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Metal Mountable Microstrip Patch UHF RFID Tag Antenna

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Introduction

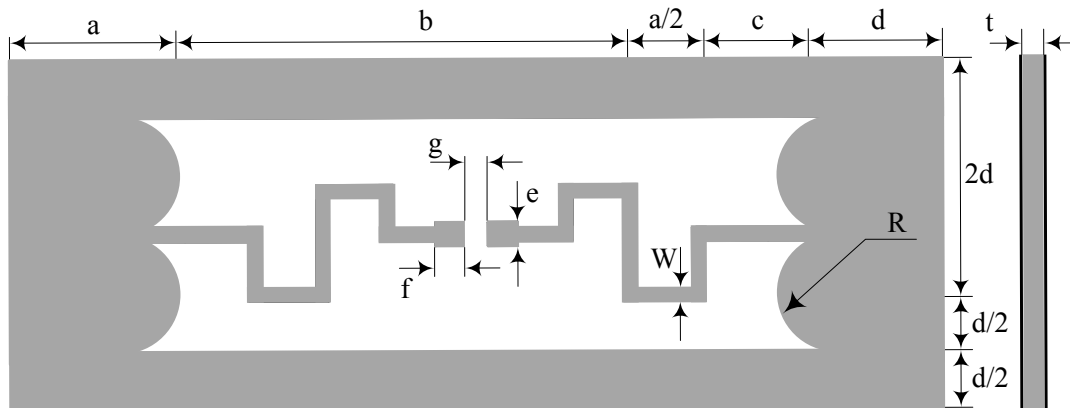
- ▶ RFID technology is widespread nowadays in various applications (i.e. ticketing, library inventory, banking, supply chain, traceability of goods and logistics)
- ▶ The high speed communication, non line of sight (NLOS), large storage capacity, high identification rate of tagged objects and low price of a tag are a few of the advantages that make RFID systems being used on a large scale.
- ▶ Depending on the operating frequency and the communication protocols, RFID systems can be categorized into four groups: low frequency (LF), high frequency (HF), ultra high frequency (UHF) and microwave (MW).

Introduction

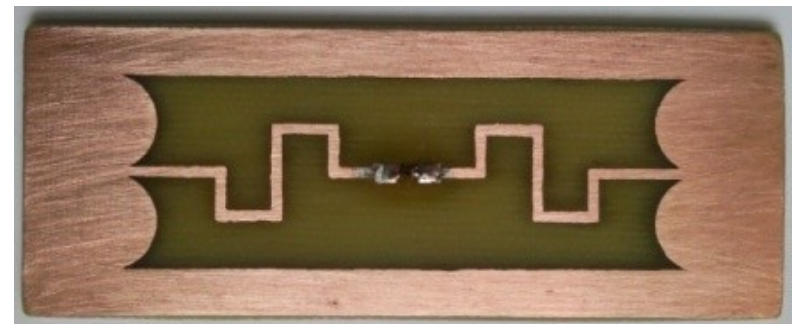
- ▶ UHF and MW systems are the most used for their long range identification (up to 100m). From those only UHF systems are widely spread because their production cost is very low (they use passive tags that can reach few cents only).
 - ▶ In this paper is presented an UHF RFID antenna model for ETSI band that can be used for metallic objects.
 - ▶ The simplistic design and good performances are few of the main advantages
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Tag antenna design

- ▶ The IC used is Alien Higgs-3, having -20dBm power sensitivity and $Z_{ic}=(16-j190)\Omega$ at $f_{res}=868\text{MHz}$.

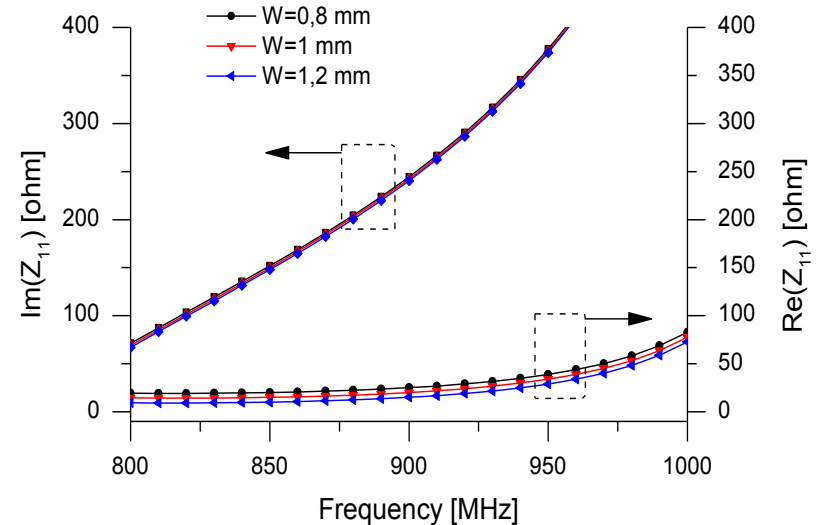
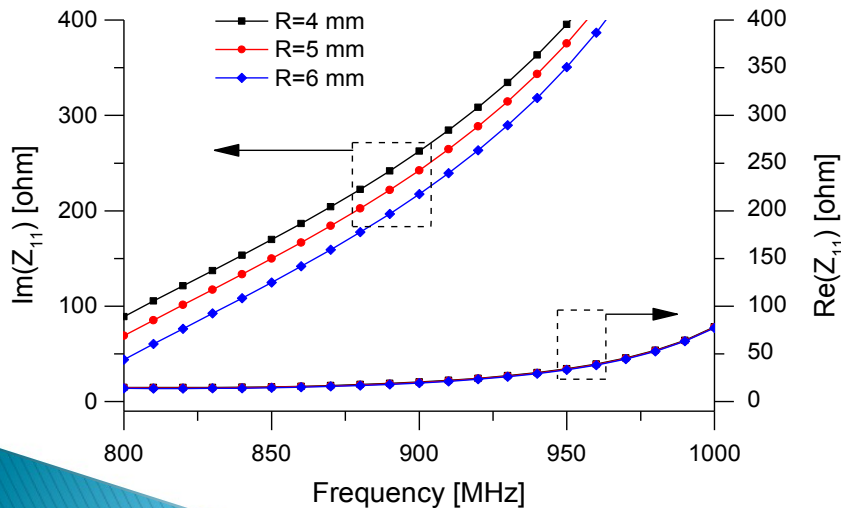


Antenna parameter	Dimensions [mm]
a	14
b	39.2
c	9.8
d	10
e	2
f	2.5
g	2
t	1.52
W	1
R	10



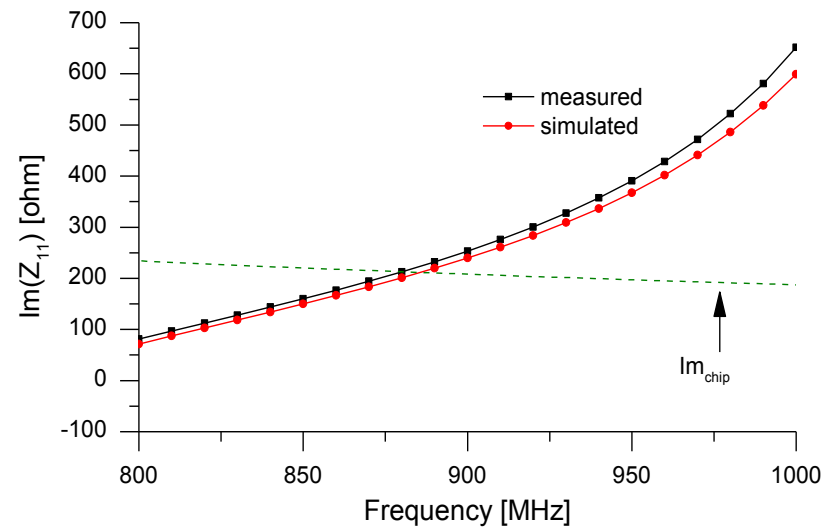
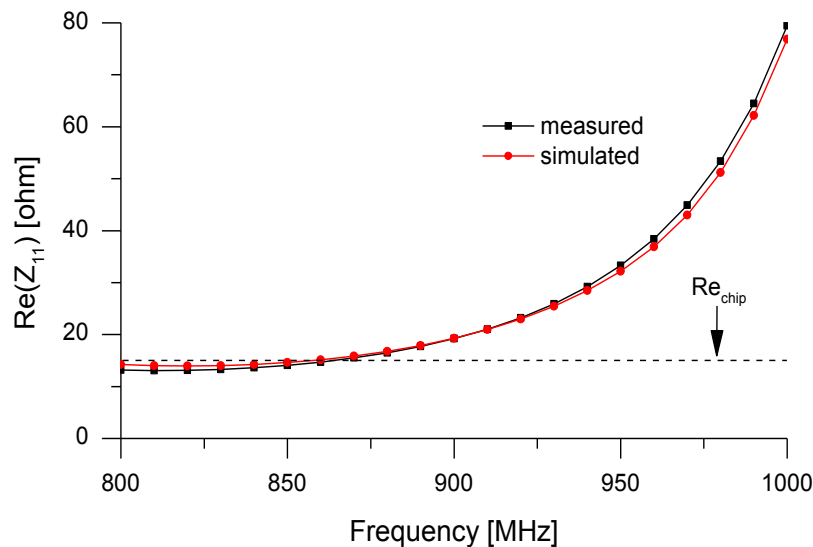
Tag antenna design

- ▶ Matching the antenna impedance with the IC chip is made using an EM simulator software.
- ▶ The circles from the radiating path are used for changing the antenna reactance and the feed lines width are used for changing the antenna resistance.



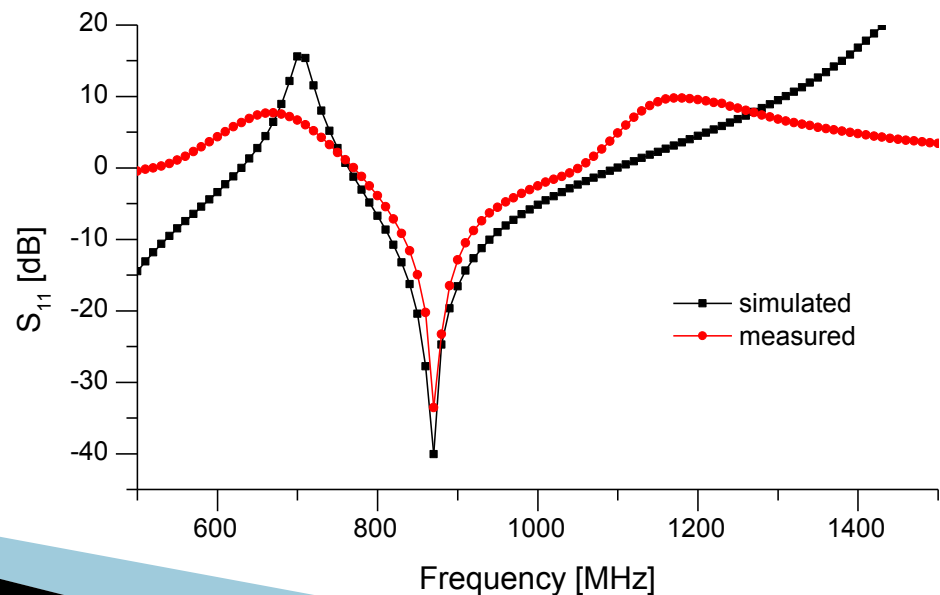
Experimental results

- ▶ The obtained results from simulations are verified using measurements with a VNA (Agilent VNA NN9912A).



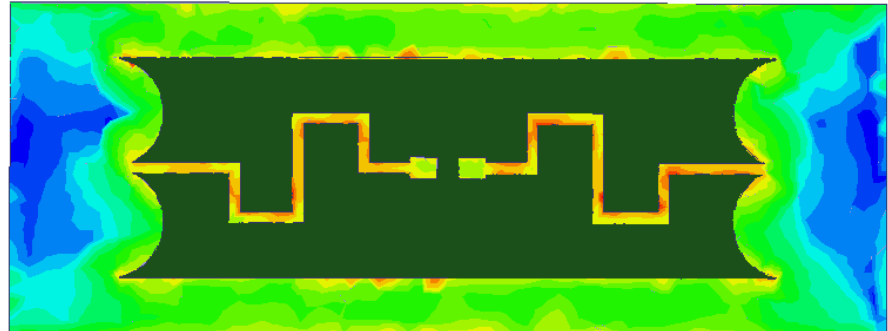
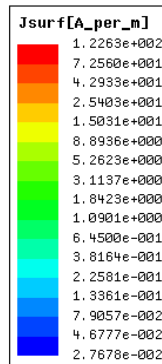
Experimental results

- ▶ To see the resonance frequency of the antenna we need to take into account the power reflection coefficient.
- ▶ At 868 MHz is obtained -40dB and -33dB , for the simulated value and for the measured one, respectively.



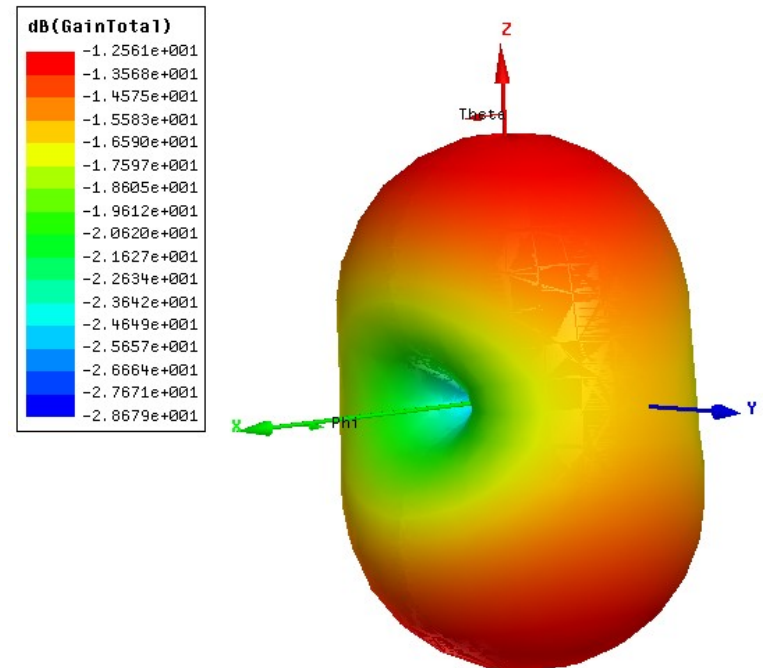
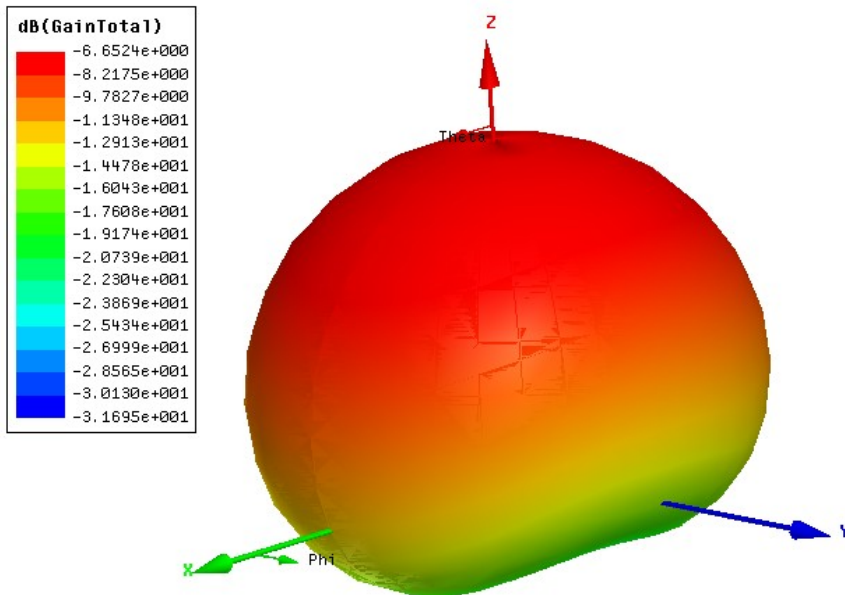
Experimental results

- ▶ Current density highest amplitude is concentrated around the feeding lines.
- ▶ Using 1.52mm FR4 as a dielectric substrate, this material helps keeping isolation between the antenna and the metallic plate beneath it and with that will reduce the cancelation of the current in the antenna.



Experimental results

- ▶ The radiation pattern of the tag is omnidirectional in yz-plane with a maximum peak of -6.65dB . In xz-plane because of the metallic plate beneath the antenna, the radiation pattern becomes more directional.



Conclusions

- ▶ A novel antenna used for UHF RFID tags was implemented and tested.
- ▶ This new model mounted on a metal plate reveals good performances in chip impedance matching and a reading distance of about 4.8 m.
- ▶ The simple structure of this antenna, without using shorting pins for the ground plane, makes this new UHF RFID tag to be low cost and efficient.
- ▶ This model can be applied with good performances in the automotive or for the steel industries.

Thank you!

Questions?

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