The RFID Industry meets Academia

Use cases, open challenges and future trends

of RFID tech for Industry 4.0

Date: September 13, Tuesday

Session Organizers:

Sara Amendola, Radio6ense, Chair

Jesse Tuominen, Voyatinc, Co-Chair

Time	COMPANY	SPEAKER	TITLE
9:00 - 9:15	**KATHREIN SOLUTIONS**	Volker Schönig	*The Virtual Proof of Concept – Using simulations to develop high performance and fault tolerant UHF RFID systems*
9:15 - 9:30	**RACE RESULTS**	Sven Hofmann	*Reader Performance in the Field*
9:30 - 9:45	**PragmatIC**	Brian Cobb	*Flexible integrated circuits enable smart packaging in ultra-high volumes*
9:45 - 10:00	**VOYANTIC**	Jesse Tuominen	*Testing and encoding RFID inlay in production*
10.00 - 10.15	**ASYGN**	Sofia Benouakta Thomas besson	*UHF RFID IC with sensing capabilities, key enabling technology for Industry 4.0*
10.15 - 10.30	**EM MICRO-ELECTRONICS**	Arthur H. MacDougall	*How the passive RFID sensors can help address some of the Food industry challenges*
10.30 - 10.45	**RADIO6ENSE**	Sara Amendola	*Unusual RFID sensors: from microscale up to large distributed systems*
10.45 - 11.00	**PFIZER**	Scrivens Garry	*Thinking Inside the Box - Miniaturized Battery-Free Temperature and Humidity Probes for Pharmaceutical Moisture Analysis*
11.00 - 11.15	**LINXENS**	Francois Germain	*Connected RFID solutions for the future of healthcare*
11.15 - 11.30		**Round Table**	

KATHREIN

The Virtual Proof of Concept –

Using simulations to develop high performance and fault tolerant UHF RFID systems

Volker Schönig, *Senior Antenna Engineer*

Nowadays, simulations are heavily used for developing electronic components. Using these tools to assess the performance of the full system, including its environment, is giving valuable insights for its setup. Commercial and self-developed tools are giving Kathrein Solutions customers, engineers, and technicians the advantage to develop and set up read points quickly and with robust performance.

The effect of the environment on the performance of UHF RFID systems can be considered even before conducting the first real world tests. Especially metal in the vicinity can lead to decreased system performance.
Considering the environment, especially metal structures, is leading to insights about optimum transponder and antenna placement.

This presentation shows how transponder antenna patterns are changed by the metal structure they are attached to and the effect on system performance. The effect of reader antenna type and placement in gate scenarios is highlighted, as well as the visualisation of key parameters that can be used for fully automated system optimisation.

Volker Schönig, *received the Diplomingenieur degree in electronic engineering from the University of Applied Sciences in Munster, Germany in 2005 and the M.Eng. degree in communication systems engineering from the University of Portsmouth, Great Britain in 2006. From 2006 to 2016 he was a development engineer in the Advanced Engineering department at Kathrein Werke in Rosenheim, currently he is working as a senior antenna engineer at Kathrein Solutions GmbH in Stephanskirchen, Germany. He is involved in the development of HF and UHF RFID transponders, as well as UHF RFID, 3G, 4G, 5G, WLAN and Bluetooth antennas and RTLS systems. Additionally, he is developing measurement systems and automates measurements and the reporting of results.*

Reader Performance in the Field

Sven Hofmann, *RF Electronics Engineer*

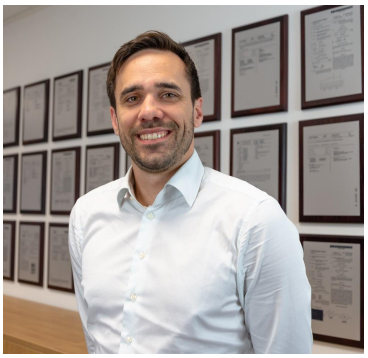
For years much of the development in UHF RFID has been focused on the transponder, steadily increasing efficiency and sensitivity. Current generations of tags are performing so well, that in some cases the reader unknowingly will be the limiting factor for communication. This can lead to difficult to interpret system behaviour and in turn reduced confidence of the end user in the technology. Without detailed knowledge and specialized measurement equipment, debugging a UHF system in the field is often limited to simply replacing key components. In this presentation we will share key learnings from large scale deployment of UHF readers with continuous performance validation and why we think this is crucial for the future of the technology.

Sven Hofmann *received his MSc in electrical engineering with a focus on communications from the Karlsruhe Institute of Technology (KIT) in 2019. Since then, he has been working as RF engineer for RACE RESULT developing UHF RFID products and testing solutions for performance validation and quality assurance. Sven's main interests are software defined radio, RF measurements and protocols, and antenna design.*

Flexible integrated circuits enable smart packaging in ultra-high volumes

Brian Cobb, *VP Product Development*

Smart packaging that incorporates RFID functionality creates supply chain efficiencies and improved insights via individual item identification, product authentication, and a variety of additional use cases. PragmatIC's FlexIC process and ConnectIC RFID products address this market via an approach based on thin, flexible, Integrated circuits. Modifications to existing processes and tooling in the supply chain, and solutions to address novel challenges associated with a new form factor and polymer substrate allow for a clear path to realize the potential of this ultra-high volume market.



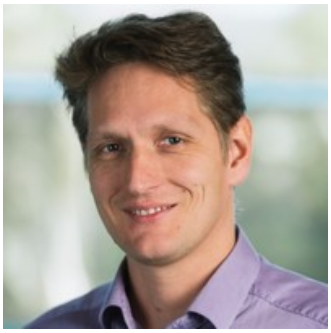
Brian Cobb, *VP Product Development, PragmatIC Semiconductor*

Brian leads PragmatIC's focused efforts on supporting both internal and external customer product development and application engineering efforts on the FlexIC Foundry manufacturing offering, including the design of PragmatIC's own ConnectIC flexible integrated circuits. His background includes 20 years of experience in semiconductor related R&D, with the majority of that time focused on display backplanes and flexible electronics. Brian received a PhD in Solid State Electronics from the University of Texas at Austin.

Testing and encoding RFID inlay in production

Jesse Tuominen, *CTO*

The testing of RFID transponders can be challenging in their inlay form as they are inherently bound next to each other. Ideally, the transponders are wished to be tested for single tag far-field performance, but in inlay form shortcuts need to be taken. To make matters more difficult prctically all RFID transponders are of different form factor and spacing. Another big challenge is the high speed of the production machines, with which testing, and possibly encoding, should keep up with. We will present some main challenges and solutions of testing extremely fast moving transponders.



Jesse Tuominen has 16 years of experience in RFID research and development, mainly in designing transponder and reader test systems. Since 2009 he has been the CTO at Voyantic, before which which he worked as a research scientist at the Helsinki University of Technology (currently Aalto University). Jesse did his PhD in the field of optical telecommunications in 2008 and before that his MSc in electronics in 2002. The main focus points currently are RF signals and protocols, antenna design, embedded systems, RF tranceivers, SDRs, and DSP.

UHF RFID IC with sensing capabilities, key enabling technology for Industry 4.0

Thomas Besson, *Application Engineer;*
Sofia Benouakta, *RFID Application Engineer*

Asygn is a company based in Grenoble (the French alps) where it started its activity in 2008. Asygn is composed of a team of engineers that have a strong background in analog and RFIC design. Using these skills they work in close collaboration with clients all around the world to contribute to challenging and ambitious customer developments in the area of high performance electronics, sensors and RF applications. Asygn contributed significantly to the RFID world by launching in 2019 the first UHF RFID chips, enabling batteryless sensing applications. The AS321X chips are fully compliant with RAIN RFID infrastructures (EPC Gen 2) and feature an analog interface for connection to external sensors and on-chip sensors such as: temperature, strain, ambient light and relative humidity. In collaboration with main tag manufacturers, the chips are integrated on inlays composed of a substrate (flexible or rigid depending on the application) and an antenna allowing to transmit the captured data about a physical property to conventional UHF RFID readers with a read range of up to 7 meters. Products developed by Asygn's engineering team target many applications and market segments including predictive maintenance, medical sector, food tracking, and automotive.

During the RFID-TA 2022's industrial panel, Sofia Benouakta and Thomas Besson, application engineers in antenna and analog design respectively will be presenting the AS321X series with details about their working principle and functionalities. Moreover, several use cases will be presented in order to provide an overview of existing deployment in the RFID market and its ability to support partners and customers in the industry as well as in the academia to achieve their objectives in the area of batteryless sensing.

***Thomas Besson**, received his M.Sc engineering degree in Radio Frequency integrated electronic system design from the French engineering school Phelma in Grenoble, France, in 2020. Since then, he is working as an application engineer with ASYGN. His work focuses on the AS321X RFID chip family. With a strong knowledge in sensor and RFID communication, he is in charge of characterizing sensors embedded in the chips (Temperature, Strain sensors or Analog and Capacitve Interface). He is also involved as a product engineer to monitor production test and bring the best support to the customers. During the last years, he realized many proof of concept, working with customers to develop tags and software solutions that can fit into their environment.*

***Sofia Benouakta,** received her M.Sc degree in Electrical Engineering from the University of Montpellier (France) in 2016. She started her PhD at Ampère Lab at the University Claude Bernard Lyon 1 (France) in 2018, focused on the development of an RFID textile yarn with augmented capabilities.This work was in close collaboration with Primo1D, (patent's owner of E-Thread technology). In 2021, after receiving her PhD degree in Telecommunications, she pursued her career as a postdoctoral researcher working on antenna solutions for integrating Near Field Communication (NFC) into a textile yarn. Recently, she joined Asygn's team as an Application engineer specialized in the design, simulation and characterization of antennas assembled with the AS321X chip family to form batteryless UHF RFID sensor tags. The main objective of her work is optimizing the antenna performance while taking into consideration the conditions required by the client's use case.*

em microelectronic

How the passive RFID sensors can help address some of the Food industry challenges

Arthur H. MacDougall, *RFID BU Technical Leader*

Close to 30% of all food produced is wasted. Consumers are demanding more and more to know how and where their food was grown and processed. New regulations are coming to improve supply chain transparency. The food industry is looking for a more efficient model to manage production information and logistics from farm to fork. Passive RFID technology and passive RFID sensor technology can be leveraged to address all these challenges.

Arthur H. MacDougall *received the M.Eng Degree in Electronics from the University of Edinburgh, Edinburgh, Scotland in 1997. Since then he has worked as an analog and mixed signal design engineer in the field of fibre-optic communications for a number of companies including Nortel and Semtech plus a period in the oil industry working on down-hole, high temperature electronics for Schlumberger. He joined EM Microelectronics in 2019 where he as Technical Leader of the RFID business unit, he is driving the technical development and the roadmap of the RFID products*

Unusual RFID sensors:
from microscale to large distributed systems

Dr. Sara Amendola, *Executive Director*

Battery-less RFID sensors can be designed to seamlessly fit where no other devices could, bringing digital identification and wireless sensing down to unreachable points.

Accordingly, any physical objects - be it a tire, a food package, an industrial equipment or even an implantable prosthesis - can be turned into a connected entity generating item-level data sourcing the *First Meter* of the Internet of Things.

Radio6ense is a spin-off of the University of Rome Tor Vergata founded in 2013. Through years of pioneering R&D activity in the framework of open innovation projects, Radio6ense has gained a unique expertise and is now leader in designing wireless architectures for the Industry 4.0 with high level of creativity and innovation.

This talk we will present how RFID architectures can serve unusual industrial challenges at multiple scales, from micro-scale devices powered by miniaturized embedded sensors up to large-scale distributed systems involving hundreds of nodes over a wide area.
Relevant use cases in healthcare, automotive and manufacturing sectors will be discussed.

Sara Amendola *received her M.Sc. (Hons.) in Medical Engineering from University of Rome Tor Vergata in 2013, and her PhD in Electromagnetics (Hons.) in 2017 for her work on Bio-integrated wireless Sensors. She has worked on mm-size telemetry for BMI implants (2013, Tampere University of Technology) and on micro-fabrication of epidermal devices (2015, ESIEE Paris). She is Co-founder of RADIO6ENSE - a University spin-off aimed at technology transfer of RF sensing technologies - where she currently holds the position of Executive Director. In a context of Open Innovation with leading international companies in the automotive, manufacturing, medical sectors she manages high-end R&D projects, from activity proposals up to development of future business scenarios.*
She is the Industry Activity Chair of the new IEEE-RFID TC on Additively Manufactured Electronics Systems. She is Contract Professor at UdT teaching RF technologies since 2021. She is co-author of more than 30 journal articles and co-inventor of 7 patents.

Applications of RFID technology in the Pharmaceutical Industry

Scrivens Garry, *Associate Research Fellow*

This presentation provides an overview of some of the analytical challenges in the supply and manufacture of pharmaceuticals in 'Late-Stage Development' and how RFID technology and miniaturized sensors could provide solutions to those challenges. By way of example, an ongoing collaboration between Pfizer and Radio6ense to develop battery-free RFID probes for the monitoring of temperature and humidity is briefly described.

Garry Scrivens is an Associate Research Fellow at Pfizer in Sandwich, UK. He has a B.Sc. in Chemistry and a PhD in magnetic resonance spectroscopy to determine the mechanisms and kinetics of organic oxidation reactions. He has over 25 years' experience in analytical chemistry in the pharmaceutical industry and in recent years, Garry has focused on pharmaceutical stability and has helped to develop methods and models for the prediction of shelf-life. Garry has authored numerous scientific papers and has recently co-authored a book on 'Accelerated Predictive Stability'.

Connected solution for Future of Healthcare

François Germain, *Medical & Sensor Business Development Manager*

In a world where digitalisation has been accelerated during the COVID crisis, how will the healthcare market leverage the new technologies to answer to the unmet medical needs, improve patient experience and optimize healthcare professionals' efficiency?

An engineer by nature, François joined the Linxens product marketing team in 2018, focusing on non-smartcard products, with a strong focus on medical.

Building on his experience on expanding Linxens' product offering in the healthcare market, François was appointed Medical & Sensor Business Development Manager in October 2021.