

Study of dual band RFID near field antenna for 0.92 GHz/2.45GHz

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Abstract - A novel antenna used in near field of 0.92GHz and far field of 2.45GHz RFID reader system is investigated. The new antenna achieves strong magnetic field distribution over the UHF RFID as well as good circularly polarization at 2.45GHz. The advantages of these two bands could be achieved by this novel RFID reader antenna.

Index Terms — RFID, dual band, near field, multiple fields.

1. Introduction

Radio frequency identification (RFID), which was developed around World War II, technologies that provides wireless identification and tracking capability.[1-2] The reader antenna is an important unit of RFID systems. Reader antennas can be classified into two classes by working scope for different application purposes: near field (NF) antenna and far field (FF) antenna. Currently, ultra-high frequency (UHF) near field RFID technology receives a lot of attention due to the promising opportunities in item-level RFID applications such as sensitive products tracking, pharmaceutical logistics, transport and medical products (blood, medicines, vaccines), bio-sensing applications, and so on [3-5]. In 2.45GHz band, far field circularly polarized RFID antenna receives more attention because of high data speed. One challenge work in RFID application is to design one antenna with two functions of near field at UHF band and far field at 2.45GHz.

In this paper, a compact near field of 0.92GHz and far field of 2.45 GHz dual band antenna is presented to generate strong magnetic field and circularly polarized wave, respectively. The proposed antenna of two bands is investigated in detail. The methodology to complete impedance matching is addressed with the practical guideline. The structure, theory and the performances of the antenna are introduced as follows.

2. Structure and Theory

Fig.1 (a) shows the structure of the antenna which is composed of three PCB layers and circular polarized microstrip antenna layer. The top layer is mainly composed of two half rectangle loops which are connected with two

folded straight terminals. The middle layer and bottom layer are feed network with ground and lead are printed onto surface and interface of the two, respectively. Fed at edge of bottom layer, 50ohm strip transmission line is connected with one circular polarized antenna and two branches which are connected to two metal columns in another end. The other end of each column is connected to metal half rectangle loop strip. There is one load on each half rectangle loop in Fig.1 (a). The top layer PCB board and middle board are fixed by two nylon columns and connected by two metal columns. A rectangle single feed circular polarized antenna is fed by the main strip line and connected under the bottom layer.

Fig.1 (b) shows the side view of the antenna. Top layer is the near field antenna, middle and bottom layer are feed network. Circular polarized antenna is located under the bottom layer. Height of the antenna is 23mm, edge length is 71.6mm. Thickness of FR4 PCB board and circular polarized antenna is 2mm and 4mm, respectively.

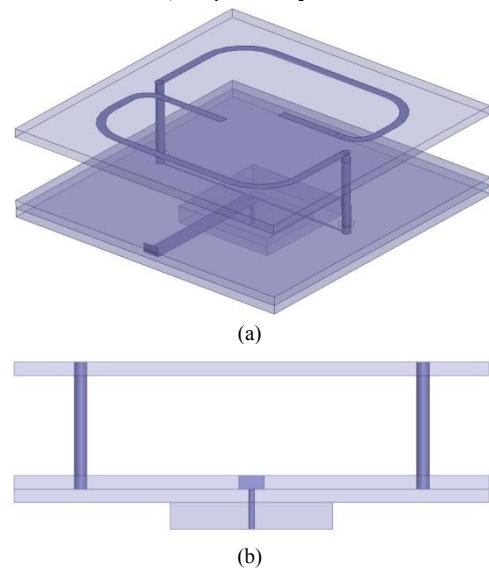


Fig.1.Model and structure of the proposed antenna: (a) 3D view, (b) Side view.

The radiation parts of antenna are two half rectangle loops and circular polarized antenna. Two half rectangle loops are near field antenna which can generate strong magnetic field at 0.92GHz. Rectangle circular polarized antenna is operated at 2.45GHz. These two radiation part are

fed by the same network which is composed of bottom and middle layers. The length of metal loops and the input impedance of near field antenna could be estimated based on monopole theory. If resonant frequency is determined, the electric length of metal column, half rectangle loop and folded terminal should match the resonant frequency.

Rectangle circular polarized antenna has minor effect at 0.92GHz because of small electric length. Near field antenna has minor effect at 2.45GHz because of high input impedance. So the two radiation part could be fed by the same feed network.

3. The Performances of The Antenna

The total height of this antenna is 25 mm. This novel antenna could be operated at two bands, S11 performances of the two bands are shown as Figure.2.

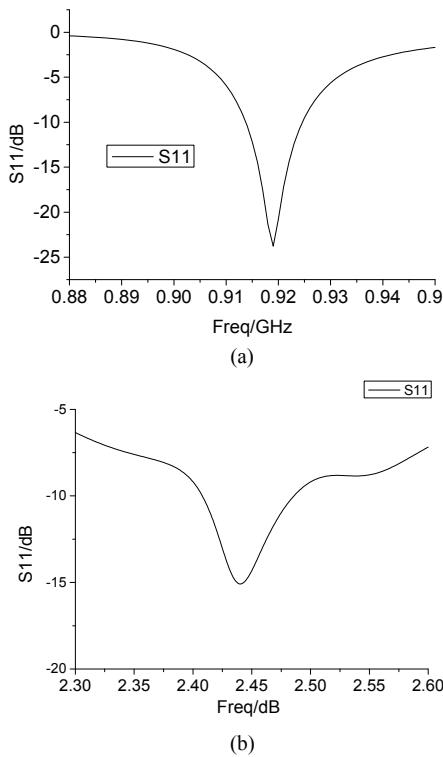


Fig.2. The S11 performances of the antenna at UHF and S band

In Fig.2, it is clear that the antenna could be operated at two bands well. So this antenna is suitable for the application of two bands. In Fig.3, radiation pattern of 2.45GHz is shown. Good gain and 26MHz axial ratio performances can be obtained. Furthermore, the z-orientation magnetic field is concentrated and uniform around the center region of antenna. The antenna has good performances in near field application.

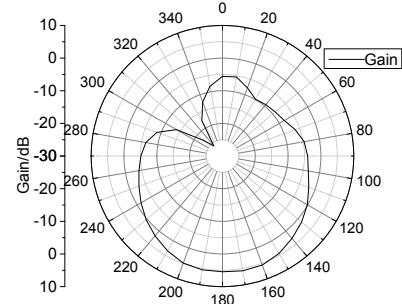


Fig.3. Gain pattern of 2.45GHz

4. Conclusion

It is a challenge to design UHF near field RFID antenna with far field circularly polarized radiation at 2.45GHz. The new proposed antenna has demonstrated the capability of producing strong magnetic field in the near field region of antenna with high gain and good axial ratio at 2.45GHz, which is very promising for RFID system of near field of 920MHz and far field at 2.45GHz.

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