UHF RFID Reader Antenna Using Double Slot Loaded Circular Patch

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***Abstract*-Radio-frequency identification technology, based on the reader/tag paradigm, is quickly permeating several aspects of everyday life. To allow optimum impedance matching with enhanced CP bandwidth, the micro strip feed technique is employed in this design. The design of a simple UHF (ultrahigh frequency) RFID (radio frequency identification) reader antenna that operates within the 900 MHz band (902–928 MHz) is studied. To allow optimum impedance matching with enhanced CP bandwidth, the proposed antenna can also yield an impedance bandwidth (10-dB return loss) from 880 to 1100 MHz, while good CP performances between 901 to 930 MHz are exhibited.**

I. INTRODUCTION

RFID support a larger set of unique IDs than bar codes and provides additional data such as manufacturer details, product type and even measure atmosphere such as temperature. RFID is not cheap as available in the market labeling technologies, but it offers more added values and is now at a critical price point that could enable its large-scale adoption for managing consumer retail goods. Today RFID is mostly used as a medium for numerous tasks including managing supply chains, possession of livestock, preventing from pirated goods, status of building access, and supporting automated checkout. The barcode is still the dominant player in supply chain industries and departmental stores. However RFID is replacing barcode technology by the major advantage of being independent of line of sight problems and scanning the objects from a distance. It offers the promise of reduced workers, enhanced visibility, and improved database management. RFID advantages over Barcode, Reader can read and write data to RFID tags without line of sight problem, it can work under, different environments and give maximum life time approximately 10 years. Fast read and write by the time taken for read/write being a few milliseconds. Now RFID tags are made with very good memory capacities ranging from (16 – 64) Kbytes which is many times more than a typical barcode. RFID tags can work with GPRS and has been used for tracking. RFID tags can also integrate with other technologies Micro strip patch antennas were first proposed in the early 1970s.

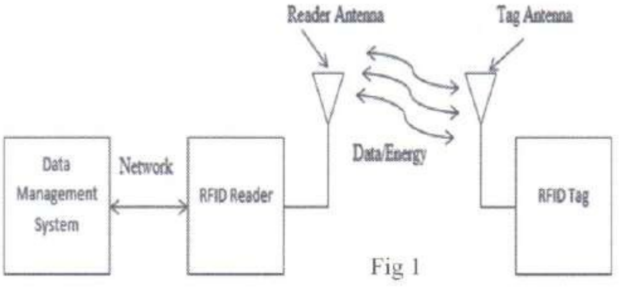

Fig 1

It is a narrowband, wide-beam antenna [1]. It consists of three layers ground plane, dielectric substrate and radiating patch. The conducting patch on ground plane is separated by dielectric substrate [2]. The patch and ground plane is generally made of conducting material such as copper or gold [3]. The patch radiator can take any shape like square, rectangular, circular, elliptical, annular ring, triangular etc. but rectangular and circular configurations are the most commonly used configurations [4]. Low dielectric constant substrates are generally preferred for maximum radiation [5]. FR4 (Flame Retardant-4) is generally used as substrate. A micro strip antenna is characterized by its Length, Width, Input impedance, and Gain and radiation patterns [6].Micro strip patch antennas radiate primarily because of the fringing fields between the patch edge and the ground plane. Micro strip patch antennas are increasing in popularity for use in wireless applications due to their low-profile structure [7]. Therefore they are extremely compatible for embedded antennas in handheld wireless devices such as cellular phone, RFID, pagers etc.

II. ANTENNA CONFIGURATION AND DESIGN

The geometry of the proposed loaded circular patch antenna with air gap $h_2=32$ is presented in Fig. 1. It is comprised of three simple elements; the top circular

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patch, L- shaped probe (made by thin copper sheet of thickness 0.2 mm), and a ground plane. The circular patch is printed on an inexpensive 0.4 mm h_t thick FR4 substrate (ε=4.4 and loss tangent 0.02) with total dimension of 130 mm 130 mm. The patch radius is 61.5 mm, while the radius of the semicircular slot S is 48 mm. Note that the semicircular slot is not exactly a halve-circular slot, it is located 6 mm away from the center line (-axis) of the circular patch. Notably, for ease of fabrication, this coaxial probe is fed through a bottom FR4 substrate (1.6 mm thickness) that is also used as a ground plane (150 mm 150 mm) for this proposed antenna

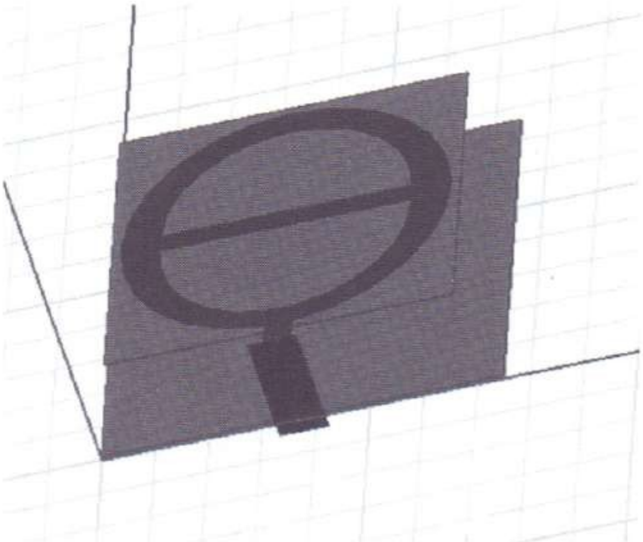

Fig 2

III. RESULT DISCUSSION AND PARAMETRIC STUDIES

The measured and simulated return losses of the proposed antenna are depicted in Fig. 2. In this figure, 10-dB return loss within the frequency range from 880 to 1100 MHz (22%) is measured. Here, the two degenerated modes are 922 and 1044 MHz (measured), while the simulated ones are 915 and 1031 GHz (simulated) . By comparing the

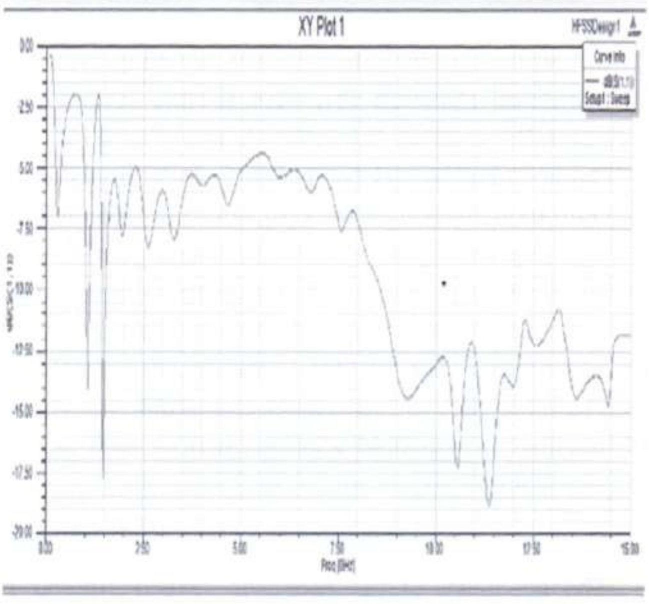

Fig3

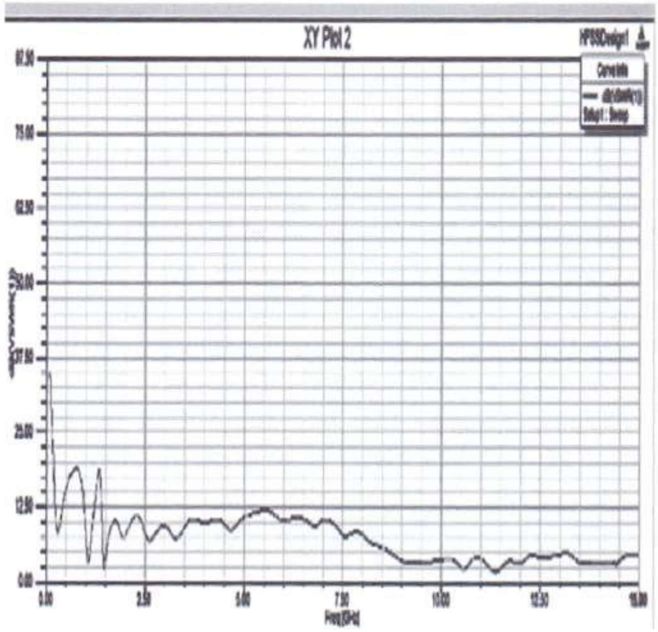

Fig 4

numerically calculated res-onant frequency (924 MHz) to these two sets of results, it can be observed that the numerically calculated resonant frequency concurred with both simulated and measured results, since it lies between the two degenerated modes. Thus, it can be concluded that the close form approximation expressions for circular patch with air gap studied in Section II can still be valid for micro-strip fed [8] [9] &[10] .

To comprehend the effect of various parameters on the performance of the proposed antenna, parametric analyses on various vital parameters are investigated via simulation [11],[12]&[13]. Here, the commercially available electromagnetic simulator An soft HFSS has been used initially to identify the CP performance of the pro-posed antenna, when a semicircular slot as depicted in Fig.2 is loaded into the circular patch [14].With increasing AR frequency. However, as shown in Fig.4, impedance mismatch is also observed when is reduced to 58.5 mm. Thus, the optimum dimension for is selected to be 61.5 mm. Nonetheless, the tuning of can allow the proposed antenna to operate in a wide range of CP frequency [15].

IV. CONCLUSION

A slot loaded circular patch antenna with CP radiation has been successfully performed both numerically and experimentally. By applying the microstrip fed technique into this circular patch, good CP bandwidth and impedance bandwidth can be acquired. Since this proposed antenna is simple to fabricate and its total dimension is only, thus, it is a potential candidate for fixed UHF RFID reader applications applied to both indoor and outdoor environment that operates in the RFID UHF band 902–928 MHz

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