RF-TTI Technology
An Efficient Tool for Online Temperature Monitoring

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Common Chilled/Frozen Products

Chilled / Refrigerated

Pharma

Meat and Fish

Dairy

Ready to Eat

Produce

Frozen

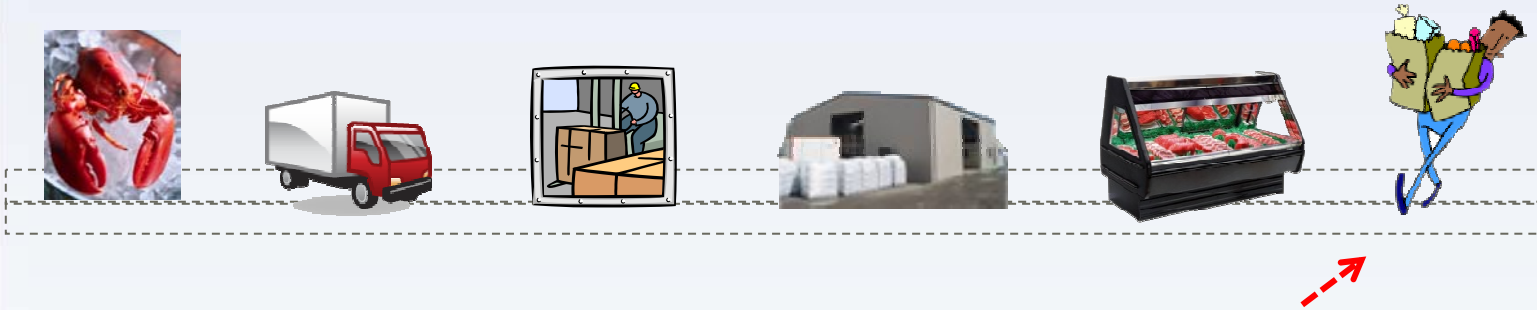
Vegetables

Ice Cream

Meat and Poultry

Fish

Typical Chill Chain for Seafood



Producer --> Transport --> Storage --> Wholesale --> Retail

Typical Chill Chain for Seafood

The preservation of the chill chain integrity from "farm to fork" is indispensable to reduce costs, decrease product waste, lessen shrinkage problems, and insure the product's quality.

What is a Time Temperature Indicator?

- A TTI is a simple device that displays a summary of the aggregate time-temperature history of the product to which it is attached

- TTIs work by producing a change in one property as a response to a predetermined stimulus. This property varies as a function of the time, at a rate which is temperature dependent.

- TTIs cannot provide information on the starting condition of the goods, i.e. proper manufacturing or presence of harmful substances.

Preservation of the ChillChain

The preservation of the chill chain integrity from "farm to fork" is indispensable to reduce costs, decrease product waste, lessen shrinkage problems, and insure the product's quality.

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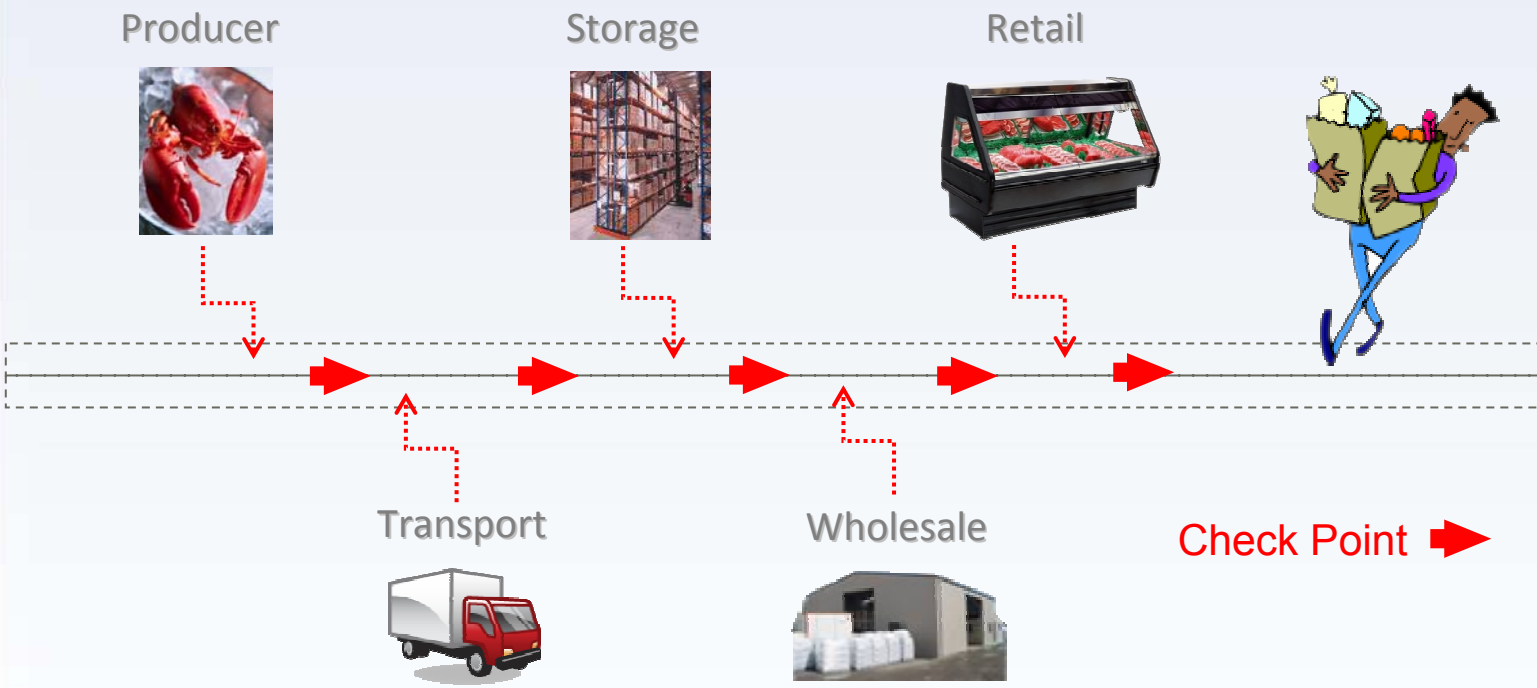
REAL-TIME MONITORING

Typical Chill Chain for Seafood



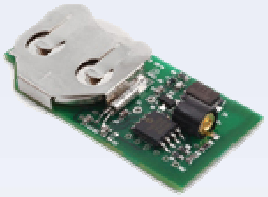
“Real Time” Monitoring

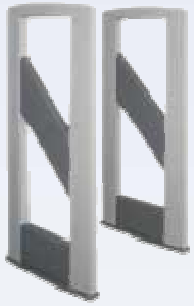
- Chill chain management:
  Isolate ruptures in chill chain
  Detect weakness in distribution network
  Allow early warning and decision

- Added value:
  Improve traceability
  Improve stock managing
  Increase safety for consumers

- Benefits for producers, retailers and food services :
  Total transparency in the supply chain.
  Product value maximization.

Some Benefits of RFID Technology





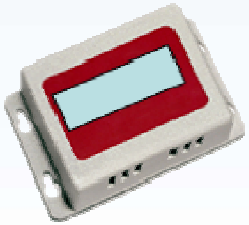
- RFID is a well established technology.
- Verifications without opening the container
- Checkout becomes a much faster process – labor cost reduction
- Integration to control systems (HACCP)

Chill-On
A European Commission-funded project

A novel concept for tracking and tracing : "**TRACECHILL**"

Smart Label: "The "**eCHILL-ON**" smart label, an innovative, consumer- and industry-relevant product that will be developed through this project.
The eCHILL-ON Smart Label will be a combination of RFID, TTI, GPS and other technologies".

Temperature sensing technologies used today:



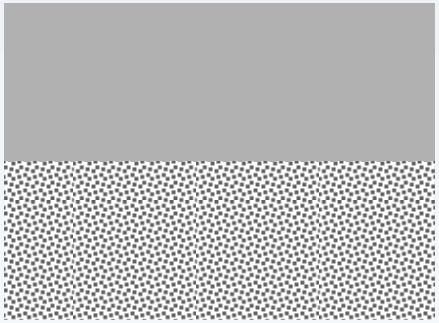
Wireless temperature sensor based on RFID technology

Battery based data logger

The Idea Behind the Electrical TTI

The TTI works by chemically dissolving a metal layer in a time and temperature dependent manner

Electrical signal 1 → Electrical signal 2



Reactive layer (Medium + Etchant)

Electrical signal 2

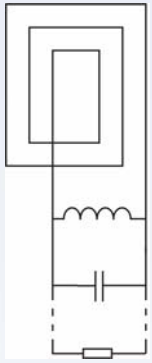
Electrical signal 1

Metal layer

The conductive layer is suited for being part of an electric circuit (capacitor, resistor, inductance; antenna etc.)

RF-TTI within the supply chain

TTI

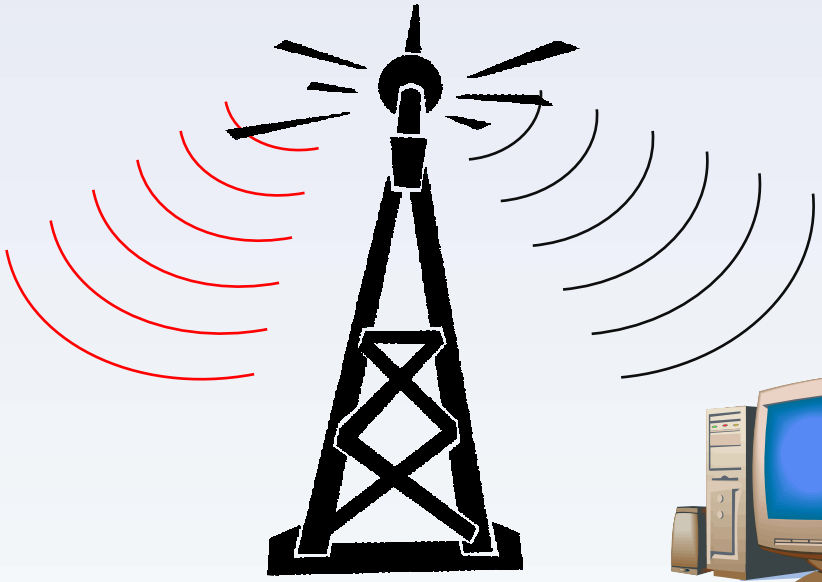


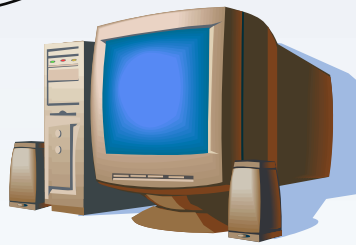
Antenna

Inductance

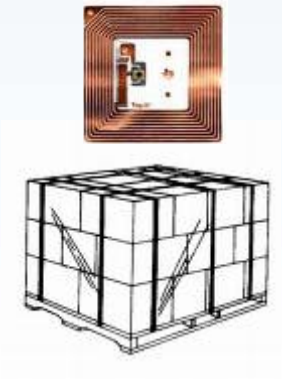
Capacitor

Resistor





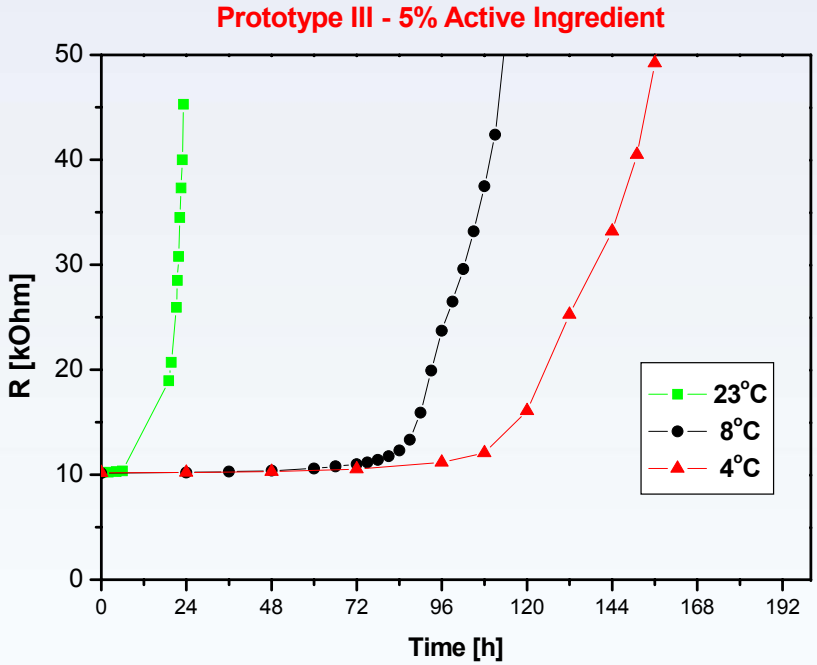
Signal emitted to the chain information system



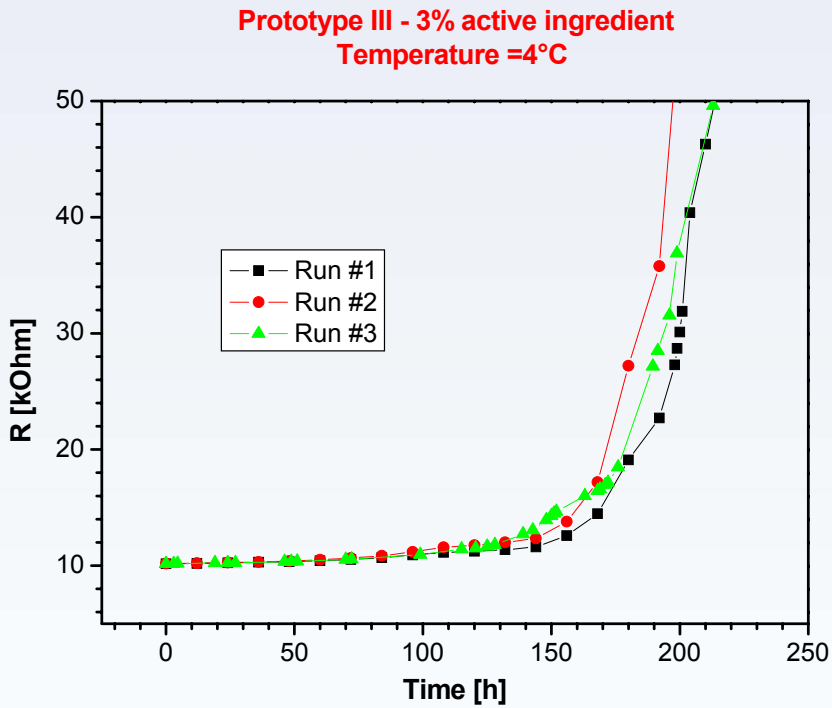
Tagged pallets and cases

Reader and Antenna

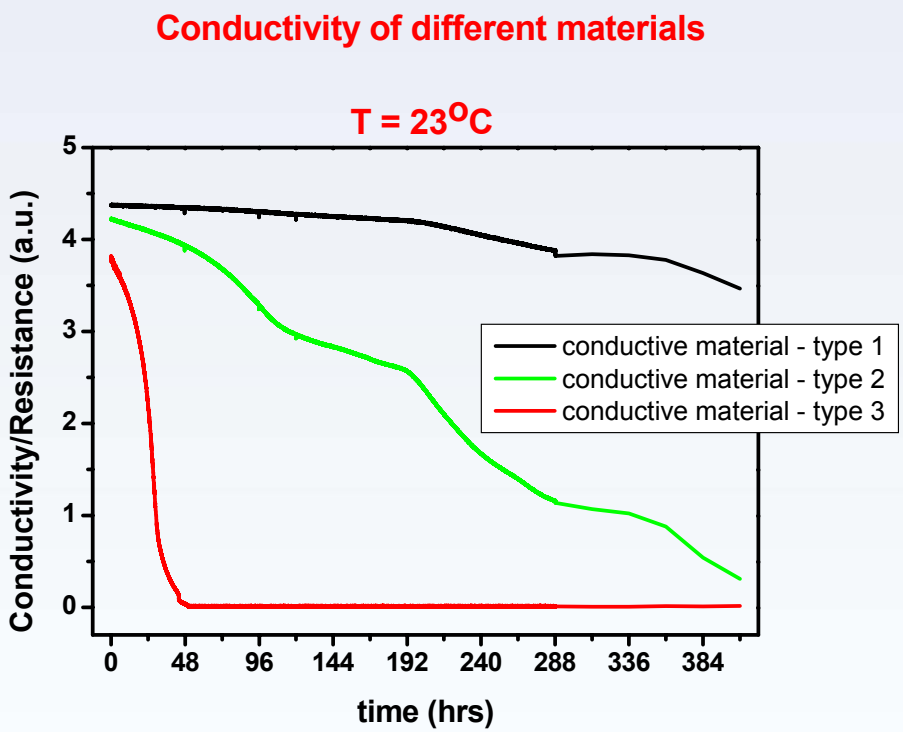
Effect of Temperature on the Rate



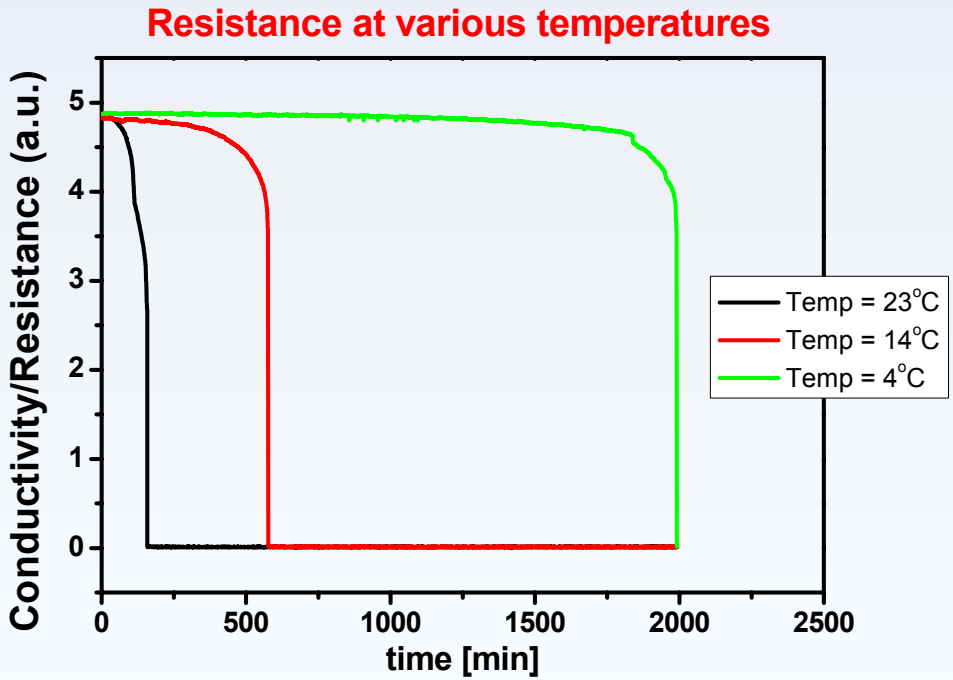
Reproducibility of the Process



Effect of conductive material



Effect of medium



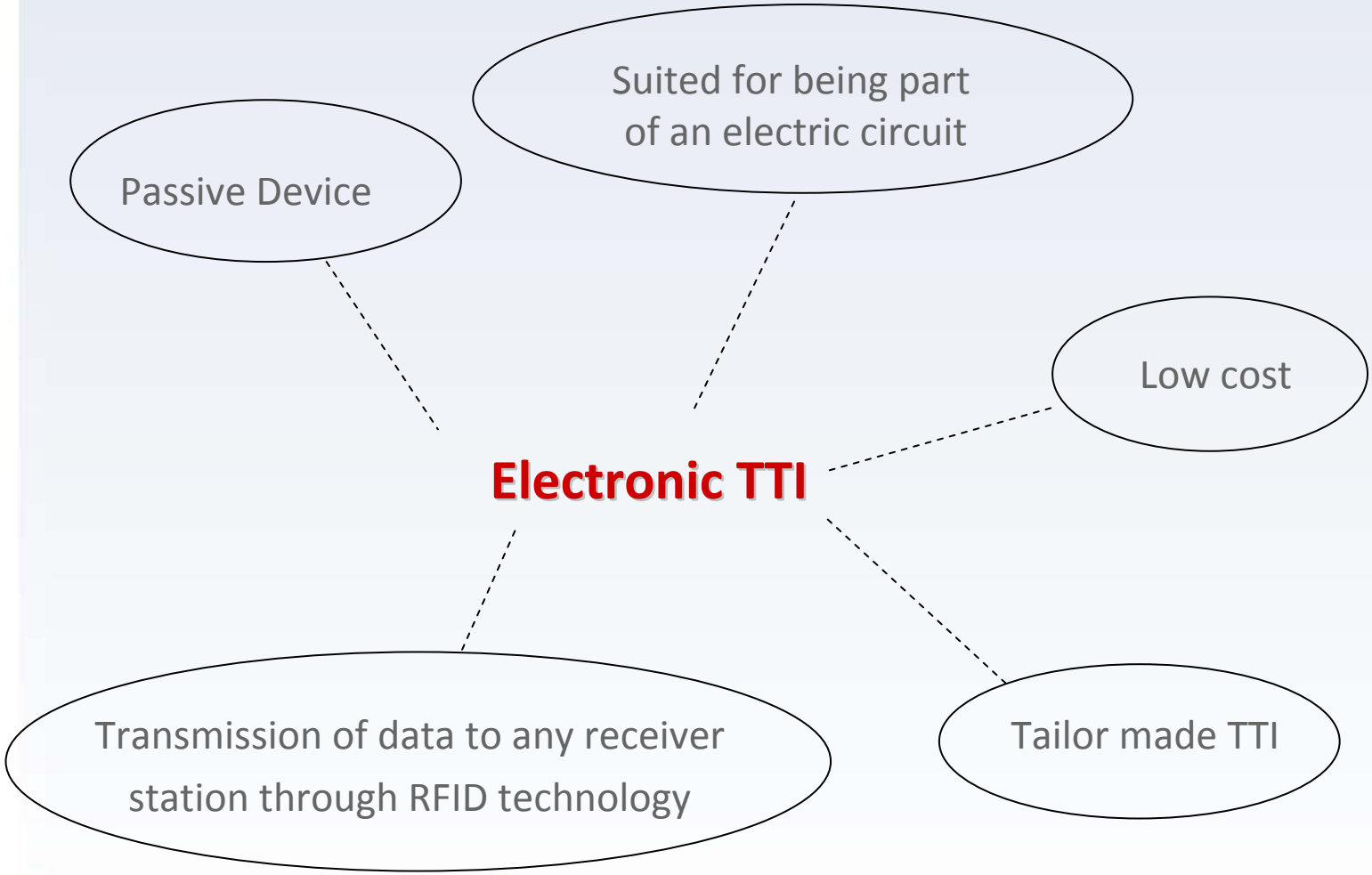
Flexibility of the Parameters

The following parameters can be changed to fit the demands from the supply chain:

- Nature of the viscous media – from digital to continuous response.
- Nature of the etchant.
- Amount of etchant.
- Nature of the metal layer.
- Thickness of the metal layer.

A TAILOR-MADE TTI

Summary


Suited for being part of an electric circuit
Passive Device
Low cost
Electronic TTI
Transmission of data to any receiver station through RFID technology
Tailor made TTI

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