

PERFORMANCE ANALYSIS OF DUAL BAND G-SHAPED MICROSTRIP PATCH ANTENNA WITH COAXIAL FEED LINE FOR WLAN

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Abstract— The following paper describes the dual band G shape Microstrip patch antenna for WLAN application. We simulated this antenna by using Ansoft HFSS. The proposed antenna is G shape Microstrip patch antenna with non conductor back. This antenna is fed by Coaxial cable feed. Measured value of bandwidth at -10 db is 50 MHz for lower band i.e. 2.42 GHz and 72 MHz for upper band i.e. 5.2 GHz.

Index Terms— Ansoft HFSS, Dual Band Operation, G shape, Microstrip Patch Antenna, WLAN.

I. INTRODUCTION

Microstrip patch antenna is radio antenna with low profile. It consists of active patch of metal with ground plane (patch of metal). The size of ground is larger than size of active patch. Microstrip patch antenna resonates due to discontinuities at each abridged rim of microstrip line. Patch antenna use's FR4 as dielectric substrate material. Patch antenna are easy to fabricate and amend, these have numerous applications including WLAN, satellite communication and military applications. WLAN has played significant role in evolving telecommunication, it compensates all the advantages of conventional LAN with benefit of mobility. Microstrip patch antenna due to being low weighted compact sized and producing optimum results are used in WLAN applications. The design of antenna gets complicated when desired operational bands are dual or multi band, up till now many antenna design which comply for dual or multi band have been presented in accordance with IEEE 802.11 WLAN

standards[1]-[6].

Due to demand of faster data rate it is advantageous to use upper band i.e. 5GHz. The upper band has 3 operational frequency bands for IEEE 802.11a i.e. 5.15GHz ~ 5.25GHz, 5.25GHz ~ 5.35GHz, 5.725GHz ~5.825GHz. As G shaped microstrip patch antenna operates on lower and upper band on single resonating frequency without using band separation techniques such as notching so in the near future G shaped antennas would be preferred over other microstrip patch antennas. Coaxial feed line is much ideal feeding method due to its potential in providing a diversity of required emission features of dual and multi band and easy incorporation with system circuit board.

In this paper we have proposed a Coaxial fed G-shaped microstrip patch antenna which is suitable for operation at lower and upper band of wireless local area network (WLAN) simultaneously i.e. 2.4/5.2 GHz. The dimensions of G shape were carefully selected by using equations [7] for dual band operation. Measured antenna performance such as VSWR, bandwidth, current distribution vector, gain and radiation pattern are discussed in this paper.

II. DESIGN ANTENNA GEOMETRY

Fig 1 shows physical dimensions of Coaxial fed G-shaped microstrip patch antenna. This antenna is mounted on FR4 dielectric substrate having 1.6mm

thickness and dielectric constant of 4.4. The physical dimension of FR4 substrate is 52 x 62 mm.

This antenna is printed on 1 side of substrate while other side consists of copper sheet which serves as ground plane. A 50 ohm Coaxial feed line is used for excitation. The G-shaped patch is operated at resonance so that real valued impedance can be achieved.

By changing different values of strip (thickness and length) and feeding point the operational frequency changed and thus by careful examination and controlling current distribution desired results were achieved. Values of parameters for desired results are listed in table 1.

Table 1: value of parameters for optimized results.

BOXES	X Plane	Y Plane	Z Plane
BOX 2	X=4.78mm	Y=-20.3mm	Z=35 μ m
BOX 3	X=-24.3mm	Y=7.5mm	Z=35 μ m
BOX 4	X=-6 mm	Y=-20.88mm	Z=35 μ m
BOX 5	X=-9mm	Y=-5mm	Z=35 μ m
BOX 6	X=2.7mm	Y=-10.5mm	Z=35 μ m
BOX 7	X=4.2mm	Y=-5.58mm	Z=35 μ m

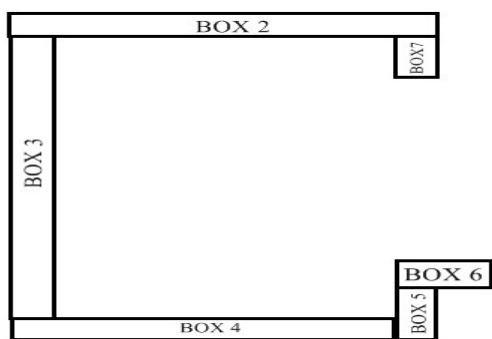


Fig 1: Geometric view of G-shaped antenna.

III. ANTENNA DESIGN

In fig 2 HFSS view of G-shaped microstrip patch antenna with Coaxial feed for dual band operation is shown.

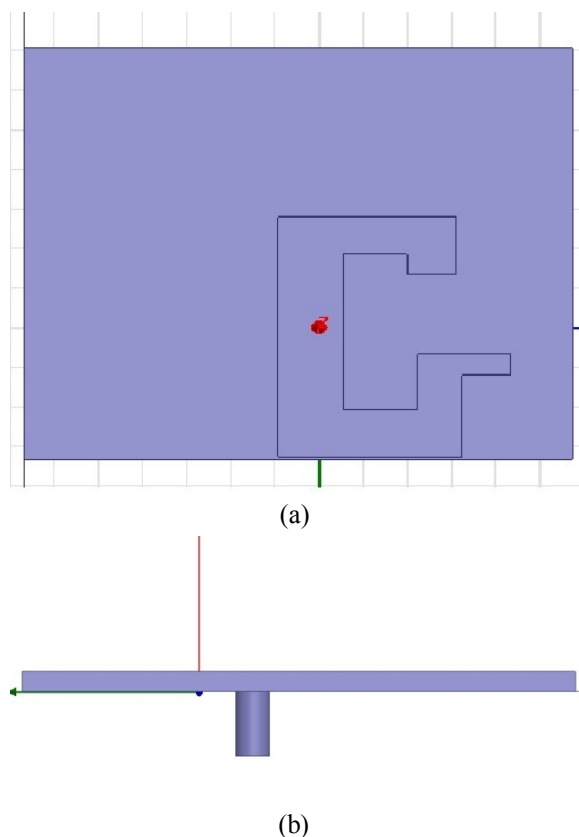


Fig 2: HFSS view of G-shaped antenna (a) front view (b) side view

IV. SIMULATED RESULTS

This designed antenna resonates at 2.42 and 5.2 GHz. The value of return loss for 2.42 and 5.22 GHz is -20.5 and -18 dB respectively. The bandwidth at 2.42 and 5.2 GHz is 50 and 72 MHz. The graph of return loss vs frequency is shown in fig 3.

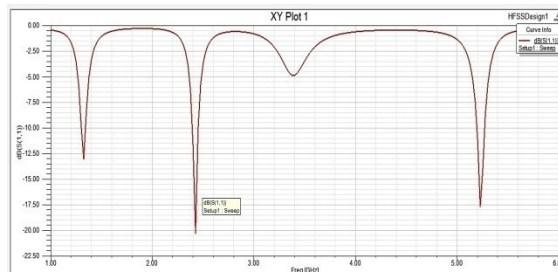


Fig 3: return loss of proposed antenna

The ideal value of VSWR lies between 1-2. The VSWR of our proposed G-shaped micro strip patch

antenna for 2.42 and 5.2 GHz is 1.2 and 1.5 dB. The graph of VSWR vs frequency is shown in fig 4.

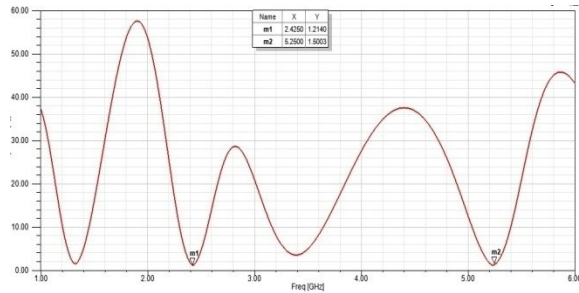


Fig 4: VSWR of proposed antenna

Radiation pattern of G-shaped microstrip patch antenna shows directivity of 6.20 dBi and direction of main lobe is 2 degree. Graph between directivity and frequency is shown in fig 5.

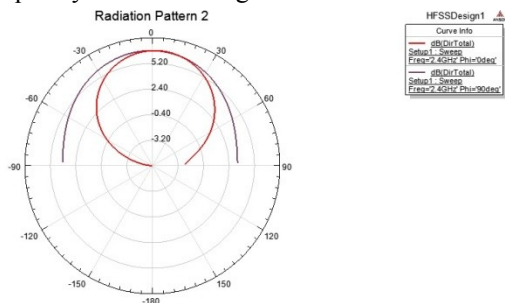


Fig 5: Directivity of proposed antenna

Current distribution on surface of patch antenna determines the operational frequency bands of antenna. current vector of 2.42 and 5.2 GHz are shown in fig 6.

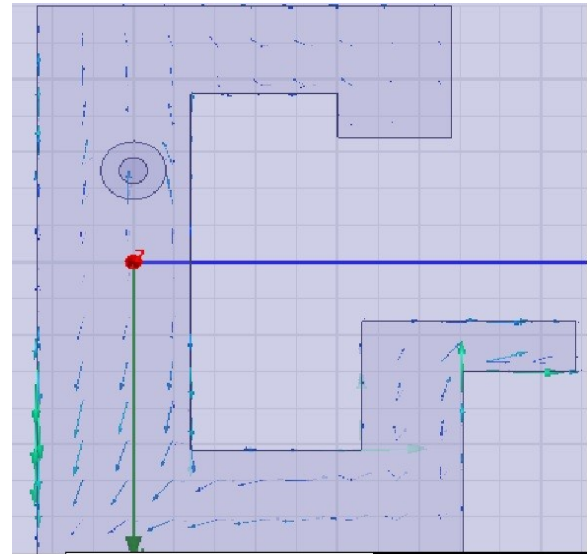
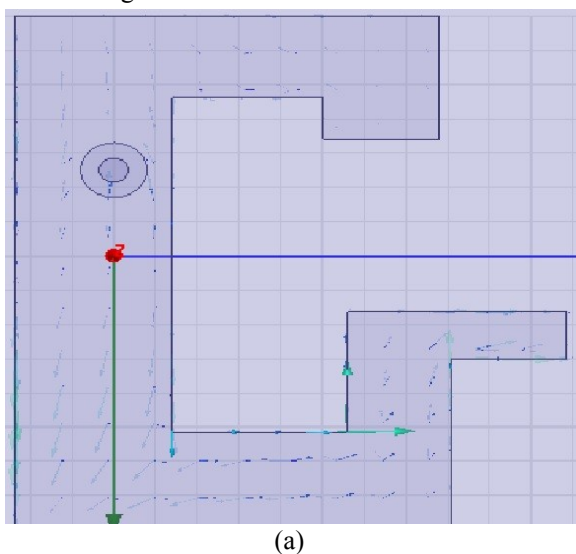


Fig 6: current distribution vector for (a) 2.42 GHz (b) 5.2 GHz

V. CONCLUSIONS

A dual band G-shaped microstrip patch antenna for WLAN has been presented. This antenna is simulated by using Ansoft HFSS software. This antenna resonates at 2.45 GHz and its operation frequencies are 2.42 and 5.2 GHz and comply with international standards of WLAN. The return loss for 2.42 and 5.2 GHz are -20.5 and -18. This antenna can be integrated with RF transmitter [8]-[10] and receiver [10]-[15] to form WLAN system and split ring resonator can be added to patch for increasing gain of antenna [15]-[24].

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