.859	8.871	5.3405	1.4232	22.32	4.8618

Table 2: Simulated results

L_d(mm)	f_1 of MPA (GHz)	f_2 of dipole (GHz)	f_1-f_2 (GHz)	f_1/f_2
20	10.02	13.80	3.78	1.38:1
22	1027	13.60	3.33	1.32:1
24	1013	12.85	2.72	1.27:1
26	9.92	11.88	1.96	1.20:1
28	9.64	10.74	1.10	1.10:1
30	9.40	10.31	0.85	1.09:1
32	9.38	10.13	0.75	1.08:1

Conclusion

Simulations and measurements on the new proposed antenna configuration have provided a useful design for a wideband width MPA of 9% or with a controllable frequency separation of the two frequencies of the dual-element with f_2/f_1 = 1.38:1 for the given construction.

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