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Harmonic Suppressed Microstrip Antenna for WLAN Applications

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***Abstract*— A novel harmonic suppressed microstrip antenna for 2.4-GHz wireless local area network (WLAN) applications is proposed. The proposed antenna is fed with inset feed microstrip line. The antenna is printed on FR4 substrate and with dielectric constant 4.4. The antenna operates on at 2.4 GHz which is used for WLAN and the simulation is done in HFSS software. The planar design, simple feeding technique and compactness make it easy for the integration of the antennainto circuit boards. The dumb bell shaped stubs are used on Feed line and on ground plane to suppress the harmonics. The defects on the ground plane disturb the current distribution of the ground plane. Simulation tool, based on the method of moments has been used to analyze and optimize the antenna. Various features such as miniature size, simple con-figuration and low fabrication cost make the antenna suitable for wireless networks**

Keywords - Dual-band, HFSS, in set fed, DGS, WLAN.

I. INTRODUCTION

In recent times, Microstrip patch antennas are extremely prevalent because of its benefits, for example, low profile, inexpensive to manufacture, light weight and easy to fabricate. Inspite of these benefits, there are faults like narrow bandwidth, poor power handling capacity in microstrip antennas [1-2]. Generally, microstrip antennas operate in different frequency bands, individual antennas are required to cover each band which prompts space-restricting problem. One way to fulfill this requirement is using multiple antennas, but itwill increase the size and complexity of the system. To conquer this problem, dual-band slot antennas are required where a single antenna provides two resonate frequencies. Henceforth it decreases the system size and complexity [3]. In dual-band microstrip antennas it is conceivable that numerous measures, for example, WLAN principles can be coordinated into a single wireless device. To accomplish the wide bandwidth, slot need to be adjusted with appropriate length and width. With suitable development of antenna, to accomplish a wide bandwidth different shapes of slot antennas were proposed, which include rectangular, triangular, circular[4], elliptical [5], triangles [6]. Slot antenna with edge fed is used to obtain dual-band antenna [7].

Over the previous years, a few procedures have been accounted for dual-band antenna design, one of the generally acknowledged strategy to outline is loading the radiating patch with a slot [12]. DGS has been integrated on the ground plane with planar transmissionline, that is, microstrip line, coplanar waveguide, and conductor backed coplanar wave guide. The defects on the ground plane disturb the current distribution of the ground plane; this disturbance changes the characteristics of a transmission line (or any structure) by including some parameters (slot resistance, slot capacitance, and slot inductance) to the line parameters (line resistance, line capacitance, and line inductance). In other words, any defect etched in the ground plane under the microstrip line changes the effective capacitance and inductance of microstrip line by addingslot resistance, capacitance, and inductance.[3]

II. ANTENNA CONSTRUCTION AND DESIGN

The structure of inset fed microstrip antenna is shown in Fig. 1. Harmonic suppressed microstrip antenna is shown in Fig. 2.

Fig. 1. Microstrip antenna

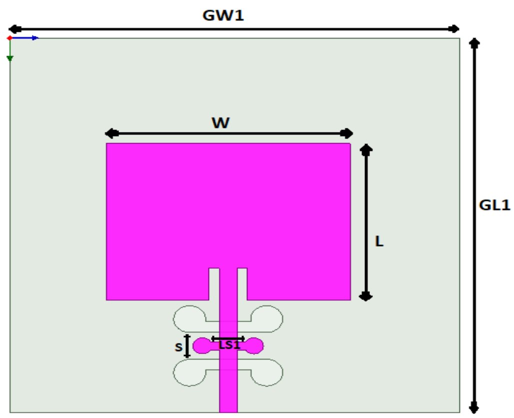


Fig. 2. Harmonic suppressed antenna

The Harmonic suppressed antenna is designed with its patch length (L) and width (W), using FR4 epoxy substrate having dielectric constant of 4.4.

Design dimensions of Harmonic suppressed microstrip antenna shown in Table I.

Harmonics are mainly suppressed with stub length and width which are presented on feed line and ground plane.

TABLE I. DESIGN DIMENTIONS

NAME	DIMENSIONS (mm)
GW1	70
GL1	70
W	38
L	29.5
L_f	33
W_f	2.8
LS1	8
S1	12

III. RESULTS AND DISCUSSION

Return loss of -14.85dB is obtained for a microstrip antenna without harmonic suppression is shown in Fig. 3. and -24.88dB is obtained with harmonic suppression is shown in Fig. 4. A Gain of 2.77 dB is obtained with Harmonic suppressed antenna. Antenna parameters are shown in Table II. 2D and 3D radiation plots are shown in Fig. 6 and Fig. 7 respectively.

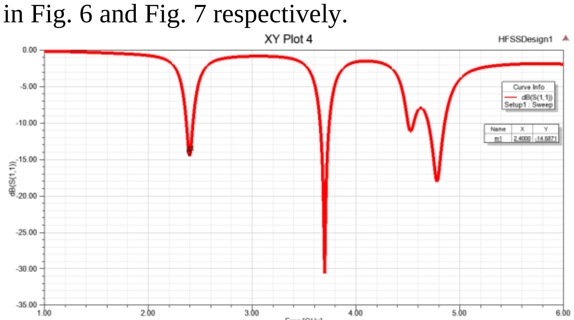


Fig.3. simulated return loss at 2.4 GHz without Harmonic suppression.

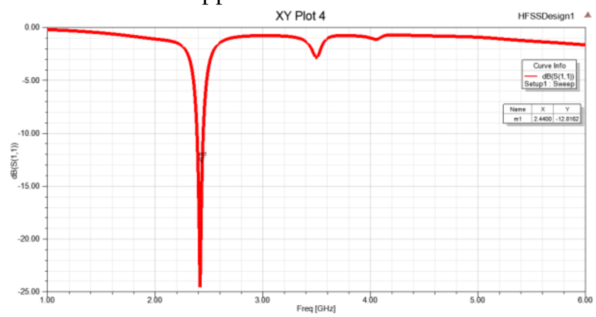


Fig.4. simulated return loss at 2.4 GHz with Harmonic suppression.

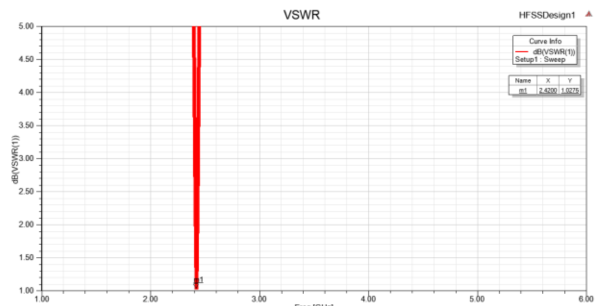


Fig.5. simulated VSWR of Dual band antenna.

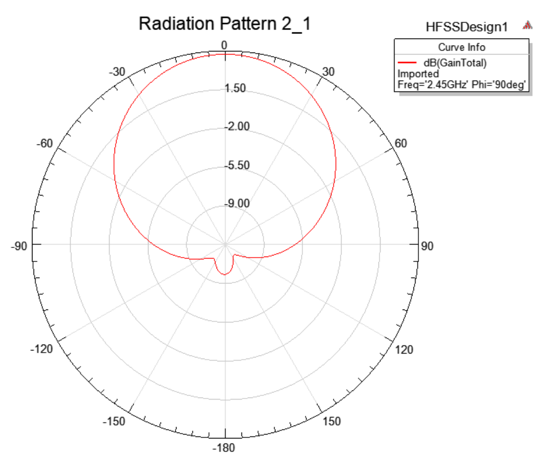


Fig.6.simulated radiation pattern

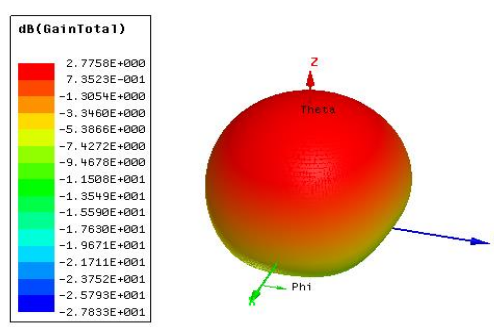
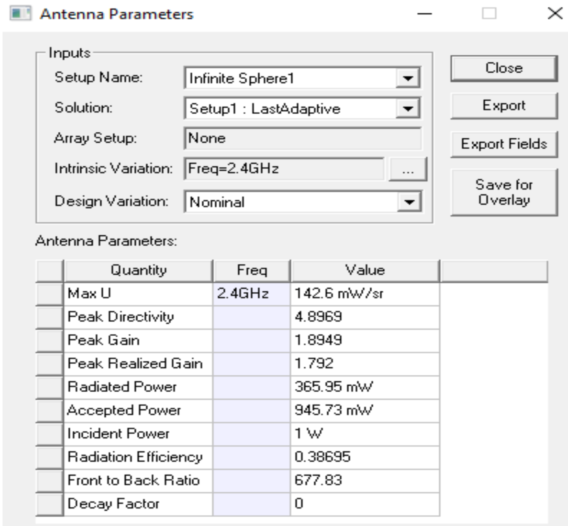


Fig.7. simulated 3D polar plot for 2.4 GHz

TABLE II. Antenna Parameters



Antenna Parameters

Inputs

Setup Name: Infinite Sphere1

Solution: Setup1 : LastAdaptive

Array Setup: None

Intrinsic Variation: Freq=2.4GHz

Design Variation: Nominal

Close | Export | Export Fields | Save for Overlay

Antenna Parameters:

Quantity	Freq	Value
Max U	2.4GHz	142.6 mW/sr
Peak Directivity		4.8969
Peak Gain		1.8949
Peak Realized Gain		1.792
Radiated Power		365.95 mW
Accepted Power		945.73 mW
Incident Power		1 W
Radiation Efficiency		0.38695
Front to Back Ratio		677.83
Decay Factor		0

IV. CONCLUSION

The simulation studies are carried for the antenna at designated frequency band. we designed The overall working ofantennas was understood. The major parameter such as Return Loss of the design at 2.4 GHz applications were studied and achieved successfully. In particular, where printed antennas are implemented on a single substrate along with active components and circuitry, this architecture may find usage in microwave integrated circuits. Higher order harmonics with a more than 80% suppression rate have been achieved in this work. The suggested idea can be used to achieve better harmonic frequency control when higher order harmonics become a significant restriction in some antennas with desirable properties.

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