# WIRELESS CAR SENSORS

## EURIPIDES FORUM 9.-10.10.2008

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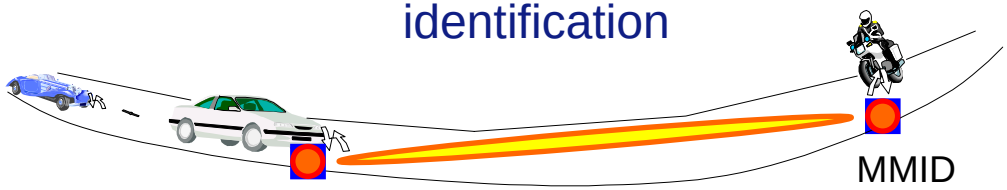
VP, R&D

Business from technology

# MMID APPLICATIONS

**Localisation** using a steerable antenna
**Miniaturized** tags
**High data rate** short range communicatio

Radar compatible identification

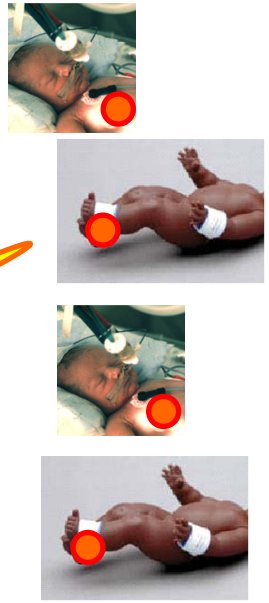


MMID Reader and tag

MMID Reader and tag

Localized identification and sensing

MMID reader



MMID tag including sensors

Fast video download

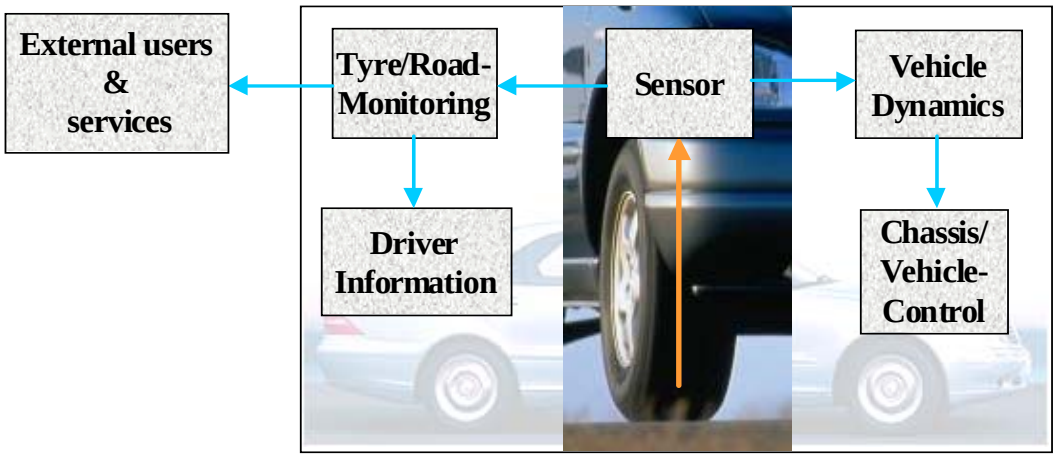
MMID reader

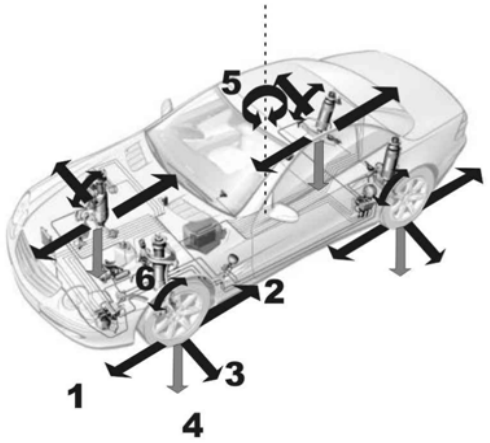

MMID tag with mass memory

**MMID technology demonstrated by VTT at 60 GHz**

# WIRELESS SENSING OF FRICTION

- EU consortium developed a new wireless sensor system for tyres, aiming at real-time monitoring of tyre contact length, slip angle, friction potential,...
- VTT developed sensors, wireless power supply and signal transfer

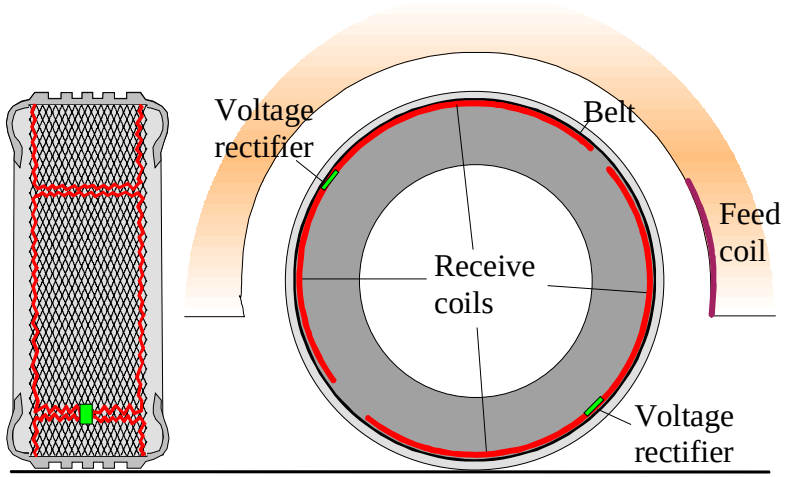


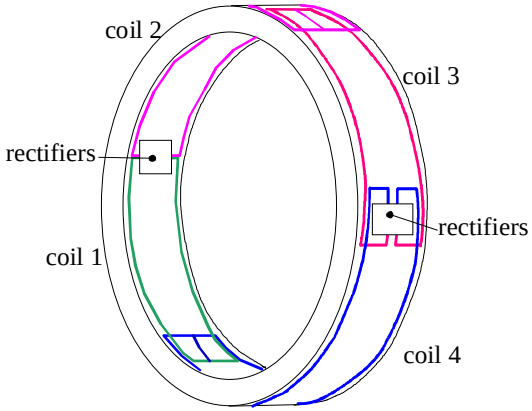



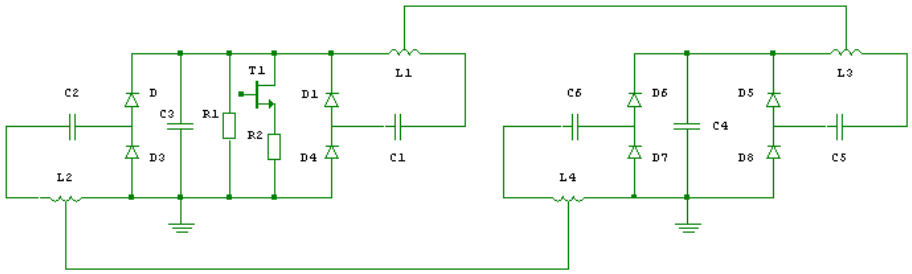
# VTT innovations in APOLLO project

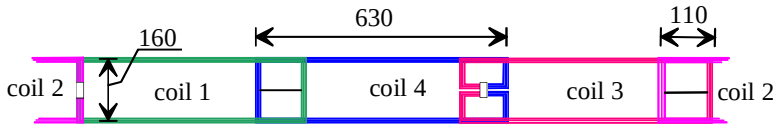
## Inductive power supply for a rotating tyre

- Coils embedded inside the tyre, integrated with steel belt
- > 400 mW of power coupled in demonstrator
- Sensor signal transmission using the same coil system



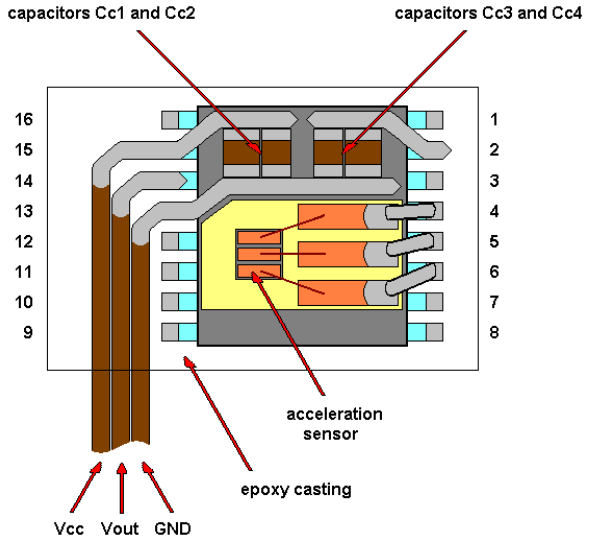



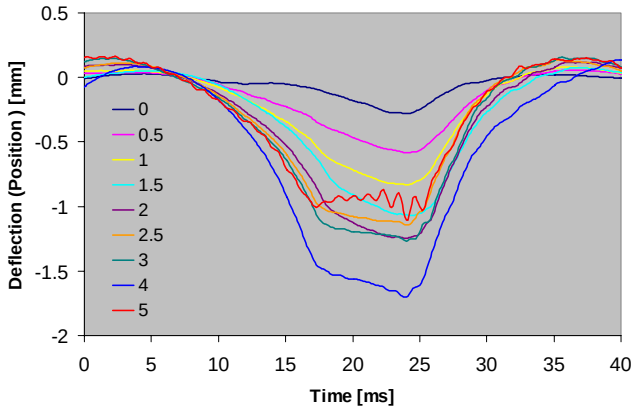

Patent pending

# VTT sensor expertise in APOLLO project

## Measurements from rotating tyre

- Acceleration sensors embedded in tread block and on the inner liner of the tyre
- Measurements on drum and road
- Determining tyre dynamics by signal processing




***And there is a lot more!***

# Conclusions

- VTT has a strong innovation potential for wireless automotive medasurements
- Several research project demonstrations are waiting for commercialization
- VTT & Finland has a strong background in wireless measurement technology but no strong car manufacturer
- ***VTT is looking for a strategic partnership with a leading car manufacturer or Tier 1 supplier***

# THANK YOU FOR YOUR ATTENTION!

**Contact points at VTT**

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# BEYOND RFID – IDENTIFICATION AT MM WAVES

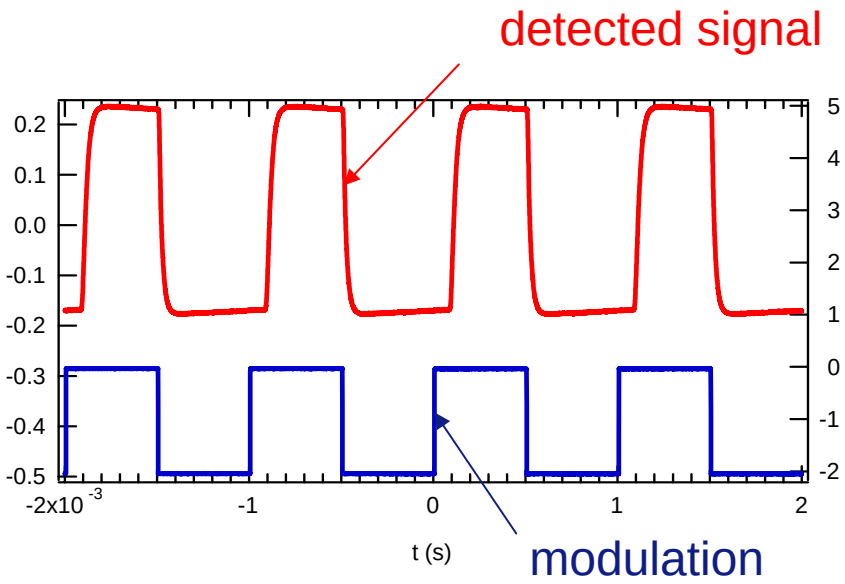
- RFID at all levels will dramatically change how people communicate, acquire services and carry out their purchases
- Present RFID systems are based on technology at 100 kHz to 2.4 GHz. Using millimeter wave frequencies will enable novel features to be included in the identification system
- The novel features include:
  - **Localisation** using a steerable antenna
  - **Miniaturized** tags
  - **High data rate** short range communication

## Advantages

- Small wavelength enables small components:  Antennas only 1cm$^2$!
- Backscattering communication makes transponder mmWave electronics simple, small and cheap.
- System compatible with mmWave radars

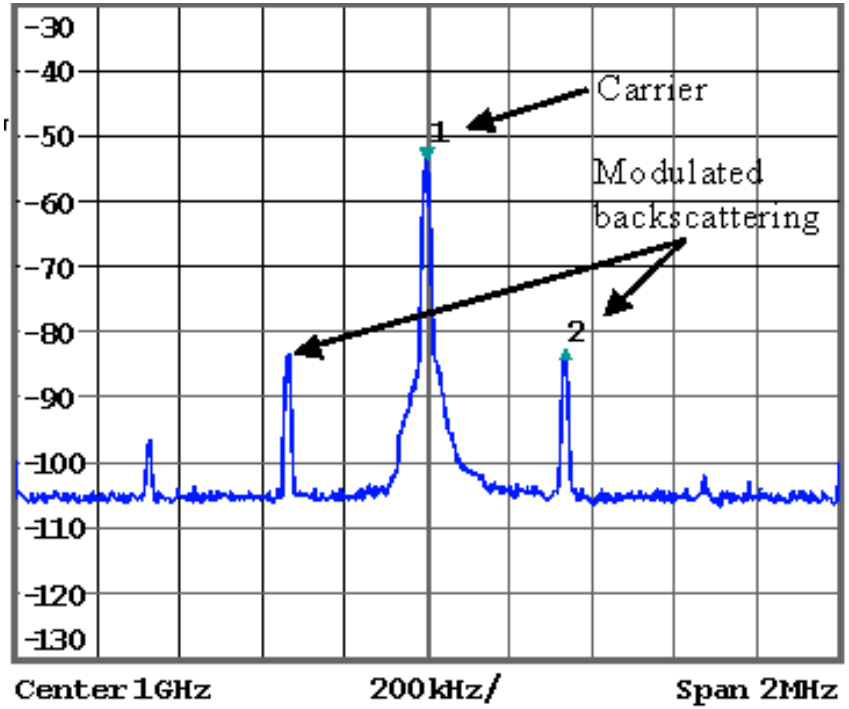
# MMID DEMONSTARATED RESULTS

## From reader to tag:



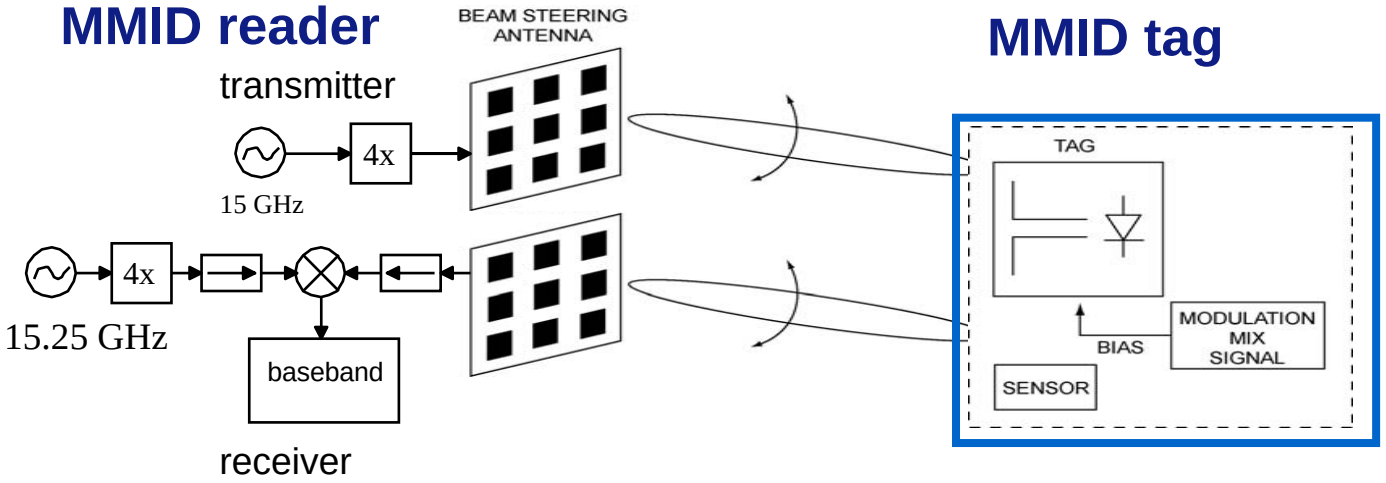

Biased diode detector: detection distance up to 6 meters recorded with $P_{tx}$ ~30 dBm EIRP

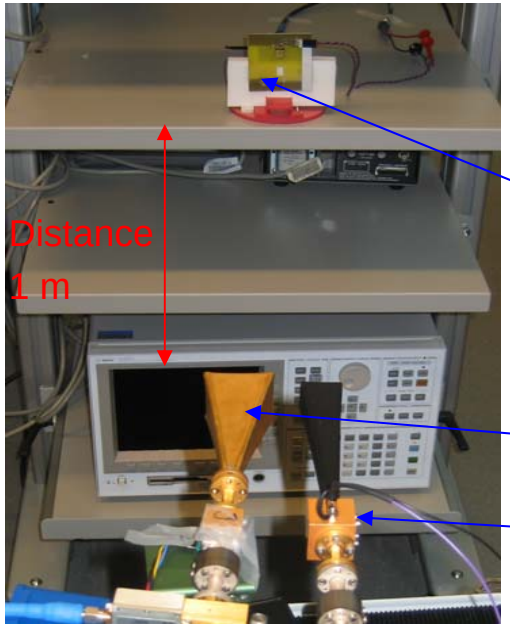
## Backscattering, from tag to reader:




Bias modulation of the diode seen over one meter distance with $P_{tx}$ ~30 dBm EIRP, RBW 10 kHz

# MMID ARCHITECHTURE




**MMID reader**

setup in laboratory

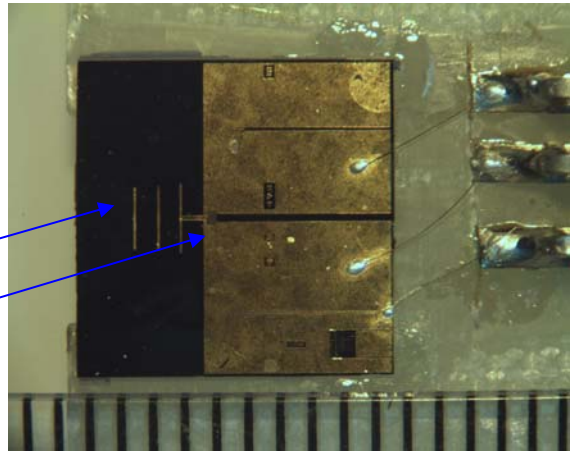
Transponder

Receiver

Transmitter

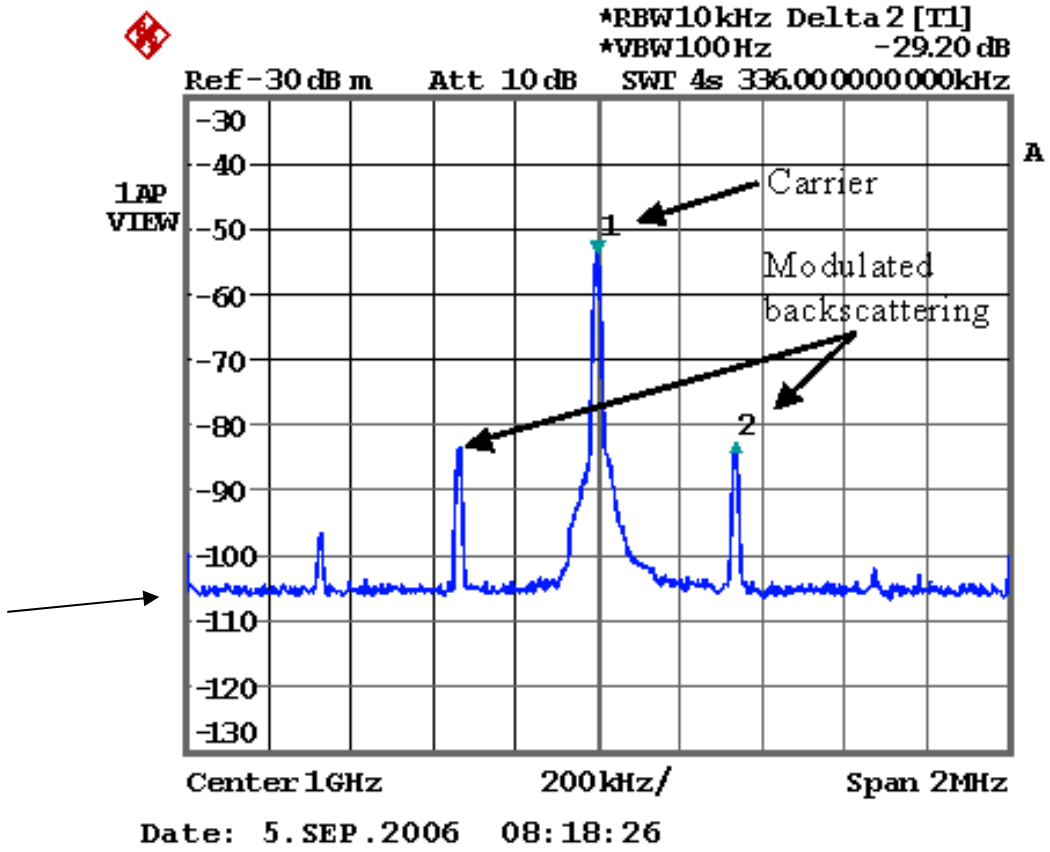
**MMID tag**

(courtesy of IMT Bukarest)



# BEYOND RFID – IDENTIFICATION AT MM WAVES

- At millimetre waves high data bandwidth can be easily realized
- Backscattering provides simple and cheap way to implement short distance links
- Backscattering spectrum from 60 GHz backscattering modulated with 300 kHz from a distance of 1 m








Si RFID

PRINTED RFID

ELECTRIC CODEs

RFID SENSORs

SKF

Korea Telecom

Resultservice

FennoID

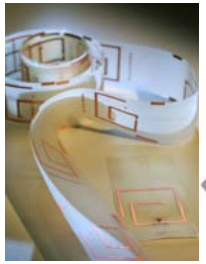
PERLOS

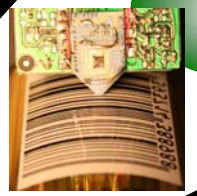
ASPOCOMP

WISTEQ

IDESCO

UPM Raflatac

ALL-PLATFORM TAGs

RAFSEC

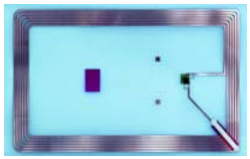
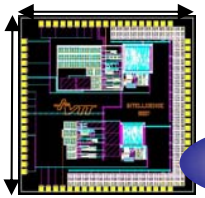
NICANTI

AVANTONE

UHF READERs

READER ANTENNAs

ATMEL

RFID ICs

PriMeBits

PrinTag

INTELLISENSE

TUOTESUOJA

PARAGON

AKATEEMINEN TIETOPALVELU

UHF TAGs

RFID-EAS

Printed RFID Sensors

KONE

HF READERs

RFID in construction

MINAmI

HF TAGs

MIMOSA

Embedded Tags

Indisputable Key

EAS TAGs

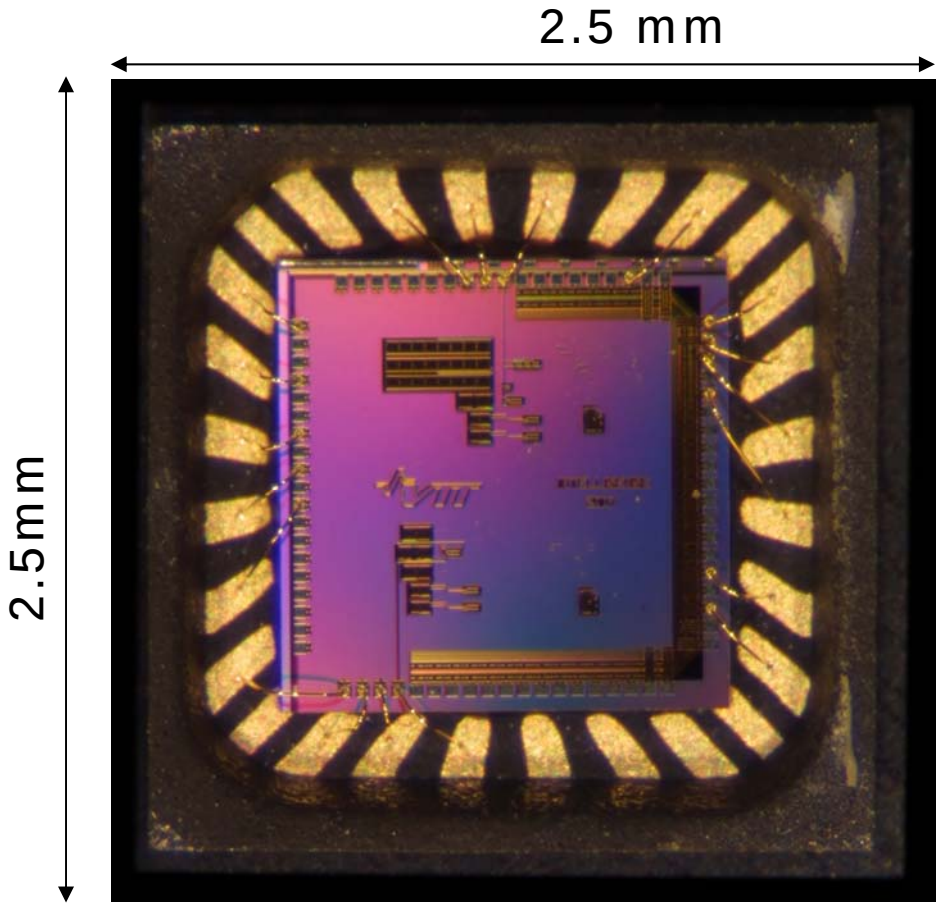
PALOMAR

SmartPack

Contract Research

# Future: Multi-protocol RFID sensor tags

- Multi-band multi-protocol RFID sensor tags
  - Support ISO 14443-A
  - Support EPC Gen2
  - Support passive and semi passive operation modes
  - Communicate with external resistive and capacitive sensors
  - Interfaced with I2C bus
- Process: UMC 0.18 µm CMOS
- Possibility to use UHF reader and/or cell phone integrated HF reader




QFN24 package
5 x 5 mm outline