

# Truncated Corners Microstrip Patch Antenna for UHF RFID Reader Applications

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## Abstract

In this paper, truncated corners microstrip patch antenna for UHF RFID Reader applications is proposed. It consists of square patch radiator with two truncated corners and two unequal square slots on its diagonal axis. The coaxial feed is used and the simulation is carried out in Ansoft HFSS. The 10dB return loss bandwidth and VSWR of proposed antenna is 17.1MHz and 1.1 respectively. The overall antenna size is  $55 \times 55 \times 2\text{mm}^3$ .

## Keywords

Microstrip Patch Antenna, RFID Reader Antenna, Return Loss, Slots and Slits, VSWR

## I. Introduction

In recent years, the RFID (Radio Frequency Identification) system in UHF (Ultra High Frequency) band has become more popular in many applications because it provides fast data rate and long read range [1]. It is an automatic identification technology. This is short range wireless communication. There are several different techniques for the automatic identification like bar code, optical scanners and biometrics but the UHF RFID system is more preferred because it does not require Line-Of-Sight [2].

The main components of RFID system are Tag, Reader and information management system [3].

RFID tag is an electronic circuit that exchanges data with an RFID reader through radio waves. It is the heart of the system. Tags are data carrying devices, so also called as transponder.

It is also called as an interrogator. The means of interrogation is a wireless and because the distance is relatively short, the line of sight between the reader and tag is not necessary. It contains an antenna to transmit information to the tag as well as receive information from tag. RFID reader can be active RFID reader and passive RFID reader on the basis of communication between tag and reader. RFID reader can also be classified based upon the application fixed RFID reader and mobile RFID reader.

The information management system is needed to collect the data to convert into useful information for the end-user [4].

The communication between tag and reader is through reader antenna. So, the reader antenna is also main component of RFID system. For handheld applications the size of reader antenna is the main issue.

In this paper the proposed antenna is used for UHF RFID system. The total frequency range of UHF band used for RFID system is 860MHz-960MHz [5]. The UHF RFID band is not universal worldwide. Table 1 lists the operating frequency bands of several countries in the world [6].

Table 1: List of Frequency Bands

Country/Region	Operating Frequency, $f_c$ (MHz)
New Zealand	864-869
India	865-867
Europe	865-868
Hong Kong	865-868 & 920-925
Singapore	866-869 & 923-925
North America	902-928
Japan	916-921 & 952-955
China	920.5-924.5 & 840.5-844.5
Australia	920-926
Malaysia	919-923
Taiwan	920-928
Brazil	902-907.5 & 915-928
Canada	-928
Korea	908.5-910 & 910-914

## II. Antenna Design

This antenna is designed for UHF RFID handheld reader applications. The proposed truncated corners microstrip patch antenna for UHF RFID reader applications is shown in fig. 1. This antenna is designed on FR-4 substrate (dielectric constant,  $\epsilon_r = 4.4$ , loss tangent,  $\delta=0.02$ ) with thickness 2mm. The size of ground plane is  $55\text{mm} \times 55\text{mm}$ . It is a square patch radiator with with two truncated corners and two unequal square slots on its diagonal axis. The unequal length cross slot  $S_x$  and  $S_y$  along the x and y axes respectively. The coaxial feed is used.

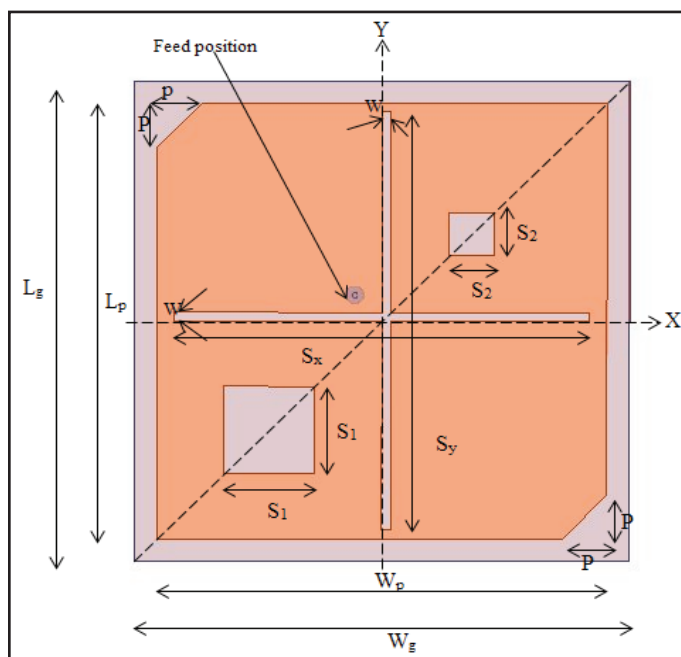


Fig. 1: Simulated Proposed Microstrip Patch Antenna

The detailed dimensions of proposed microstrip patch antenna is given below in Table 2.

Table 2: Dimensions of Proposed Microstrip patch Antenna

Parameter	Value (mm)
$L_g$	55
$W_g$	55
$L_p$	50
$W_p$	50
$S_x$	46
$S_y$	48
W	1
$S_1$	10
$S_2$	5
P	5
Feed Position	$x = -3, y = 3$

### III. Results and Discussion

The Simulation of proposed antenna is carried out in HFSS software. The simulated return loss at 922.3 MHz frequency is -23.6dB shown in fig. 2. Fig. 2 shows the 10dB return loss bandwidth of proposed antenna is 17.1MHz (912.4MHz-929.5MHz). Figure 4 shows the VSWR plot and the value of VSWR is 1.1 at 922.3MHz. The value of VSWR must be  $\leq 2$  at resonant frequency. Fig. 5 shows the radiation pattern of proposed antenna.

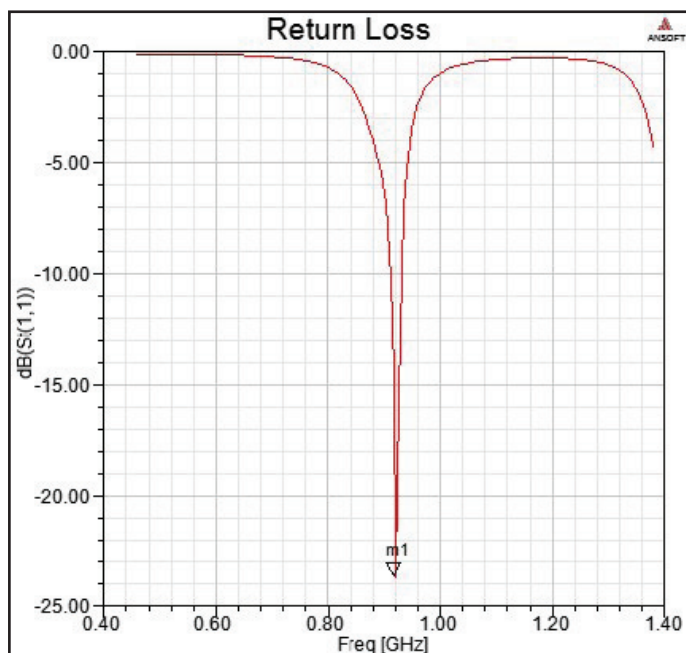


Fig. 2: Simulated Return Loss Plot

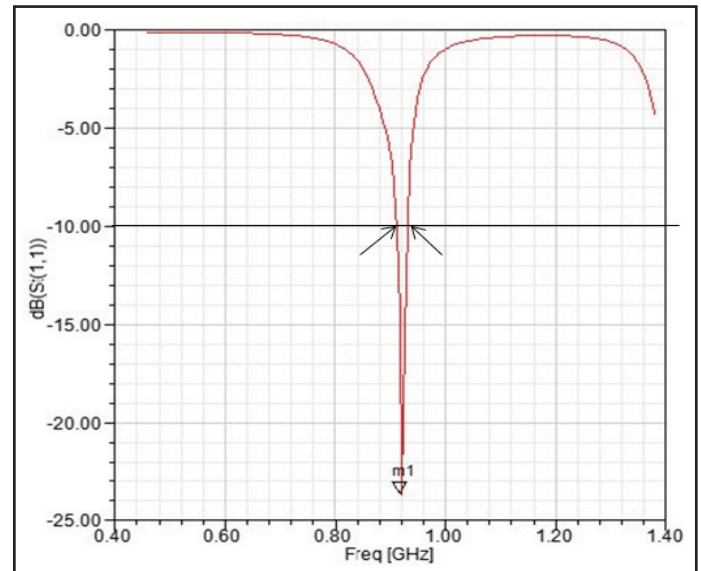


Fig. 3: Simulated 10dB Return Loss Bandwidth Plot

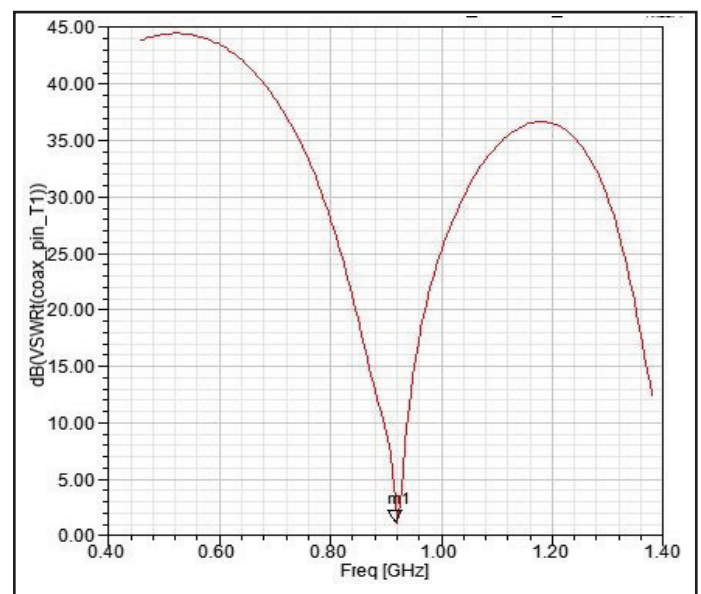


Fig. 4: Simulated VSWR Plot

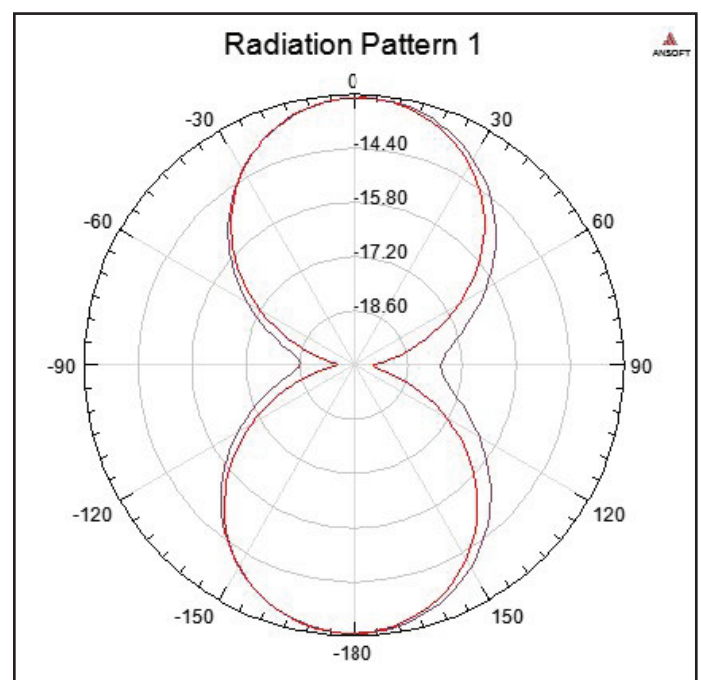


Fig. 5: Simulated Radiation Pattern

#### IV. Conclusion

In this paper, the design and simulation results of truncated corners microstrip patch antenna for UHF applications is shown. This antenna is designed based upon the handheld applications and suitable for RFID handheld reader applications. Slots on the patch radiator are used to achieve the compact size. The overall size of antenna is  $55 \times 55 \times 2\text{mm}^3$ . The resonant frequency, Return loss, 10dB return loss bandwidth and VSWR are 922.3MHz, -23.6dB, 17.1MHz (912.4MHz-929.5MHz) and 1.1 respectively.

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India, New Delhi and currently six research scholars leading to their Ph. D degree are working under his guidance.