TETRACOM: Technology Transfer in Computing Systems

FP7 Coordination and Support Action to fund 50 technology transfer projects (TTP) in computing systems.
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TEchnology Transfer for RFID Assessment in Cake supply chain (TETRACAKE)

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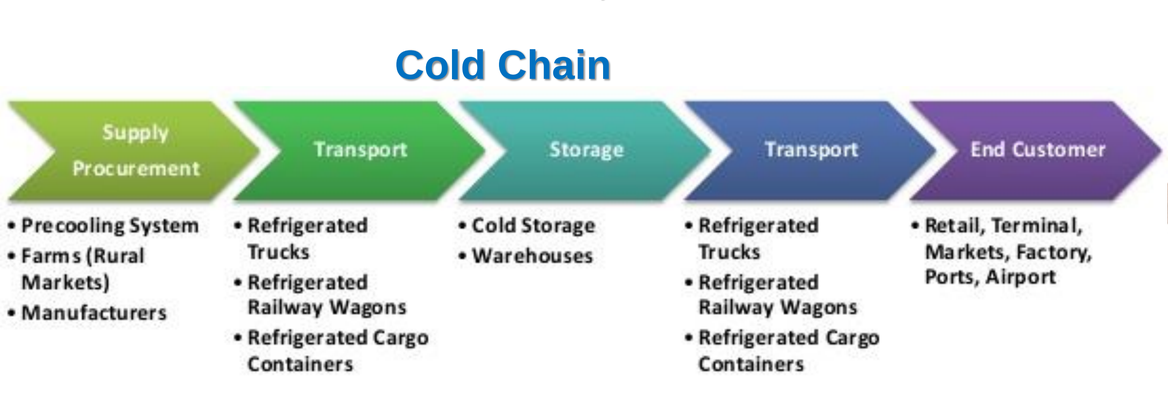
TTP Problem

The effective traceability is a serious challenge not only in terms of consumer safety but also for all the stakeholders along the cold chain as well as National Governments and the European Union.



RFID-based traceability problems

- Electromagnetic interferences due to metallic assets and presence of ice;
- Multipath;
- Very low temperature (robust hardware)

TETRACAKE project aims at transferring the University of Salento recognized skills on UHF RFID technology, including patented intellectual properties, into the cake production chain so to significantly enhance traceability of both fresh and frozen pastries and make a return on investment for the SME partner.

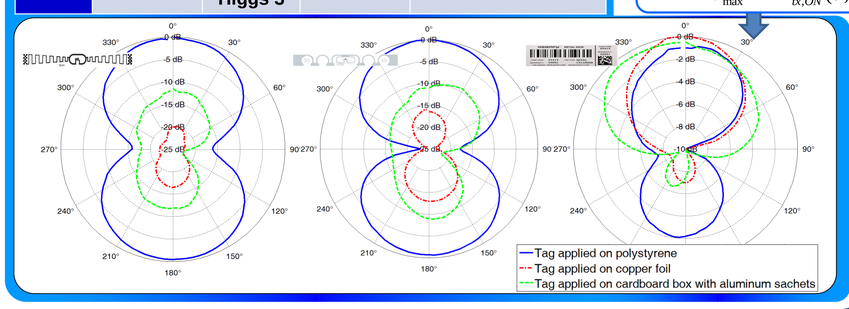
TTP Solution

The experience matured by the Electromagnetic group of the University of Salento in the framework of RFID-based traceability, along with its capability to design RFID hardware tailored for working also in harsh electromagnetic environments, will be exploited to demonstrate the ability of customized RFID technology to allow an effective traceability in a sector as complicated as the cake industry.

RFID Technology

Electromagnetic Characterization of RFID Tags

Brand	Model	Chip Model	Chip Sensitivity	Layout
Impinj	Thin-propeller	Impinj Monza 3	-15 dBm	
UPM	SD	Impinj Monza 5	-20 dBm	
Xerafy	Metal Skin	Alien Higgs 3	-18dBm	



Angular Sensitivity

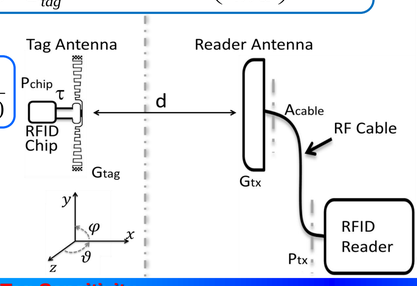
$$P_{TH,tag}(\theta,\varphi)=\frac{P_{TH,chip}}{\tau\cdot G_{tag}(\theta,\varphi)}=P_{tx,ON}(\theta,\varphi)\cdot G_{tx}\cdot\left(\frac{\lambda}{4\pi d}\right)^2\cdot\eta_{plf}$$

Frequency Sensitivity

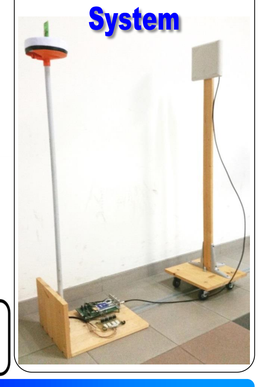
$$P_{TH,tag}=\frac{P_{TH,chip}}{\tau\cdot G_{tag}}=P_{tx,ON}\cdot G_{tx}\cdot\left(\frac{\lambda}{4\pi d}\right)^2\eta_{plf}$$

Radiation Pattern

$$RP=\frac{G(\theta,\varphi)}{G_{\max}}=\frac{P_{tx,ON,\min}}{P_{tx,ON}(\theta,\varphi)}$$



Characterization System



Tag Sensitivity:
The minimum power reaching the tag in correspondence of which the chip is turned-on. It includes antenna factors such as gain, transmission coefficient, impedance matching. It can be deduced by the Chip Sensitivity starting from the free space Friis model.

Although the use of RFID in various food supply chains has been largely adopted with appreciable returns for the involved companies, the radio-propagation within premises of a cake company presents important differences compared to other more friendly environments. Indeed, due to the electromagnetic interferences and the multipath caused by the presence of large amounts of ice and metallic elements, the performance of traditional RFID systems significantly decreases. Consequently, the performance evaluation of UHF RFID tag is mandatory.

TTP Impact

The most critical step in the Martinucci's supply chain is the storage in the cold rooms, because of the very low temperature (-27 °C) that can impact on the performance of both RFID readers and tags.

A set of both proprietary and commercial UHF RFID tags has been selected through in-lab measurements.
The performance of the selected tags in terms of radiation pattern and tag sensitivity has been evaluated before and after the storage in traditional refrigerators.

Selected tags have been then applied on cake boxes and stored in a cold room along with a reder antenna.
Performance will be evaluated once again at the end of January 2016.

TTP Facts

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UNIVERSITÀ DEL SALENTO

MARTINUCCI Maestri Pasticceri dal 1950