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Performance Analysis of Circular Shaped Patch Antenna for IoT Application Device

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Abstract— Now a days Technological industries are focusing on IoT to provide services like emergency health care, Environment monitoring, Control home appliances etc. IoT device mainly consist of sensors also Radio device to communicate sensed data. For communication we need efficient antenna. Since we have designed and simulated circular shaped micro-strip patch antenna for IoT device, performance of antenna is analyzed through $S_{1,1}$ parameter and gain.

Keywords— microstrip patch antenna, IoT, WLAN.

I. INTRODUCTION

Micro strip antenna are widely used in used communication device due to its low conformal and low profile properties [1]. Currently industries are more concentrating on Internet of things and its application. IoT device most of the time they need to communicate wirelessly through it can easily access internet. Antenna are the most required part of communication device like Smartphone, smart cities, smart watch, smart ring, smart tv, smart helmet etc. multiband antenna are useful in smart devices. Communication system must be efficient to transfer all type of data such as voice text and multimedia information.

In this paper we have designed a multiband antenna that can be give performance in terms of return loss $S_{1,1}$ parameter, designed antenna is modification of antenna presented in [2]. We modified antenna by providing one extra square patch on another side of substrate. Since antenna gain has improved.

Some research work focused on MIMO, In [3] MIMO triple band antenna designed and. The triple band micro-strip monopole antenna FR4 is used as substrate with thickness of 1 mm. Asymmetrical truncated square ground plane used to construct the antenna with dimension $36\times72mm^2$. This new design of antenna can be used for Bluetooth/WiBro/WiMax/LTE/WLAN, LTE/C-band/FS/FSS, and WiMax/WLAN Applications with Bandwidth of antenna is 2.33-2.82,3.68-4.31 and 5.7-6.48.

Extensive research has been taken place in the field of transmission-line metamaterials that is transmission line are comprising of electronic devices like capacitor and inductors[4].

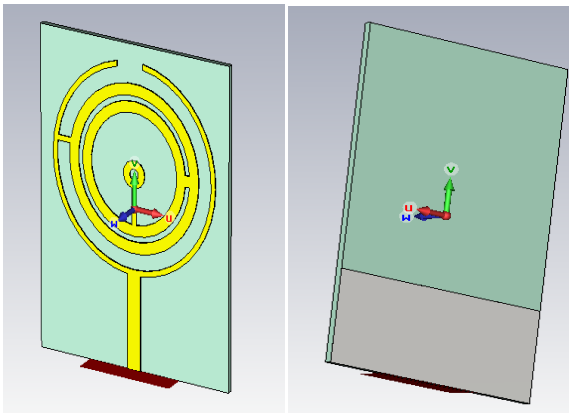

Fig 1. Design of Antenna

Antennas are powered by Transceiver. Antenna work with proper way required to match its impedance with impedance of transmission line[1], VSWR is one parameter used to measure impedance of antenna and impedance of transmission line.

S11 parameter is called reflection coefficient, relationship between antenna ports are measured with help of S parameter. If one port available then we recognize it as S11 parameter.[1]

SAR value is one of the important parameter used to measure how much radiated power from antenna is absorbed by the human body tissue. SAR value always be kept low[1].

Some researchers made extensive research to get performance from antenna. In [5] , Hussein and Luau, proposed a new antenna design for WLAN applications, where the design includes multilayer of substrate with dielectric constant 11.9 and 4.6 they used silicon/glass/silicon. The proposed antenna shows gain 2.8dB and return loss -20. with bandwidth of 920MHz There are many types of antenna that have been proposed for multiple frequency band operations like Wi-Fi, WiMax, ISM band etc. [6][7]. Authors in [8] proved that for applications which require high bandwidth staked configuration on patch antenna can used for. The antenna performance can be improved by inset feeding mechanism and substrate materials play major role in it [9]. For example 'Rogers' which is used as substrate material of an antenna has higher possibilities of good results like s11 parameters gain and return loss [10]. Electromagnetic waves are scattered by many ways so it is very important to have good transmitter and receiver. It needs to consider the polarization and other QoS parameters of antenna [11].

II. ANTENNA DESIGN

Here we have designed a antenna with aim of having a multiband antenna which can be used for the IoT application.

Dimensions of proposed antennal are given in table 1 and the material details are mentioned in table 1.

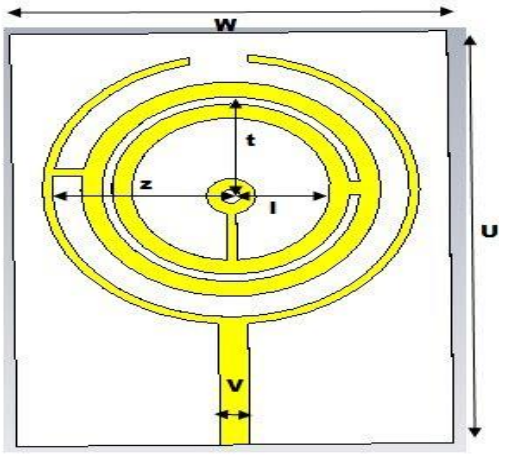

Fig 2. Antenna Dimension

TABLE I

Antenna	MEterial used
patch	Copper(loss)
substrate	Silicon loss free

TABLE II

parameter	Value in mm
w	22
u	29
z	9
t	6.5
l	5
v	1.5

Designed antenna is highly low profile and can mounted on any type of printed circuit board. Antenna is made with substrate material Silicon loss free with epsilon value 11.9, mue 1, Rho Value 2330{kg/M^3} therm. Cond., 248[w/k/kg] and heat capacity 0.7 [KJ/K/kg]. Patch is designed with copper metrical having following properties mue 1, Rho 8930 kg/m^3.

Patch is combination of 3 circular ring with slot. Antenna is feed with I shape patch. Results are discussed in next section

$$\boldsymbol{w} = \frac{\boldsymbol{c}}{\boldsymbol{2f0}\sqrt{(\frac{(\varepsilon r+1)}{2}}} \qquad (1)$$

$$\varepsilon\text{ref} = \frac{\varepsilon r+1}{2} + \frac{\varepsilon r-1}{2}(1 + \frac{12h}{w})^{\frac{-1}{2}} \qquad (2)$$

Width of antenna and dielectric constant represented in equation (1) and (2) [1]

III. RESULTS

Return loss Displayed in Fig 3. It shown good values in the frequency range 2.4 and 5.2. Gain in showed here is nearly 8dBi .shown in fig 4. Radiation pattern shown in fig 5. Antenna performance can be improved by making slot on circular Ring.

All results are displayed in next page.

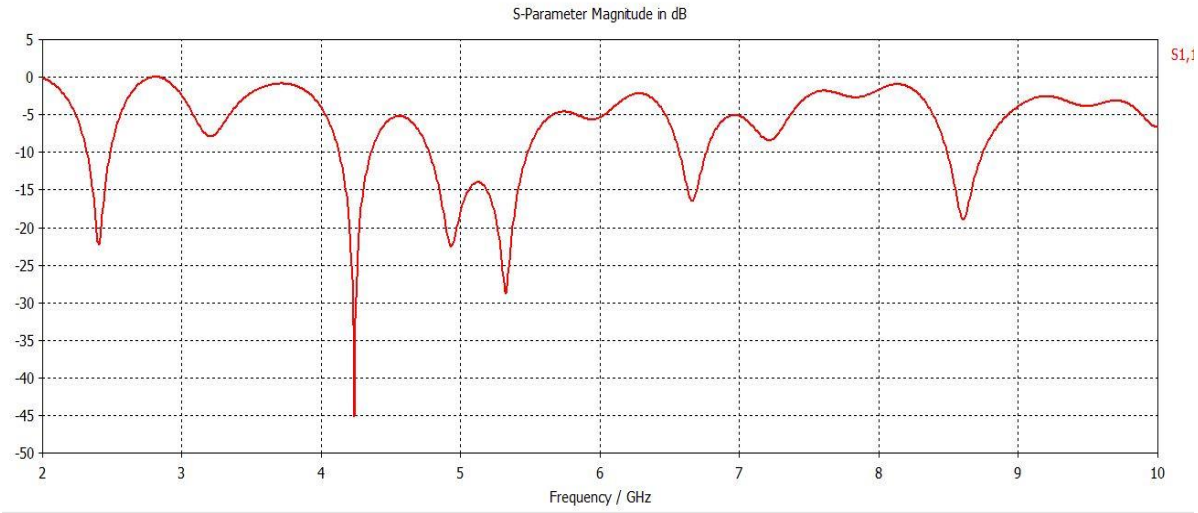

Fig 3. S11 parameter

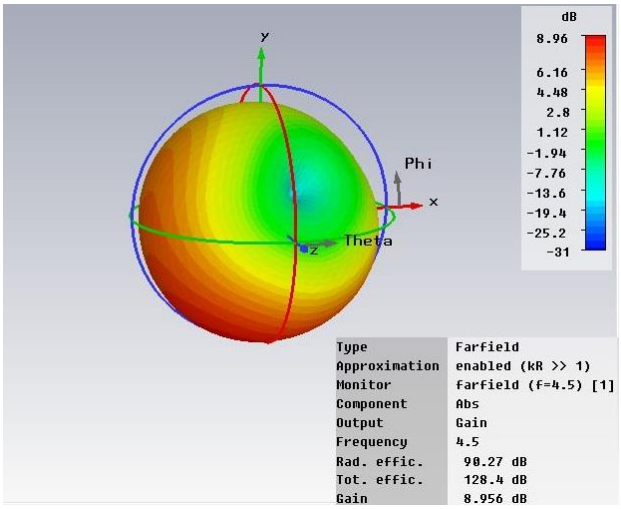

Fig 4. Antenna Gain

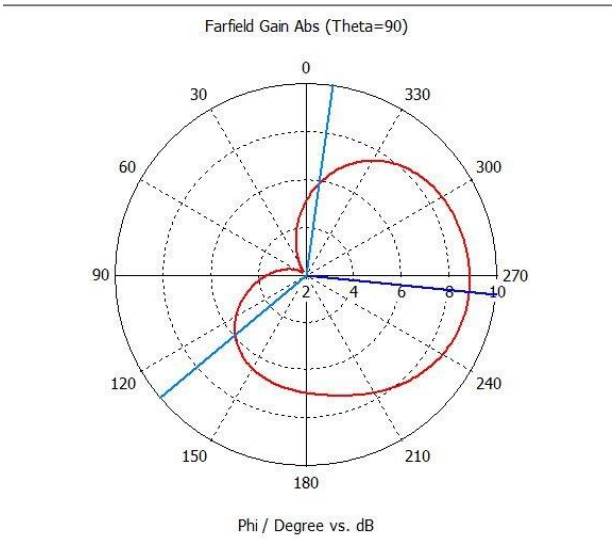

Fig 5. Antenna Radiation pattern

IV. CONCLUSIONS

Designed antenna performance is improved from referred antenna deign in terms of Antenna Return loss and Gain. Antenna Designed can be used for IoT Application which uses WLAN for Communication 5.4Ghz Frequency band.

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