

UHF RFID METAL TAG APPLYING TO LICENSE PLATE USING METAL SHIELDING AND WATERTIGHT METHODS

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Abstract: This paper describes a design for RFID (Radio Frequency Identification) tag using license plate attached the vehicle bumper in 900 MHz band. The implemented metal tag for a license plate is applied metal shielding method, watertight method of RFID tag, and metal corrosion protection method using silk screen technique. Moreover, its range of the fabricated tag antenna that the license plate and the vehicle bumper were fixed by bolt and nut was observed 8.2 m. This measured readable range showed about 5 m above far distance more than the average readable range of commercial tag antenna. The RFID have ability of 0.5 seconds of recognition speed in the evaluation of performance. The tag for license plate will be able to provide to the custom administrator and goods manager in various telemetries services.

Index Terms: Metal Tag, UHF RFID, Metal Shielding, Corrosion Protection, Watertight Method

I. INTRODUCTION

RFID (Radio Frequency Identification) technology has been around for many years. Before 2000, common uses for RFID in the USA included toll road passes, access ID cards and the tiny ID chips that are inserted in animals for identification purposes[1-7]. The recent introduction of RFID in the supply chain, retail store applications and tracking goods, as well as several mandates, has added to the awareness and value of this technology[1,3,5]. RFID is possible technology to recognize information of the characteristics ID from the product attached tag. The extension of RFID technology is able to use in the vehicle. However, to

speed and range in the license plate. It describes analysis of a reflection loss and the Smith chart regarding each RFID Tag pattern and will give proof which could be for license plate.

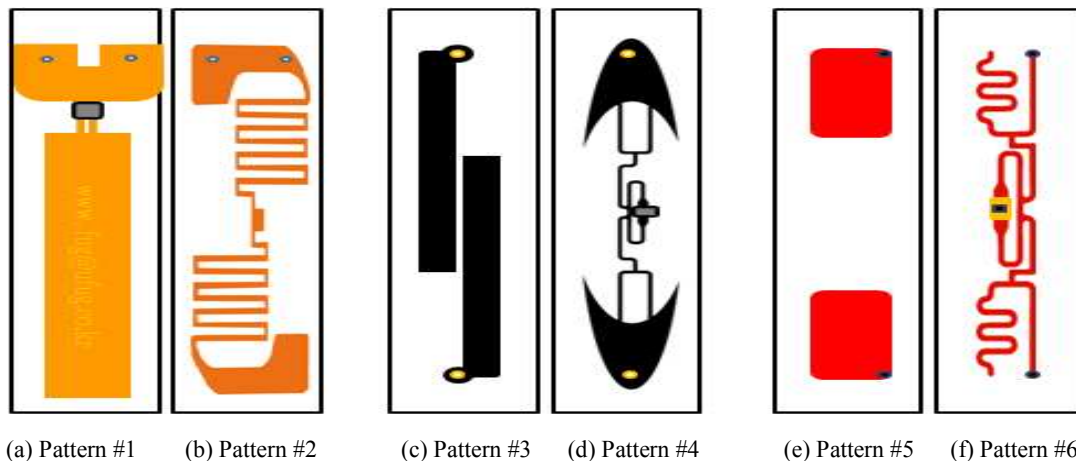


Figure 1. Pattern of 900MHz RFID Metal Tag used License Plate

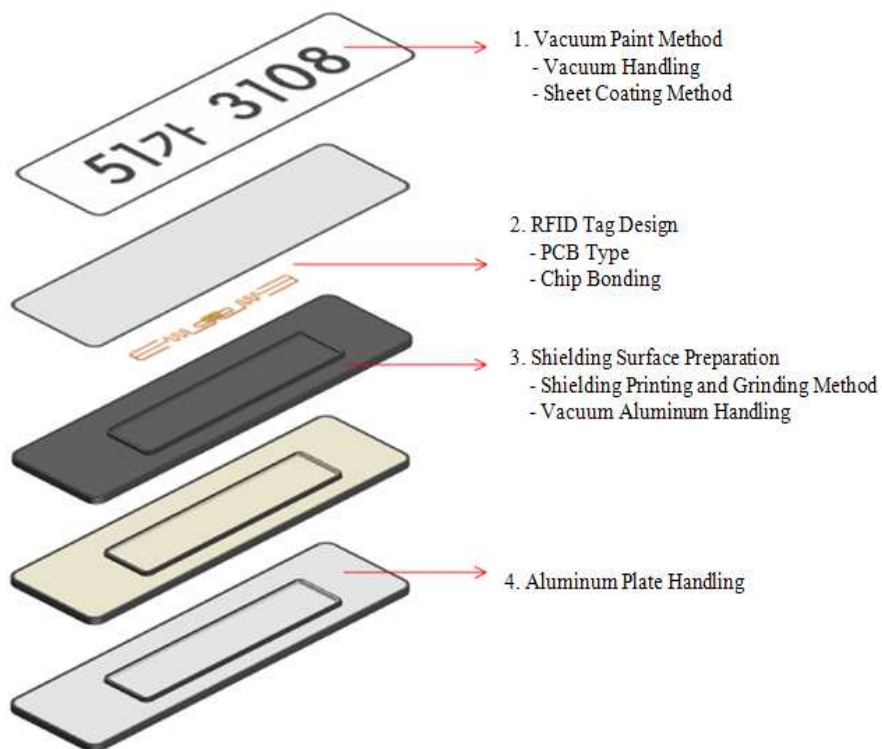


Figure 2. Configuration of 900MHz RFID Metal Tag for License Plate

A waterproofing technique for RFID with license plate is important. The processing of a vacuum method for License plate with RFID is semi permanently for maximum watertight.

- ✓ Cover processing technique after chip bonding

The antenna printing technique which hits to an antenna pattern composition and a specialized metallic: antenna design and print of antenna for optimized cognizing distance.

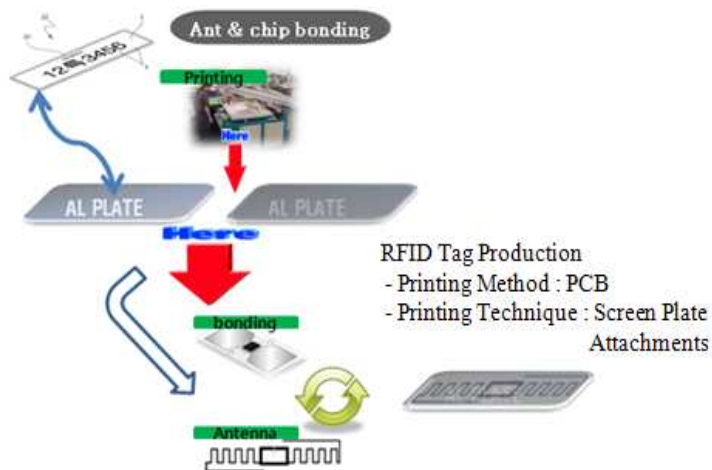


Figure 4. Design and Pattern of Antenna Configuration and Implementation.

Step 3: Antenna surface cover processing technique

- ✓ Processing surface print technique.
- ✓ To maintain waterproof of RFID antenna and complements problem about erosion of RFID license plate.

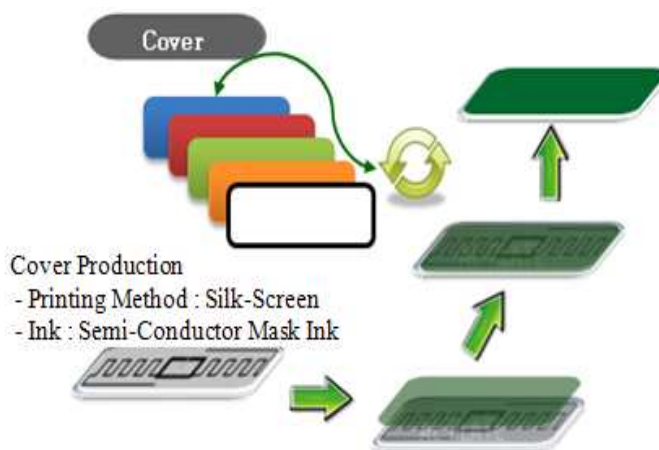
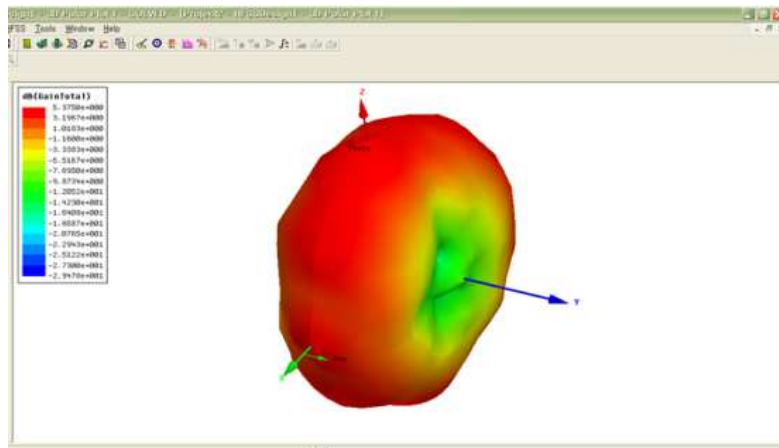
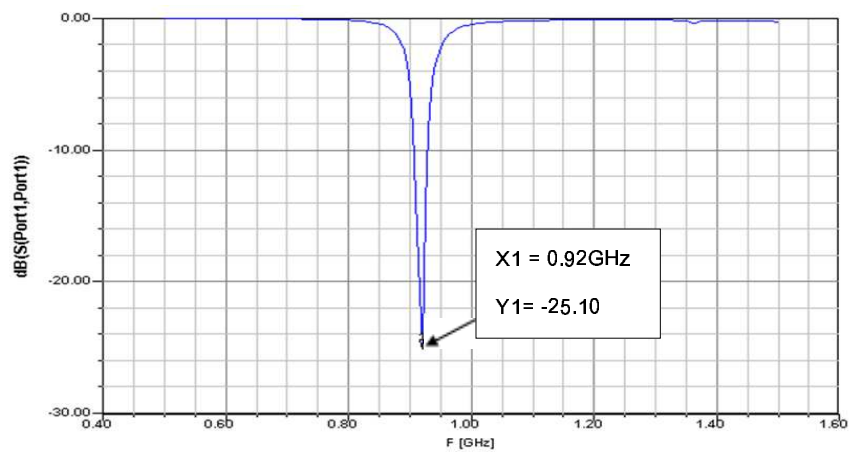


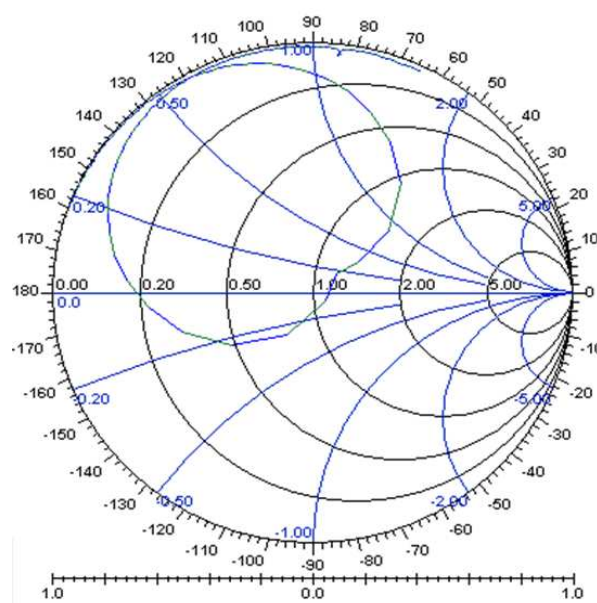
Figure 5. Antenna Cover Surface Processing Technique



(a) 3D Polar Plot



(b) Return loss



(MP=1.671 \angle -22.732, RX=-2.525-j1.820, GB=-0.261+j0.188)

(c) Smith chart

Figure 8. 3D Polar Plot, Return loss and Smith chart

In order to propagate the electric wave, RFID Tag did not besiege with the aluminum and the minimum RFID Tag of one phase has to open for communication with RFID Reader. It does not cover all phase of RFID with metal to consider the radiation quality of RFID tag.

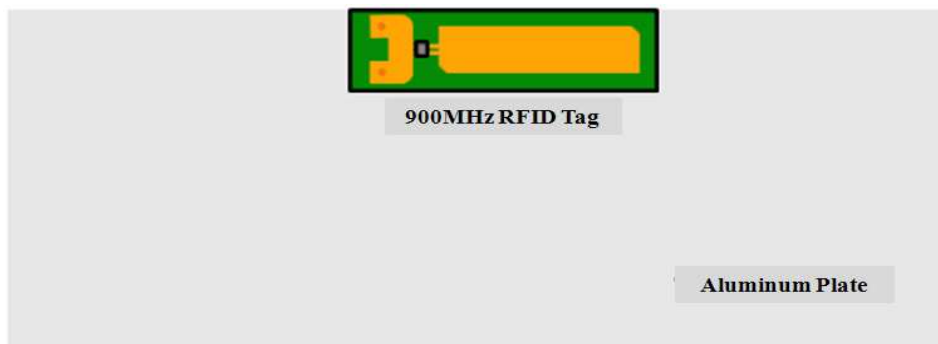


Figure 10. Position of RFID tag in Aluminum Plate

Step 2: Screening Shield Insertion:

The screening shield is inserted in license plate to reinforce metal vulnerability which is on aluminum plate, back and rear of bumper.

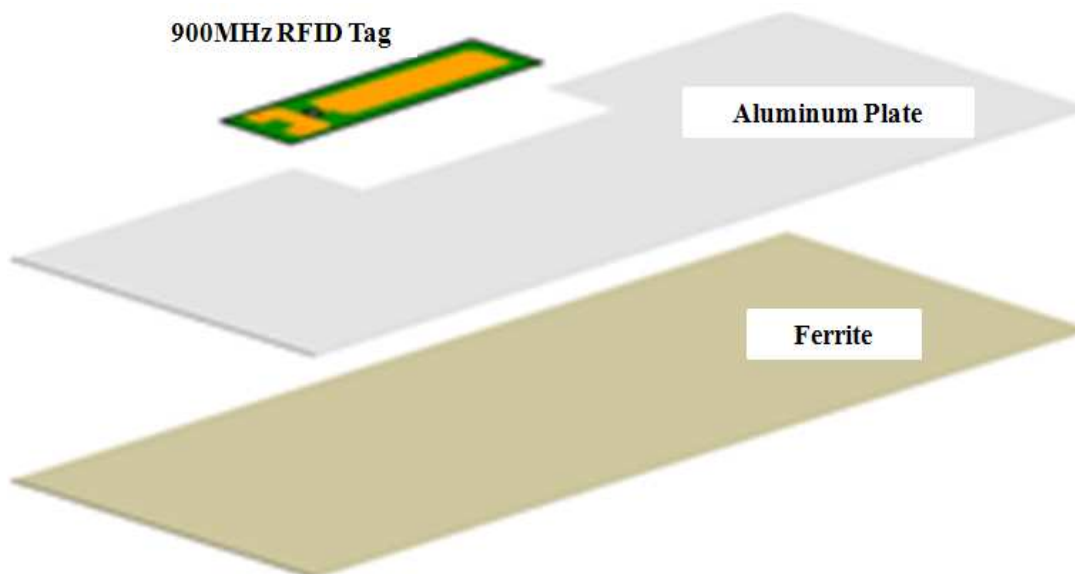


Figure 11. Screening Shield Insertion

Step 3: Drainage Control

The back side of the license plate processed ferrite and front side of the license of plate protected water-proof protect the RFID tag.

Step 5: Prototype Production:

After coloring the white coating above primer paints compound, it completed the base plate of the license plate and after put a black color to the number mold, prototype is implemented prototype attached black in the base plate after coloring the number mold.



Figure 14. 900 MHz RFID Tag License Plates

IV. EXPERIMENTAL RESULTS

The Figure 15 presents experiment equipment for efficiency testing about implemented 900 MHz RFID tag attached license plate. Like seeing from figure 15, we performed an experiment on testing bad which consist of 900 MHz antenna and reader modulation with RFID software about each patents.



Figure 15. 900 MHz RFID Tag License Plates Test Device

We execute an efficiency test about the RFID tag license plate. The actual result of experiment is visible about the license plate with 900 MHz RFID tag in figure 16. As see the figure, each pattern has different character on speed and distance of perception.

V. THE CONCLUSIONS OF ESTIMATION OF LICENSE PLATE WITH RFID TAG

The table 1 exhibited the result of UID (User Identification) recognition speed in license plate. The distance on experiment is 4m to RFID reader from license plate. The speed of awareness on developed 3 RFID pattern is excellent as such 0.5 sec as seeing table 1. The table 2 illustrates awareness distance about RFID with license plate and pattern 2 cognize well.

Table 1 RFID Tag is Built-in of the License Plate Stirs Recognized UID Speed

	Pattern #1	Pattern #2	Pattern #3
Cognition speed	0.5sec	0.5sec	0.5sec

Table 2 RFID Tag is Built-in License Plates of the Street

	Pattern #1	Pattern #2	Pattern #3
Cognition distance	6.3m	8.4m	5.7m

VI. CONCLUSIONS

This paper present to develop 900 MHz RFID license plate applied watertight technique of RFID tag and erosion shield technique by silkscreen. Implemented RFID tag in the 900 MHz band is designed by HFSS commonly and makes an experiment with entity. The developed RFID metal tag, we analyze its Return Loss using HFSS and its characteristics using Smith Chart methodology. RFID metal tag has approximately 20db in 910 MHz frequency and the impedance is 50Ω with matching.

We evaluate developed RFID license plate at the testing equipment and the RFID license tag is excellent performance to be 0.5 seconds as cognizing speed and 8.2 meters as cognizing distance. The RFID tag with license plate is possible to apply vehicle and will be important technology in the telemetric.

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