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Design of Microstrip Patch antenna for IOT Applications

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A B S T R A C T

Antennas plays a vital role in wireless communications. The Internet of things (IoT) refers to the Internet connectivity among computers, mobile devices and sensors. These devices can able to communicate and interact with each others over the Internet, and they can also be remotely monitored and controlled.[1]

Most of the IoT applications function in the unlicensed ISM (The Industrial, Scientific, and Medical radio) bands of 2.4GHz, Wireless connectivity for IoT devices can be done using Bluetooth, Zigbee, Wi-Fi which can utilize the frequency zone of ISM band . The Institute of Electrical and Electronics Engineers agreed that 2.4 GHz, with its wide channel selection and range/penetration/cost potential, was a safer bet. Today, some Wireless N routers can operate on both 2.4 GHz and 5 GHz bands concurrently.[6] The 2.4 GHz ISM band is a commonly accepted band for worldwide operations. MW ovens, cord-less phones, medical machines, military RADARS and industrial heaters are uses this ISM band which is also be called unlicensed bands.[2]

In this paper we are using L -shaped patch The finalized antenna operates at 2.4 GHz with a 96% radiation efficiency and peak gains of 2.35 dBi .The performance of the simulation and measurement are found to be in good agreement. Based on the performance that was achieved, the developed L-shaped antenna can be used in a variety of 2.4 GHz ISM bands and IoT application environments, especially for indoor localization estimation scenarios, such as smart offices and houses, and fourth-generation (4G) wireless communications applications due to its small size and high fractional bandwidth.

Keywords: Internet of Things; antenna; gain; bandwidth.

1. Introduction

The idea of the Internet of Things (IoT) has now been integrated into the Internet. It is a rapidly expanding global network of linked things that supports several I/O devices, sensors, and actuators using a common communication protocol. The effectiveness of IoT application operation and device internet connectivity are both enhanced using wireless sensor technologies [4]. With the rapid advancement of IoT technologies, ever- more applications are being found in a variety of fields, such as agriculture, tracking, security, smart cities, smart homes, etc. The antenna is one of the key components of wireless communication sensor technology that is moving into the future. Over the past few years, small and readily integrated antenna design drew a lot of attention due to the enhanced potential for using multi-frequency and multi-function antenna in communication technologies [5].

This paper reports a well-modified L-shaped compact antenna for 2.4 GHz ISM band IoT applications. The simulation was conducted using the HFSS software. A straightforward L-shaped strip line was attached to the feed SMA connector in this design, and integrated with an etching slot built on the backside to obtain sufficient gain and bandwidth. It is demonstrated that a ground shape can provide the gain at a constant value while improving both band- width and efficiency results. Additionally, an experiment to assess the performance of the antenna is provided, and the findings show that the results are in good agreement with the simulation.

1.1. Antenna Design

The configuration of the antenna is shown in Fig 1. The Microstrip Patch antenna is Rogers RT/ Duroid5880(tm) substrate with 2.2 permittivity and 1.55 mm thickness.

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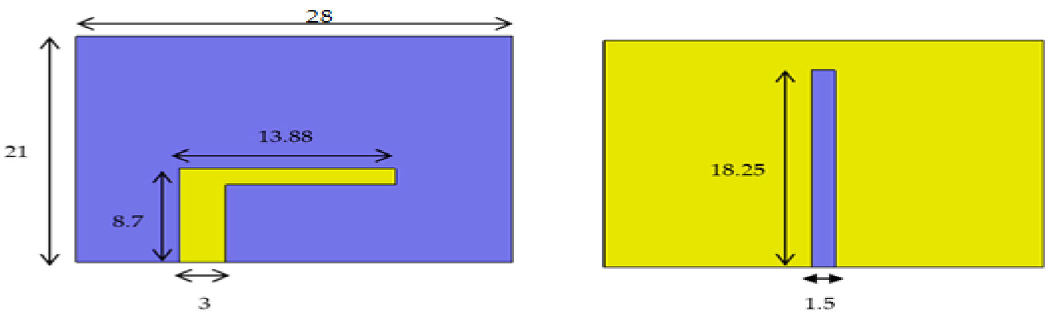

(a) (b)

Fig 1. Antenna topology: (**a**) front patch, (**b**) back side ground plane. Unit: mm.

The antenna measured 28 mm × 21 mm in dimensions. The microstrip patch was two perpendicular lines forming an inverted L-shape to produce the main radiator.

1.2. Simulated results and discussion:

Simulated (using HFSS [8]) results of return loss of the antenna is shown in Fig 2. The resonance frequency of the antenna occurs at 2.4GHz with a return loss of -35.9dB.

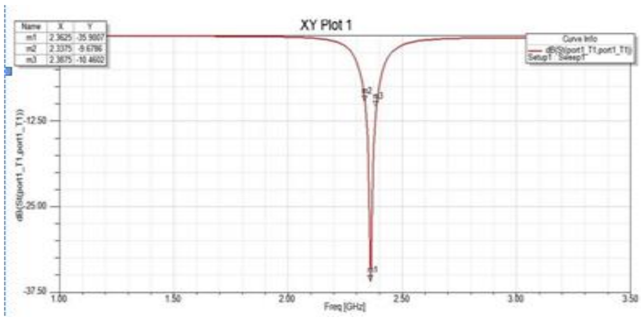

Fig 2:Return loss of the antenna

Simulated radiation pattern

The simulated E –H plane radiation pattern for antenna is shown in Fig 3

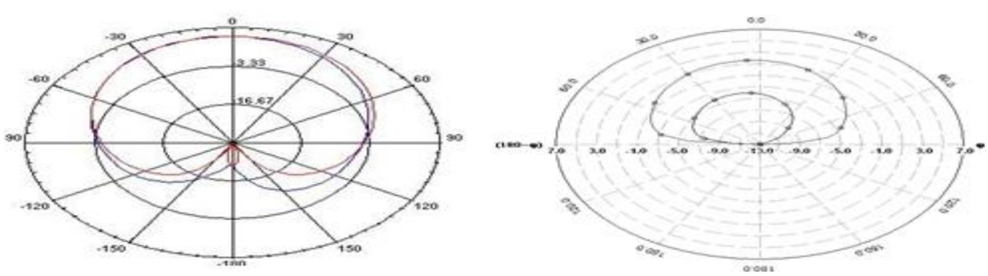

Fig. 3:E & H plane Radiation Pattern of the antenna for 2.4 GHz

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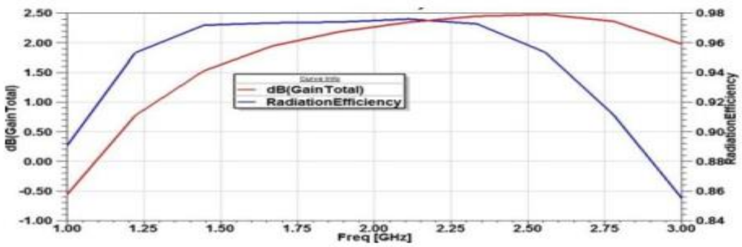
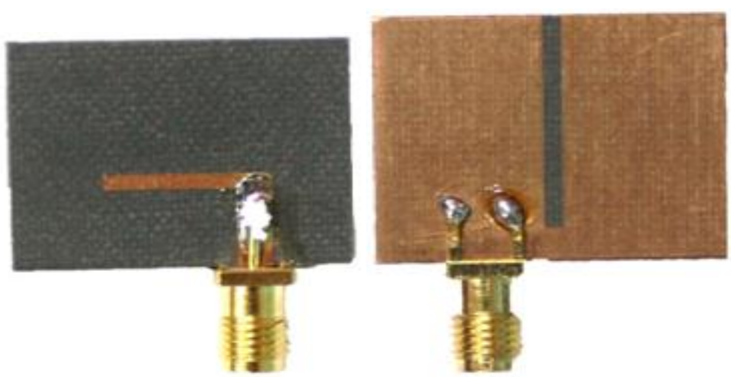


Fig. 4 Gain versus frequency plot for the antenna

Fig 4 shows the Gain versus frequency plot for the antenna. It is observed that gain is about 2.35 dBi for 2.4 GHz.

Experimental Results:

Fabricated Prototype of the antenna is shown in fig.5 .Comparisons between the measured return losses with the simulated ones are shown in Fig 6. All the measurements are carried out using Vector Network Analyzer (VNA) Agilent N5 230A.The agreement between the simulated and measured data is reasonably good. The discrepancy between the measured and simulated results is due to the effect of improper soldering of SMA connector or fabrication tolerance.



(a) **(b)**

Fig. 5. Fabricated prototype: (**a**) patch, (**b**) backside ground.

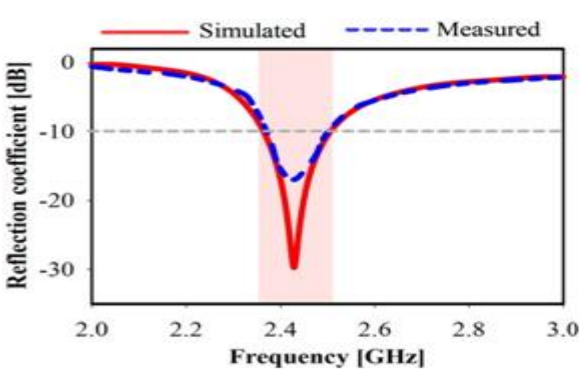


Fig. 6 Comparison between measured and simulated return losses of the antenna

Conclusion:

A Microstrip patch antenna with a conservative size was introduced and researched. An antenna renovation is done on High Frequency Structure Simulator HFSS. The clarification of demarked reception apparatus is streamlined by directing parametric investigation on a few huge plan boundaries named as feed width, feed length, sweep of Bloom petals and decreased ground plane length. The slits reduced the size of the antenna by 75.3 % with a return loss of -35.9dB, absolute gain about 2.35 dBi. Efficiency of antenna has been achieved 96% An optimization between size reduction and bandwidth enhancement is maintained in this work.

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