A DOUBLE-LAYER RFID ANTENNA DESIGN

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Abstract

In this paper, a planar tag antenna placed onto human body working in UHF band is proposed. To minimize the efficiency loss and acquire long range transmission, the inductive tag antenna's impedance is expected to match the capacitive chip's conjugate impedance. However, it is difficult to rise the reactance of antenna placed onto human body caused by human body dissipation and scattering. This study shows a double-layer RFID antenna which can raise synthesis of the antenna input reactance .

Introduction

In recent years many applications of Radio Frequency Identification (RFID) technology that allows wireless communication between a reader and a tag [1] have been developed, such as logistics, aero-ID, anticounterfeiting, supply-chain monitoring, and pharmaceutical. Especially, the RFID tag with a biosensor incorporated can be used for application in biomonitoring in real time, such as temperature, blood pressure, heartbeat, glucose, human behavior etc [2], [3]. The RFID tag consists of an antenna and a chip. The RF signal transmitted by the reader is captured by the tag antenna. To minimize the efficiency loss and acquire long range transmission, the inductive tag antenna's impedance is expected to match the capacitive chip's conjugate impedance.

In this paper, a planar tag antenna placed onto human body working in UHF band is proposed. However, the design of UHF RFID antenna for on-body application is arduous caused by human body dissipation and scattering [4]. Skin tissue, which dielectric is high, behaves as a substrate when the tag antenna is placed onto it. Therefore, increasing the synthesis of the antenna input reactance is needed to take into account in the design.

Experimental

The proposed double-layer antenna layout for UHF RFID tag is depicted in Fig. 1. The proposed antenna consists of two layers, a top layer which connects a RFID chip and a bottom layer which placed onto skin. These two layers are closed together and isolated by a plastic film less than 0.05 mm. The dimensions of the proposed antenna are L = 16.75 mm and W = 32 mm, where Lg = 3 mm in the bottom layer. A RFID chip is embeded in the openning of rectangle ring on the top layer. Furthermore, the tissue model [5] (Fig. 2) were used to measure the impedence of the proposed antenna onto skin for simulation.

Results and Discussion

The measured results of the impedance for the proposed antenna are shown in Fig. 3 and 4. Varying size La = 5 mm to 13 mm on the top layer, the resistance of the antenna is getting rise at 915 MHz, but the maximum reactance of the antenna is occurred when La = 8 mm. Then the impedance in the design is 124 + j351. Hence, the desire impedance of the antenna can be obtained by modifying size La.

In addition, the reactance drops off substantially when the bottom layer is removed from the proposed antenna. Then the impedance of the only top layer antenna is 123 - j52. From the result, the resistances are almost the same and the reactance with the bottom layer is higher than without the one. In other word, the bottom layer can raise synthesis of the antenna input reactance. Comparison of the proposed antenna and the one without bottom layer is shown in Fig. 5.

Conclusion

This study shows a double-layer RFID antenna which can raise synthesis of the antenna input reactance. Experimental results show that the proposed antenna can be provided high reactance when the RFID tag place onto human body. The impedance in the design is 124 + j351. And varying size La on the top layer can adjust the antenna input impedance. In addtion, the proposed antenna also exhibits low profile, and miniaturization. Therefore, this antenna is suitable for the uses of on-body RFID tag.

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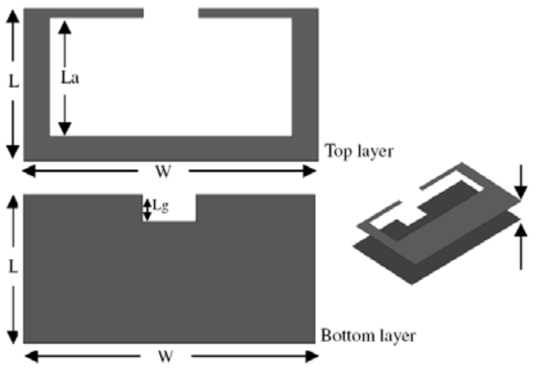

Fig. 1 The top layer and bottom layer of the proposed RFID antenna.

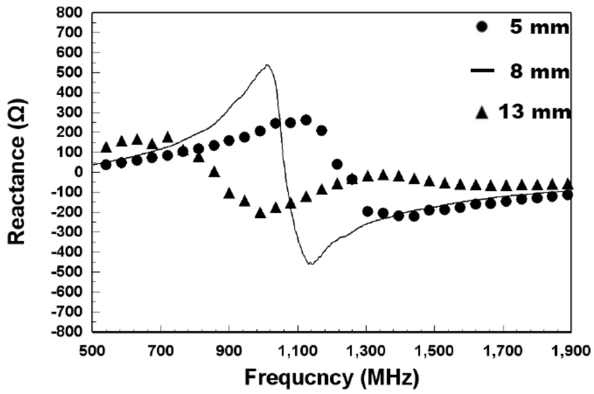

Fig. 4 Measured the reactance of proposed RFID antenna when La = 5 mm, 8 mm, and 13 mm.

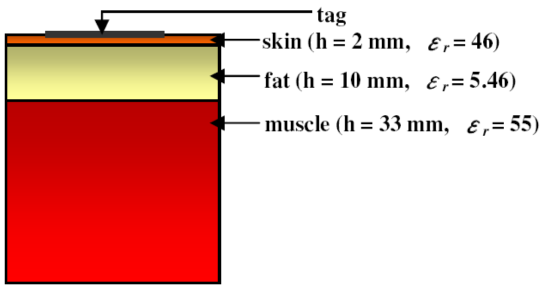

Fig. 2 Tissue model

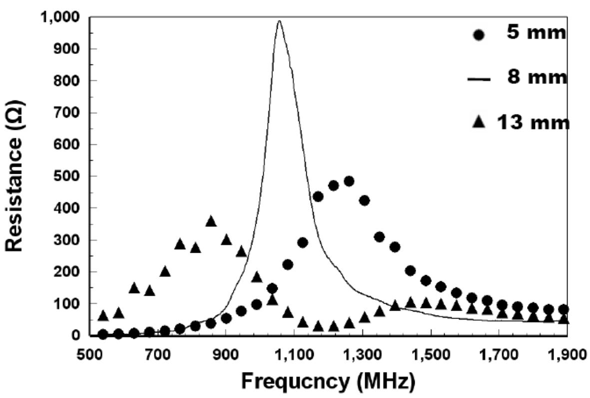

Fig. 3 Measured the resistance of proposed RFID antenna when La = 5 mm, 8 mm, and 13 mm.

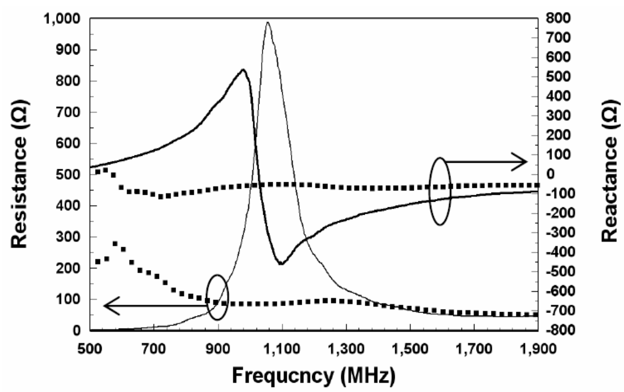

Fig. 5 Measured the resistance and reactance of proposed RFID antenna with (solid line) and without (dot line) bottom layer when La = 8 mm.