

Multi Application Antenna for Wi-Fi, Wi-max and Bluetooth for better radiation efficiency

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ABSTRACT:

This paper presents the radiation performance of rectangular patch antenna having a two slots. The design is used for three different frequencies 2.4, 5 and 7GHz . As a substrate material Cu_clad is used. The simulated results for this antenna are obtained by varying the length and width of three dipoles.The results indicate that rectangular patch antenna with two slots offers a good antenna efficiency 41.576 at 2.45 GHz,51.958 at 5 GHz,46.810 at 7 GHz with the input feed 50 Ohm. . Desired patch antenna design was simulated by ADS simulator program. ADS supports every step of the design process—schematic capture, layout, frequency-domain and time-domain circuit simulation, and electromagnetic field simulation, allowing the engineer to fully characterize and optimize an RF design without changing tools. With ADS's Wireless Libraries and circuit-system-EM co-simulation technology, ADS provides full, standards-based design and verification within a single, integrated platform. In view of design, selection of the patch width and length are the major parameters along with the feed line dimensions.

Key words: Wi-Fi, Wi-max and Bluetooth, ADS, Micro strip Patch, 2.4, 5 and 7GHz

INTRODUCTION:

In this paper the good efficiency is offered by modified Microstrip Patch antenna which operates at frequency range 2 to 11GHz has been discussed in detail. Microstrip patch antenna has been received tremendous attention since the last two decades and now it becomes a major component in the development of Wi-Fi, Wi-max and Bluetooth.

Microstrip antenna is a printed type antenna consisting of a dielectric substrate sandwiched in between a ground plane and a patch. In this project Micro strip patch antenna technology is used for different application for different frequencies different materials are used for better efficiency.

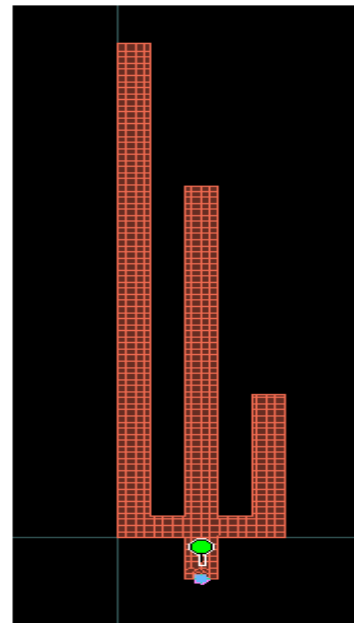


Fig.1:Patch layout mashed structure

These are preferred over other types of radiators because of its low profile and light weight but its major drawback is its low antenna efficiency and low gain. This is one of the problems that researchers around the world have been trying to overcome.

In this project, we have tried to increase the efficiency of the patch antenna. It has been noticed that there is some significant increments in antenna efficiency measurements.

FUNDAMENTAL SPECIFICATIONS OF PATCH ANTENNAS

A micro strip or patch antenna is a low profile antenna that has a number of advantages over other antennas it is light weight, inexpensive, and easy to integrate with accompanying electronics. While the antenna can be 3D in structure (wrapped around an object, for example), the elements are usually flat hence their other name, planar antennas.

1) Antenna Efficiency and Gain:

Antenna gain is defined as antenna directivity times a factor representing the radiation efficiency. This efficiency is defined as the ratio of the radiated power (P_r) to the input power (P_i). The input power is transformed into radiated power and surface wave power while a small portion is dissipated due to conductor and dielectric losses of the materials used. Surface waves are guided waves captured within the substrate and partially radiated and reflected back at the substrate edges. So here the antenna efficiency 41.576 at 2.45 GHz, 51.958 at 5 GHz, 46.810 at 7 GHz. The gain for 2.4 GHz is 3.652 db, for 5GHz it is 5.102db and for 7GHz it is 6.162db.

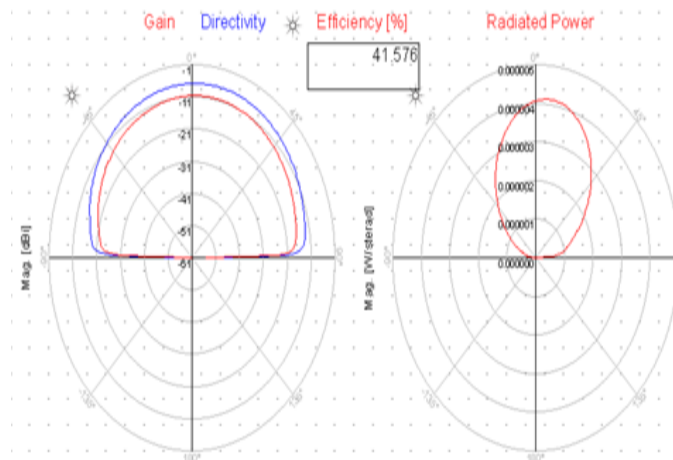


Fig.2: Gain & Efficiency for 2.45 GHz

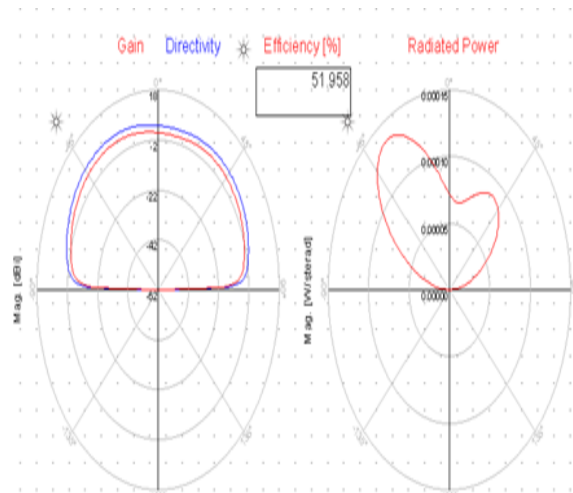


Fig.3: Gain & Efficiency for 5GHz

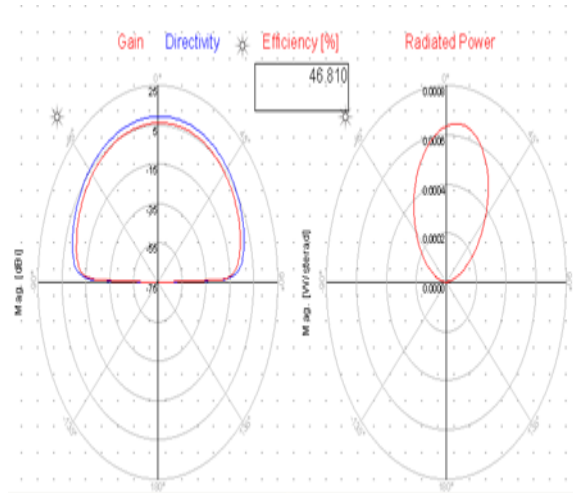


Fig.4: Gain & Efficiency for 7 GHz

2) Radiation Pattern:

The patch's radiation at the fringing fields results in a certain far field radiation pattern. This radiation pattern shows that the antenna radiates more power in a certain direction than another direction. The antenna is said to have certain directivity. This is commonly expressed in dB. The rectangular patch excited in its fundamental mode has a maximum directivity in the direction perpendicular to the patch (broadside). The directivity decreases when moving away from broadside towards lower elevations. The 3 dB beam width is twice the angle with respect to the angle of the maximum directivity, where this directivity has rolled off 3 dB with respect to the maximum directivity.

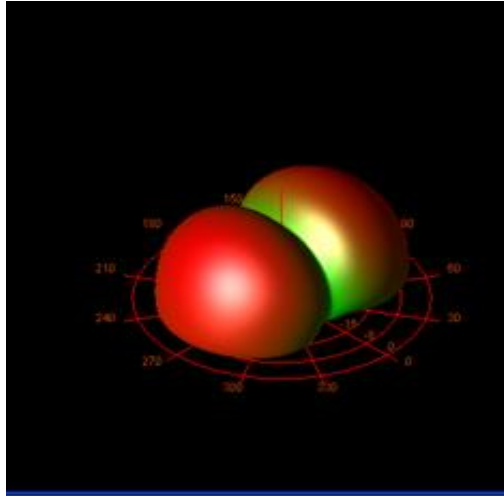


Fig.5: 3D Radiation Pattern of Patch Antenna for 2.45 GHz

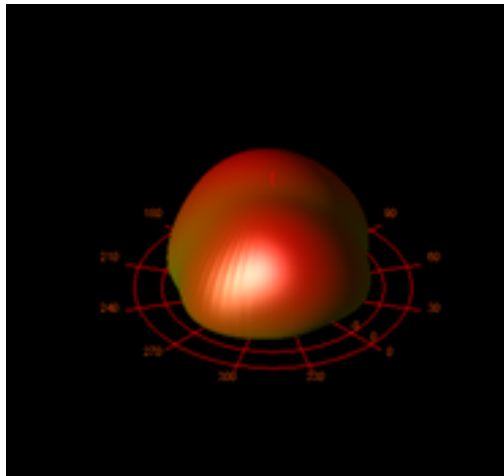


Fig.6: 3D Radiation Pattern of Patch Antenna for 5 GHz

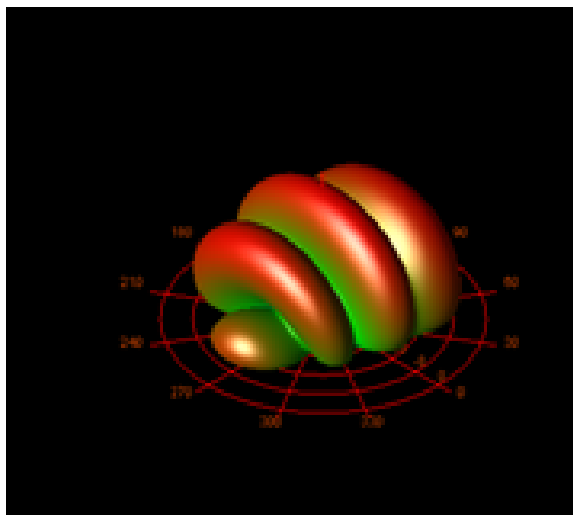


Fig.7: 3D Radiation Pattern of Patch Antenna for 7 GHz

3)Return Loss:

In telecommunications, return loss is the loss of power in the signal returned/reflected by a discontinuity in a transmission line or optical fiber. This discontinuity can be a mismatch with the terminating load or with a device inserted in the line. It is usually expressed as a ratio in decibels (dB). The results indicate that rectangular patch antenna with two slots offers impedance -2db for 2.4 GHz, -1.5 db for 7 GHz and -5 db for 7 GHz with the input feed 50 ohm.

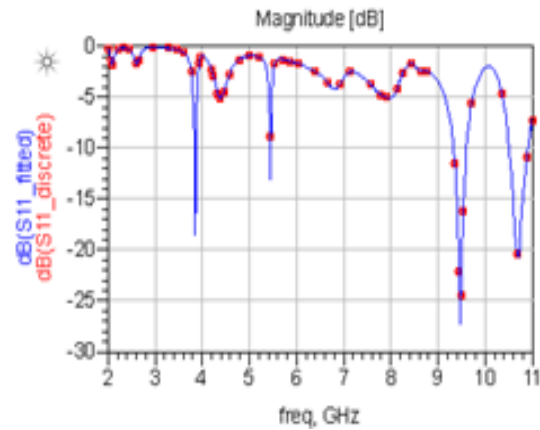


Fig.8: Return loss of Multi Application Patch Antenna

4)Antenna Parameters:



Fig.9: Antenna Parameters for 2.45 GHz

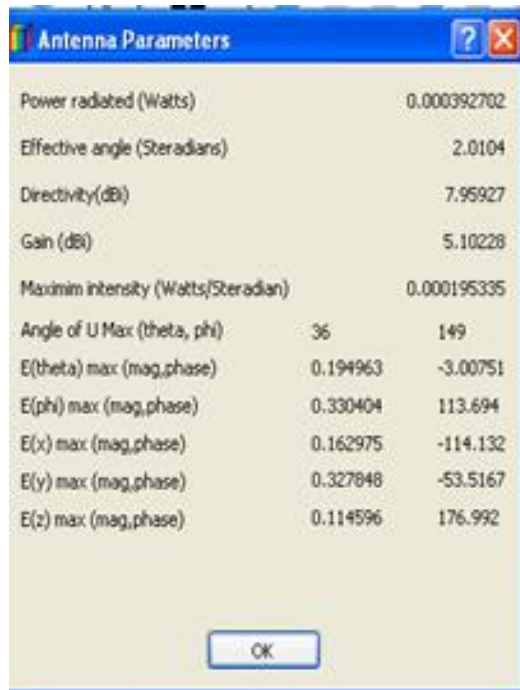


Fig.10: Antenna Parameters for 5 GHz

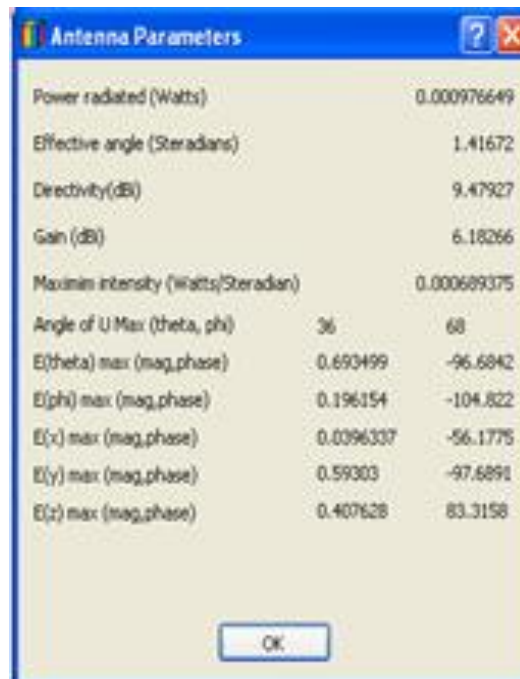


Fig.11: Antenna Parameters for 5 GHz

CONCLUSION:

The research motivation of this project is to design multi application patch antenna for Wi-Fi, Wi-max and Bluetooth applications which operates at 2.45, 5 and 7 GHz. The rectangular patch antenna with two slots with 50ohms feed has been designed. It's operating range is 2 to 11GHz and substrate material used here is Cu clad. Antenna efficiency 41.576 at 2.45 GHz, 51.958 at 5 GHz, 46.810 at 7 GHz. ADS electromagnetic simulator is used for design and simulation of patch Antenna.

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