Baqueano–Pro®, an ISO compliant RFID reader in a SoC

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Custom Technology

Contents

- Introduction: Baqueano-Pro® highlights, low frequency RFID, and the ISO11784/85 standard.
- An RFID engine in a programmable analog, programmable digital System on Chip (PSoC).
- Results, conclusions, trends.

BQN - Uruguay (http://www.bqn.com.uy)

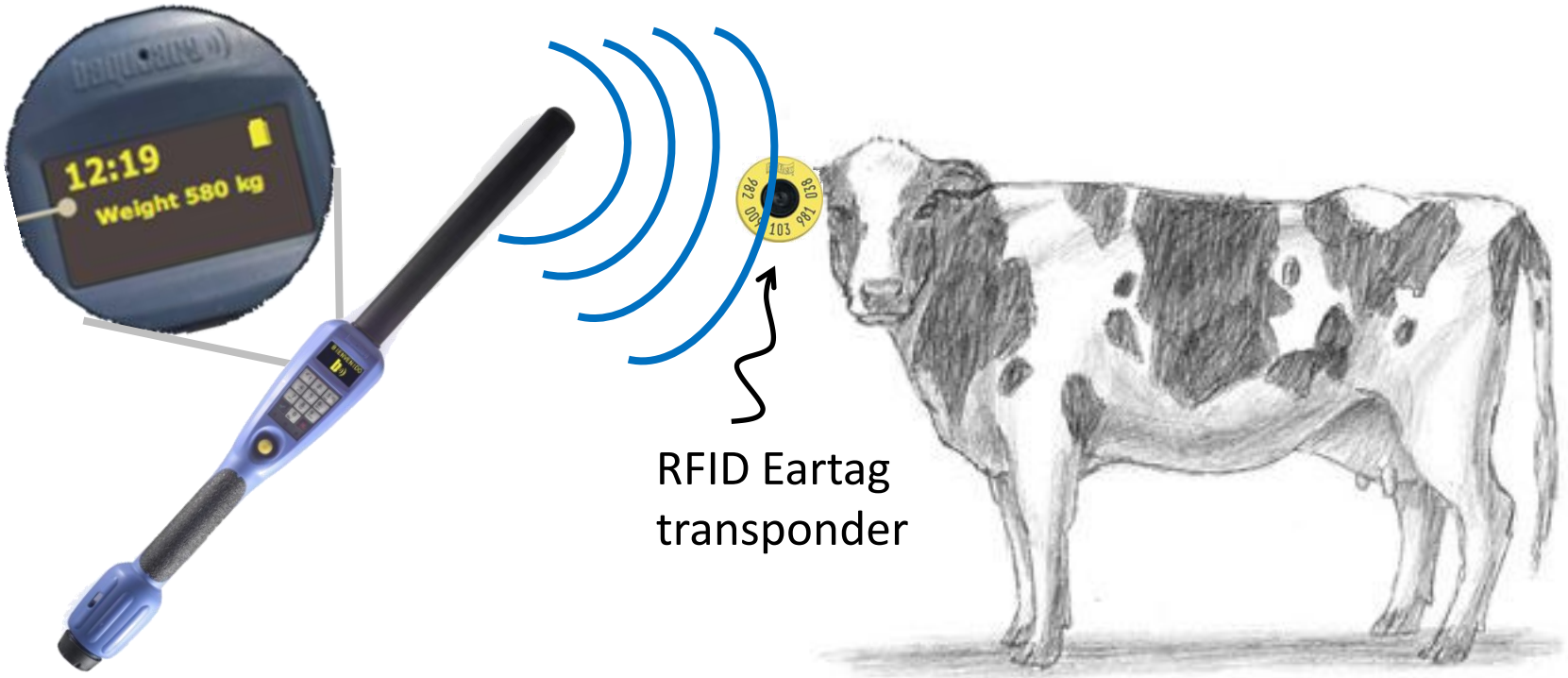
Develops **HW & SW** (POS, RFID, medical, data center), low volume batches for specific niches. **ASICs for implantable medical** devices, nano power, safe & highly reliable circuits, FDA approvals etc. (http://www.chipmateic.com).

The product - an ISO 11784/85 fully compliant RFID reader for traceability within the livestock industry.

- Baqueano-Pro® for traceability and animal data management.

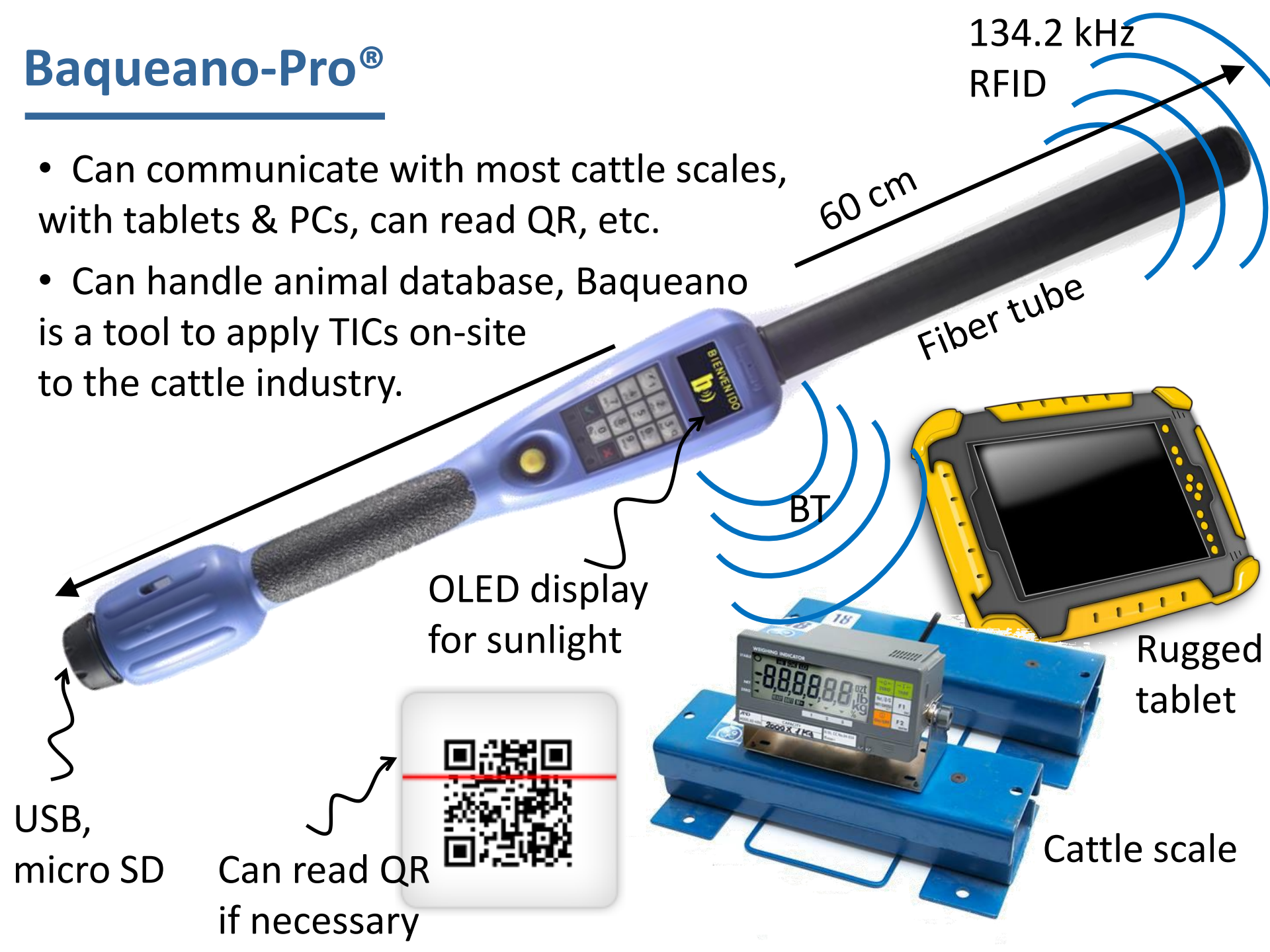
The user access the information in the cattle yards.

- LF RFID engine in an analog/digital programmable SoC.



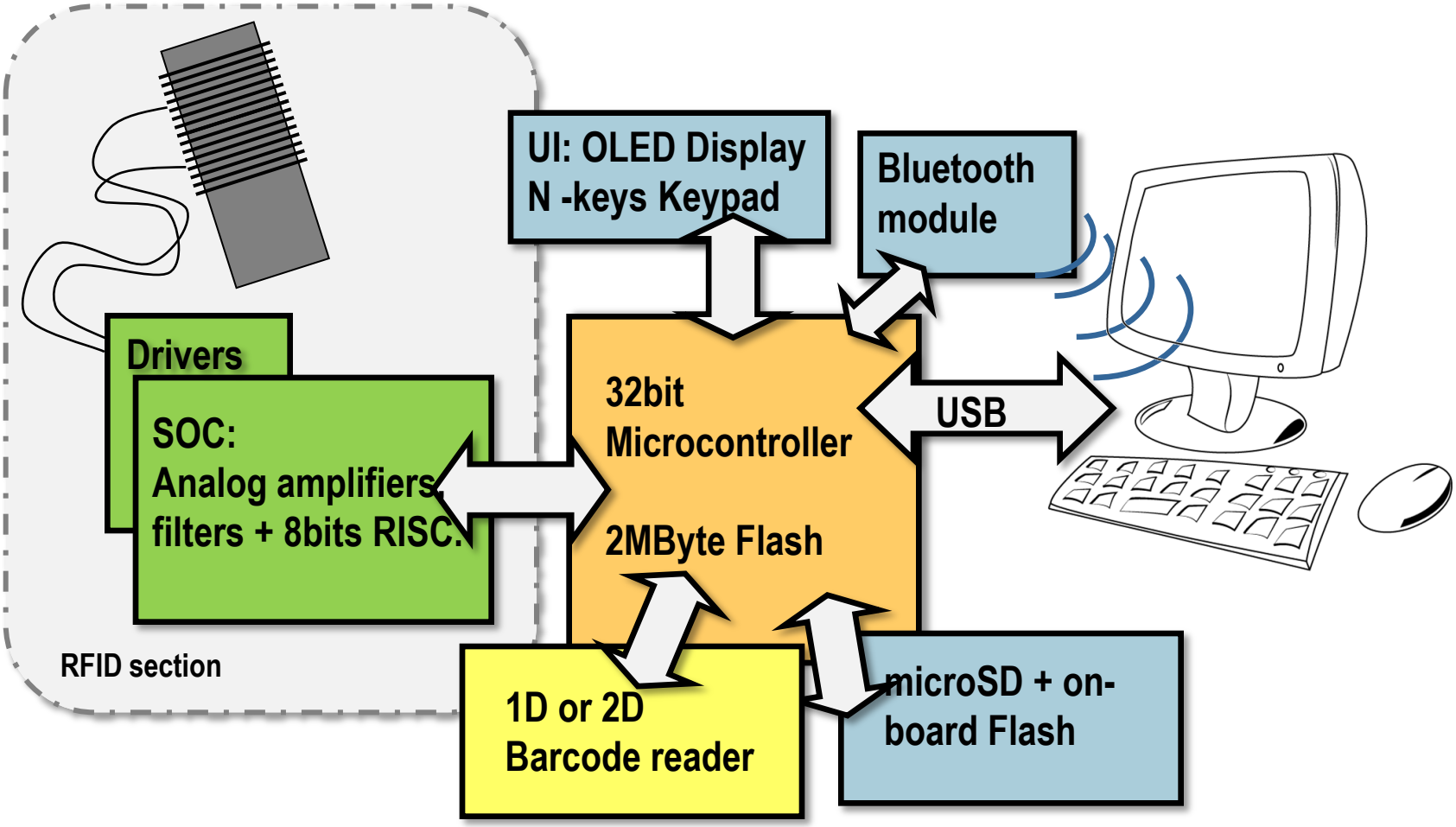
Baqueano-Pro®

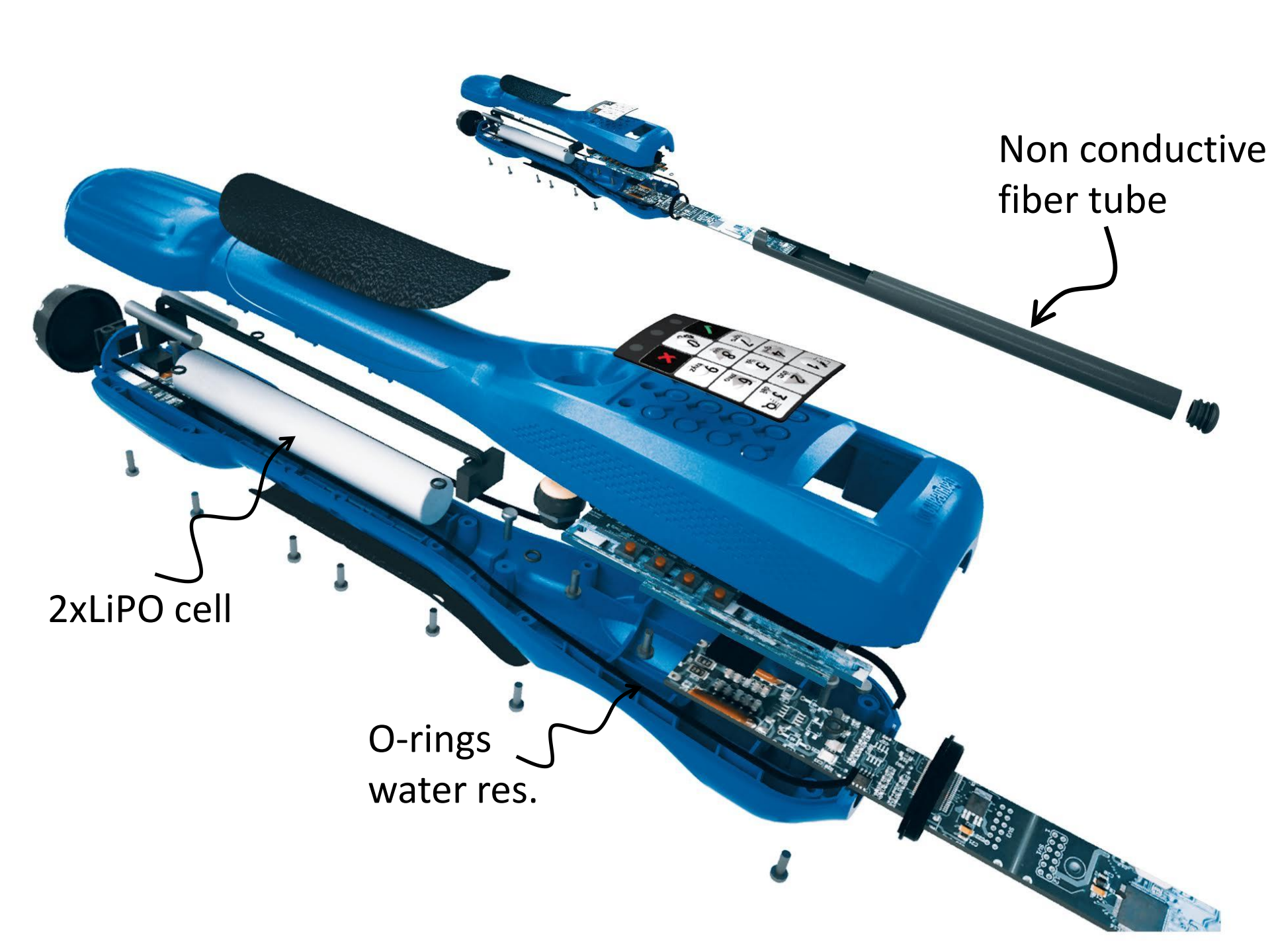
- Can communicate with most cattle scales, with tablets & PCs, can read QR, etc.
- Can handle animal database, Baqueano is a tool to apply TICs on-site to the cattle industry.

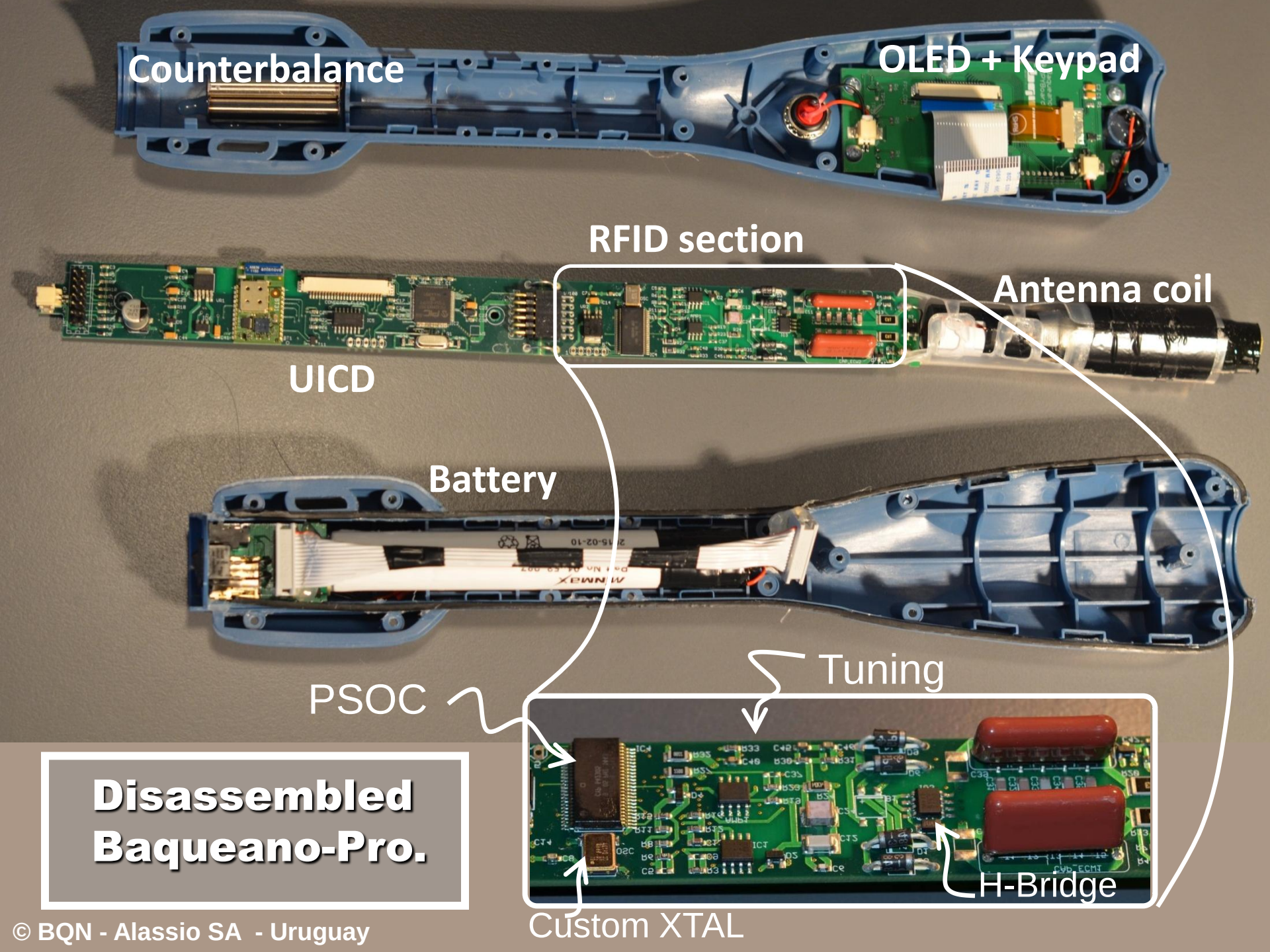


Baqueano-Pro® block diagram

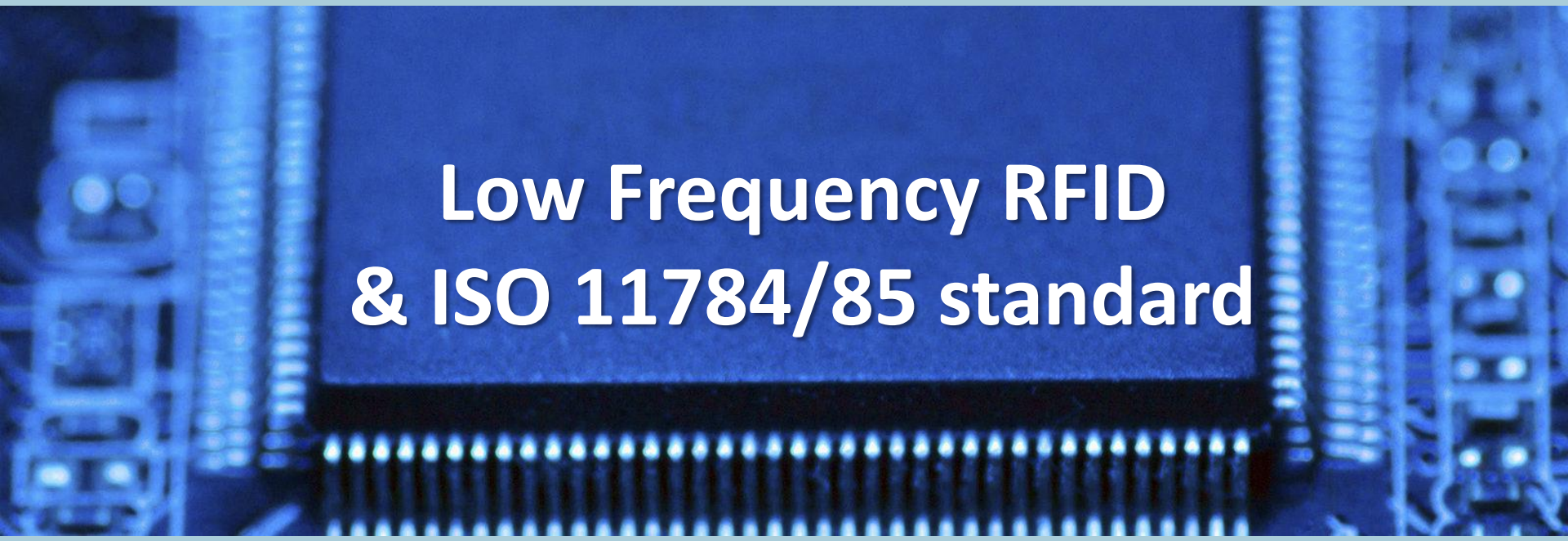
It is a portable embedded system, using 32bits μC for UI & top hierarchy functions + PSoC for the RFID engine at real time.




Non conductive
fiber tube
2xLiPO cell
O-rings
water res.



Disassembled Baqueano-Pro.



Low Frequency RFID & ISO 11784/85 standard

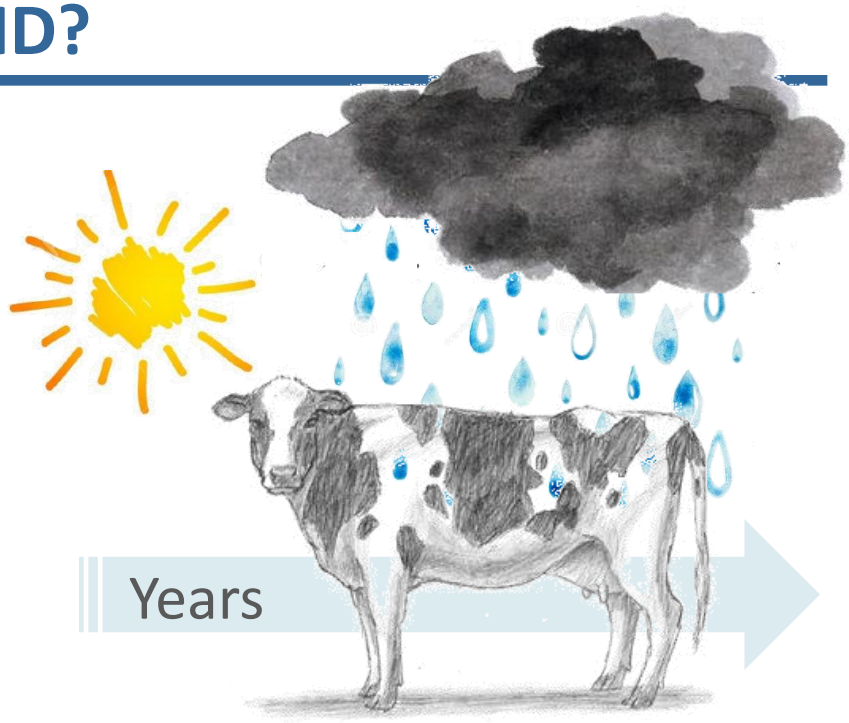
Why LF is employed in animal ID?

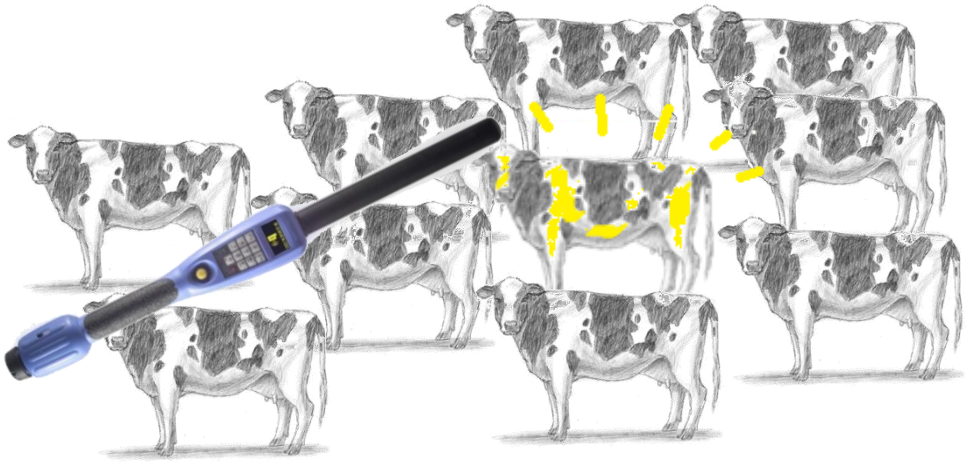
- **Rugged**, mature technology.

- **Water**, tissue, do not affect reading. Thus is also adequate for **implantable tags**.

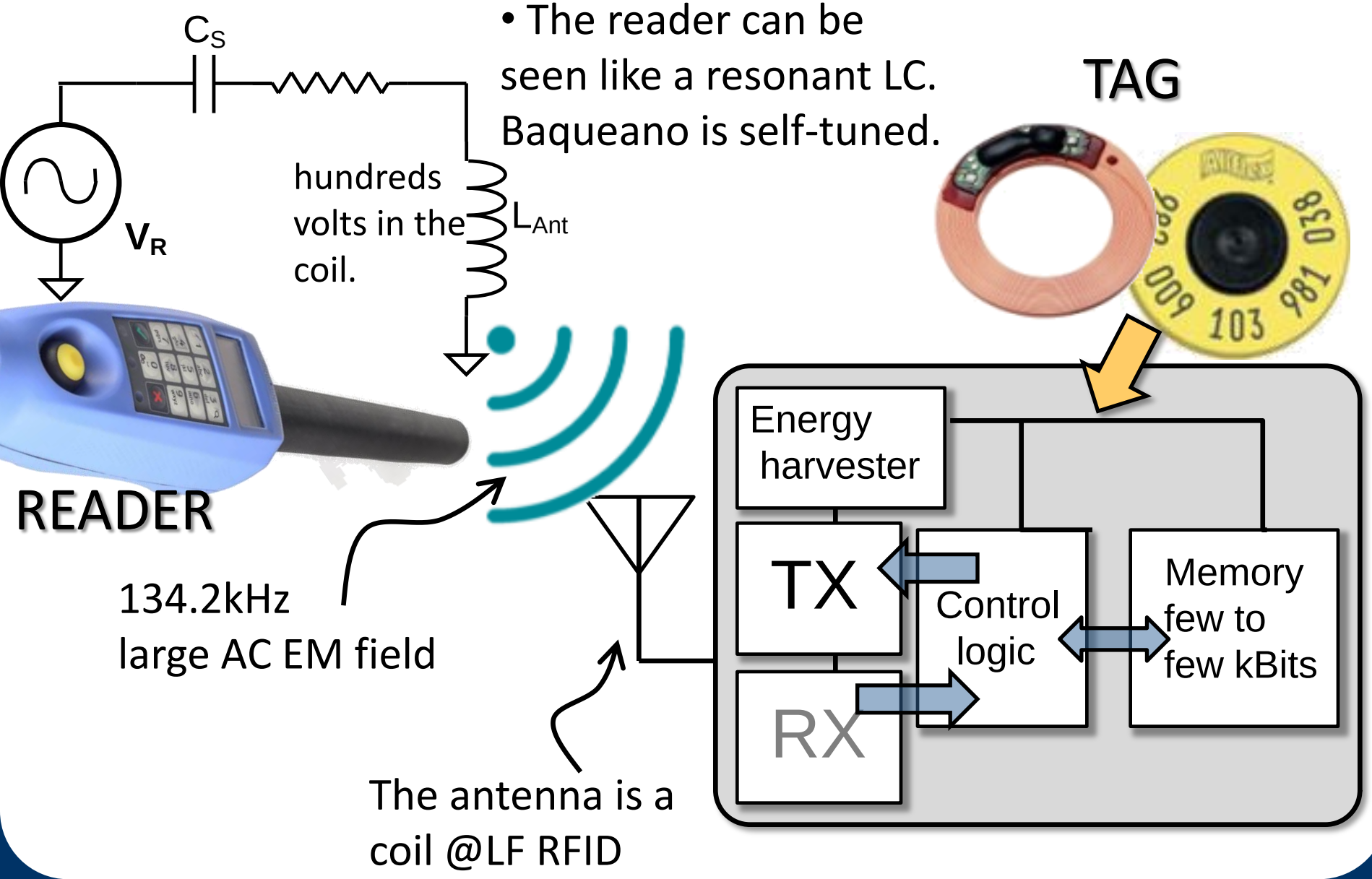
- Is a **standard**, ICAR adopted & national regulations.

- **Localization**.





LF RFID (125-134.2 kHz)



ISO 11784/85 – Defines two modes HDX & FDX

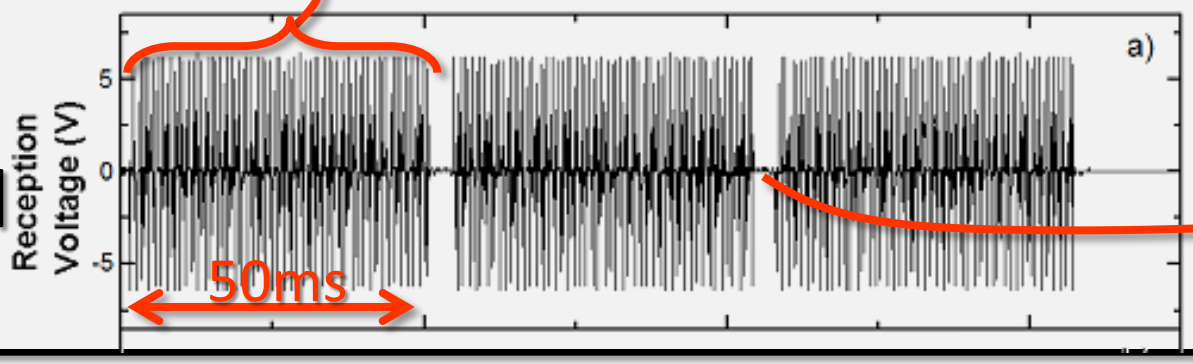
FDX

- The Tag scatters back data in **ASK**. The reader EM field is modulated.
- Tag transmits while powered.
- Problem: few mV ASK in hundred Volts carrier.

HDX

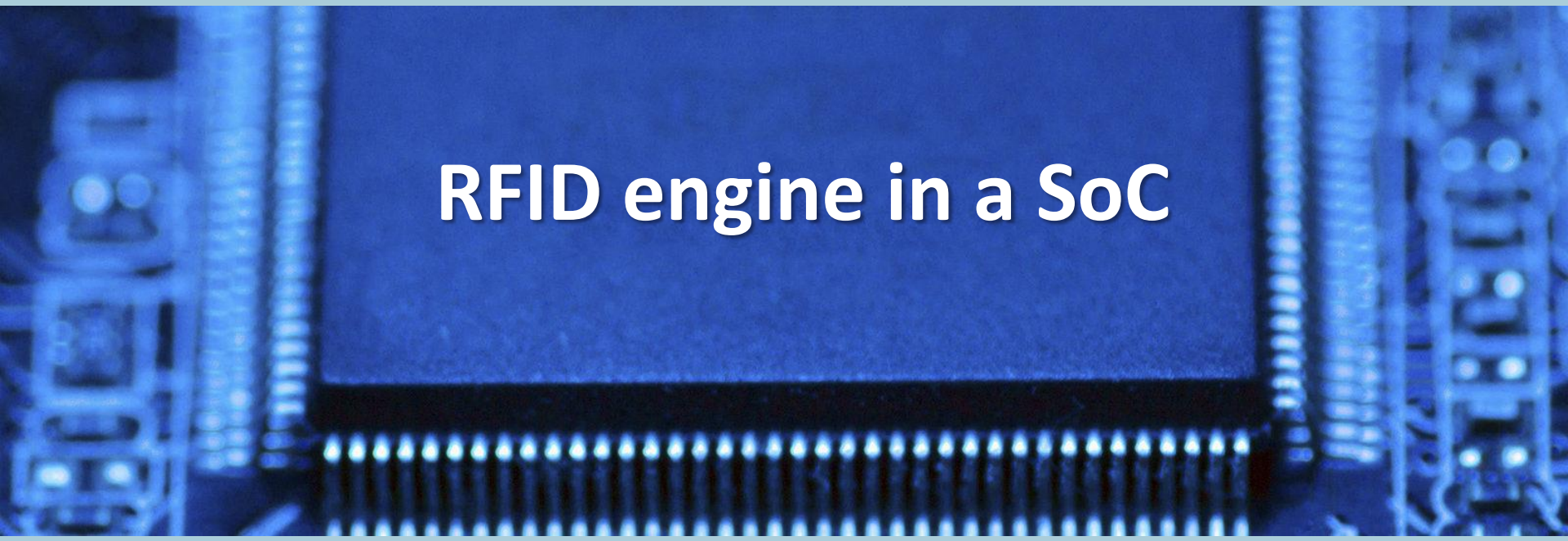
- The tag stores energy from the EM field, in a small 100s nF capacitor.
- The Tag transmit data in **FSK** (124.2 – 134.2 kHz) MDMC when no reader field is present.
- Problem: more expensive tag, requires storage & tuning Caps.

Reader EM field



FDX time slot

HDX time slot


RFID engine in a SoC

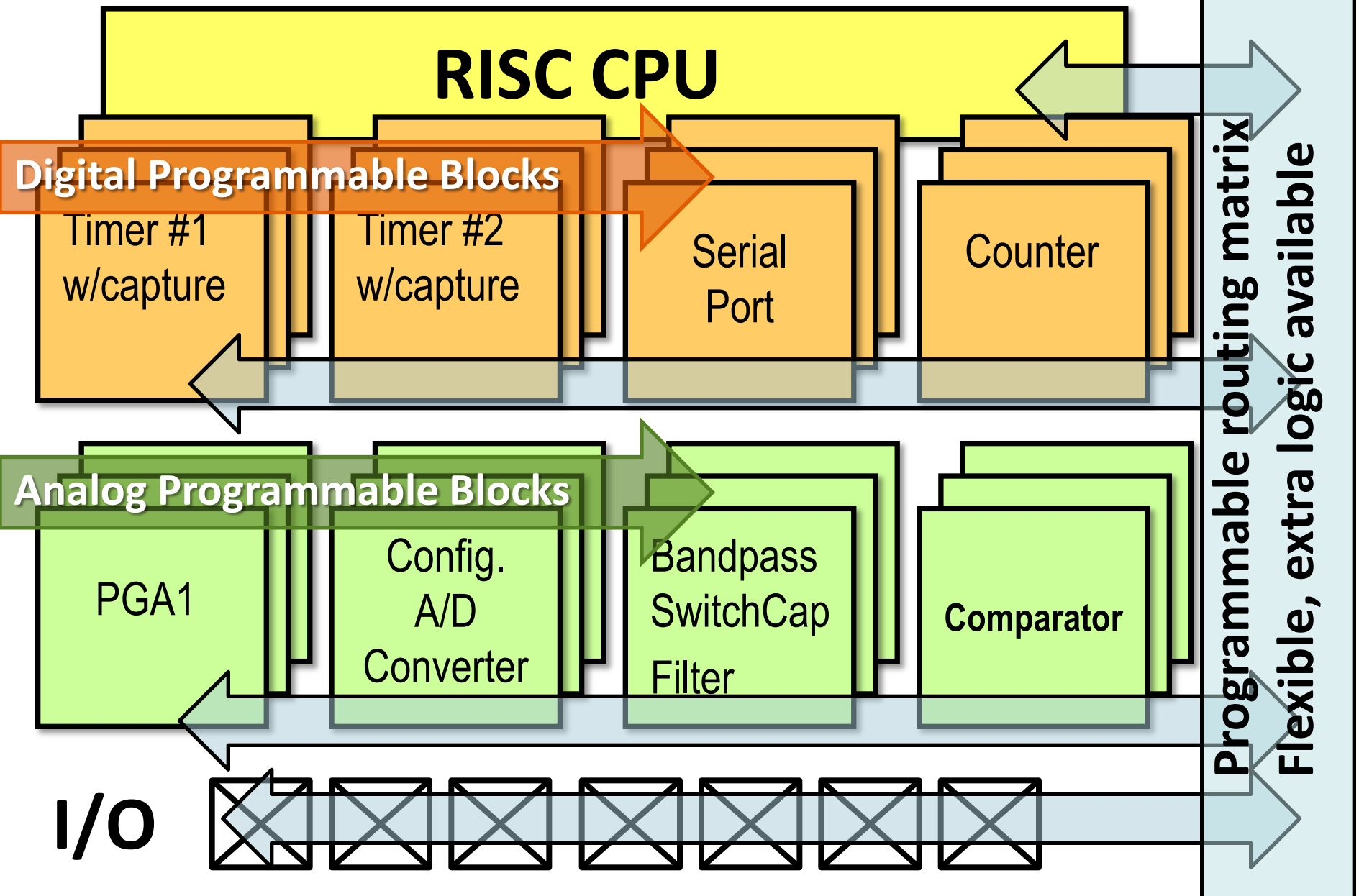
RFID engine - options

- Analog frontend + fast AD + DSP.
- Off the shelf ICs for RFID ….. no single chip solution.
- PSoC: an analog/digital programmable SoC, implements the RFID frontend & digital detection scheme. Using PSOC from Cypress.

Baqueano-Pro option

- A nice embodiment of **SW defined HW**.
- **Lower component count** in comparison to other options.
- Very suitable for **low volume production** & fast time to market.
- Very **flexible** to test & optimize the reader, also to develop new LF RFID standards, etc.

PSOC topology



PSOC design

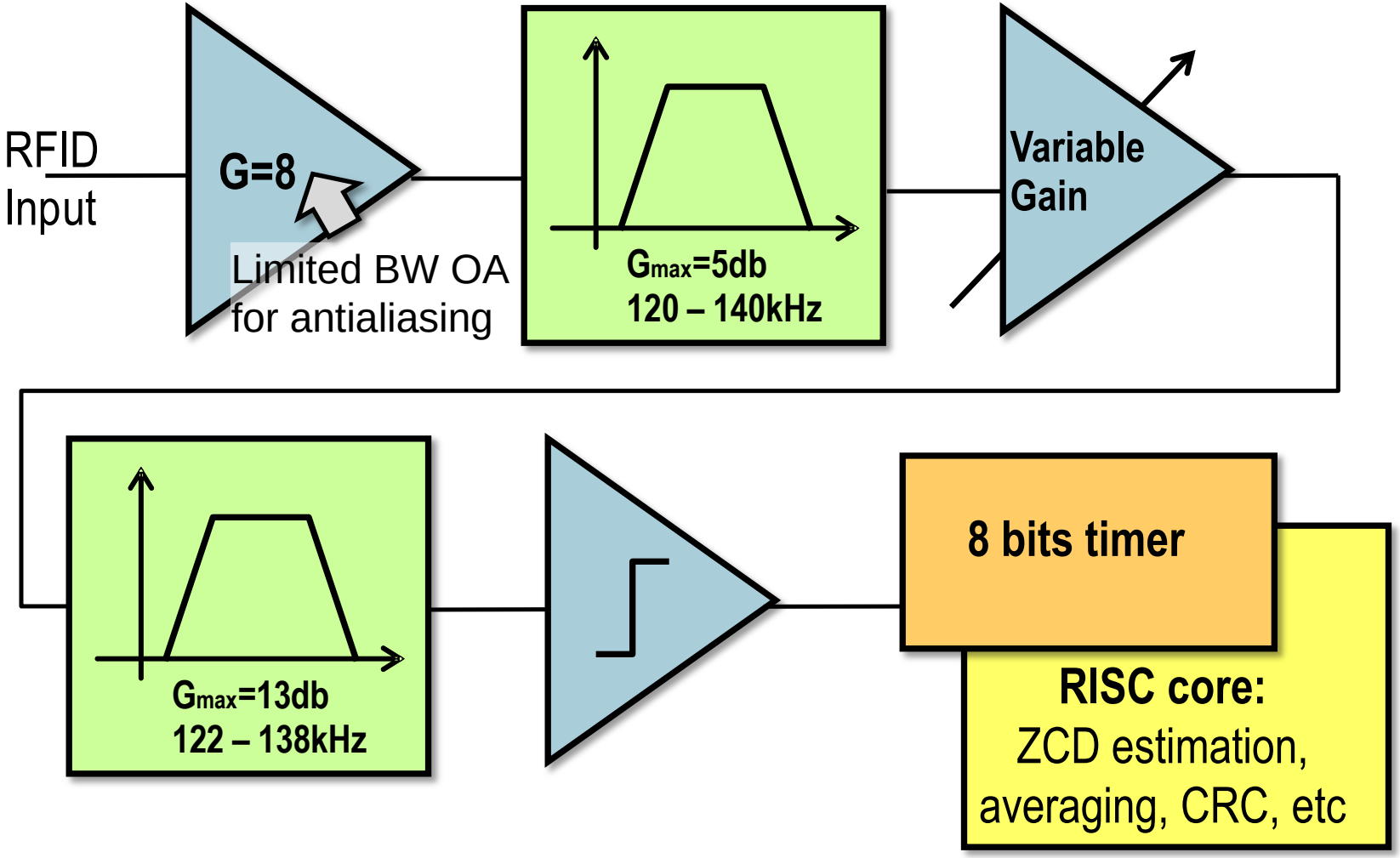
- Everything is programmable with registers, analog frontends and digital circuitry can be configured **on-the-go.**

- Very simple programming tool provided by the manufacturer: **graphic configuration tool**, ASM & C compiler for the CPU. Graphic SW/HW blocks like a modem or complex AD can be defined.

- Very **fast prototyping**, it is possible to test dozens frontends in a few days to optimize for the best reading distance, speed, noise immunity, etc.

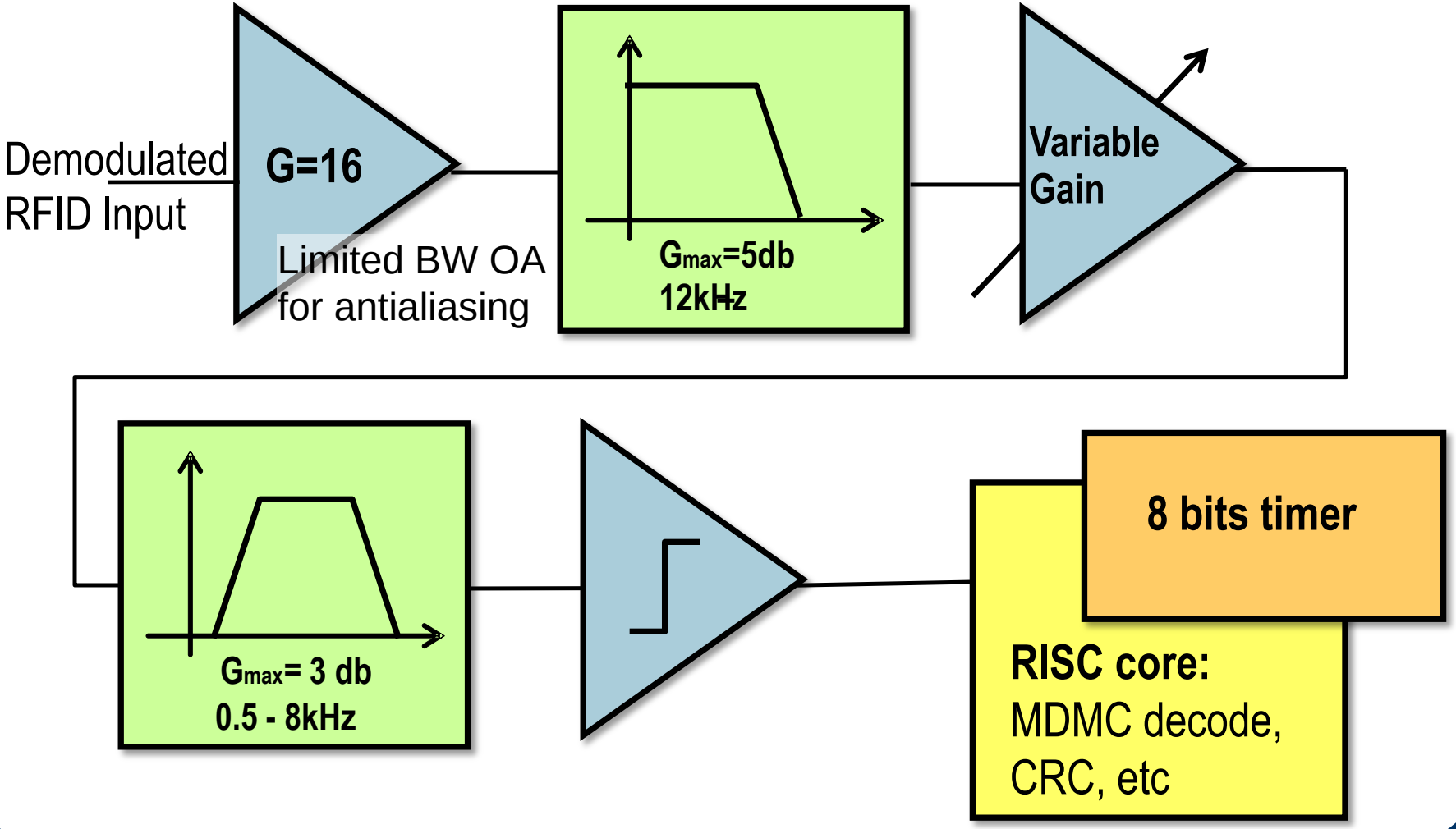
HDX – Decoder configuration

PSOC frontend includes CT differential amplifier, SC filters, AGC + frequency estimation in the digital domain.



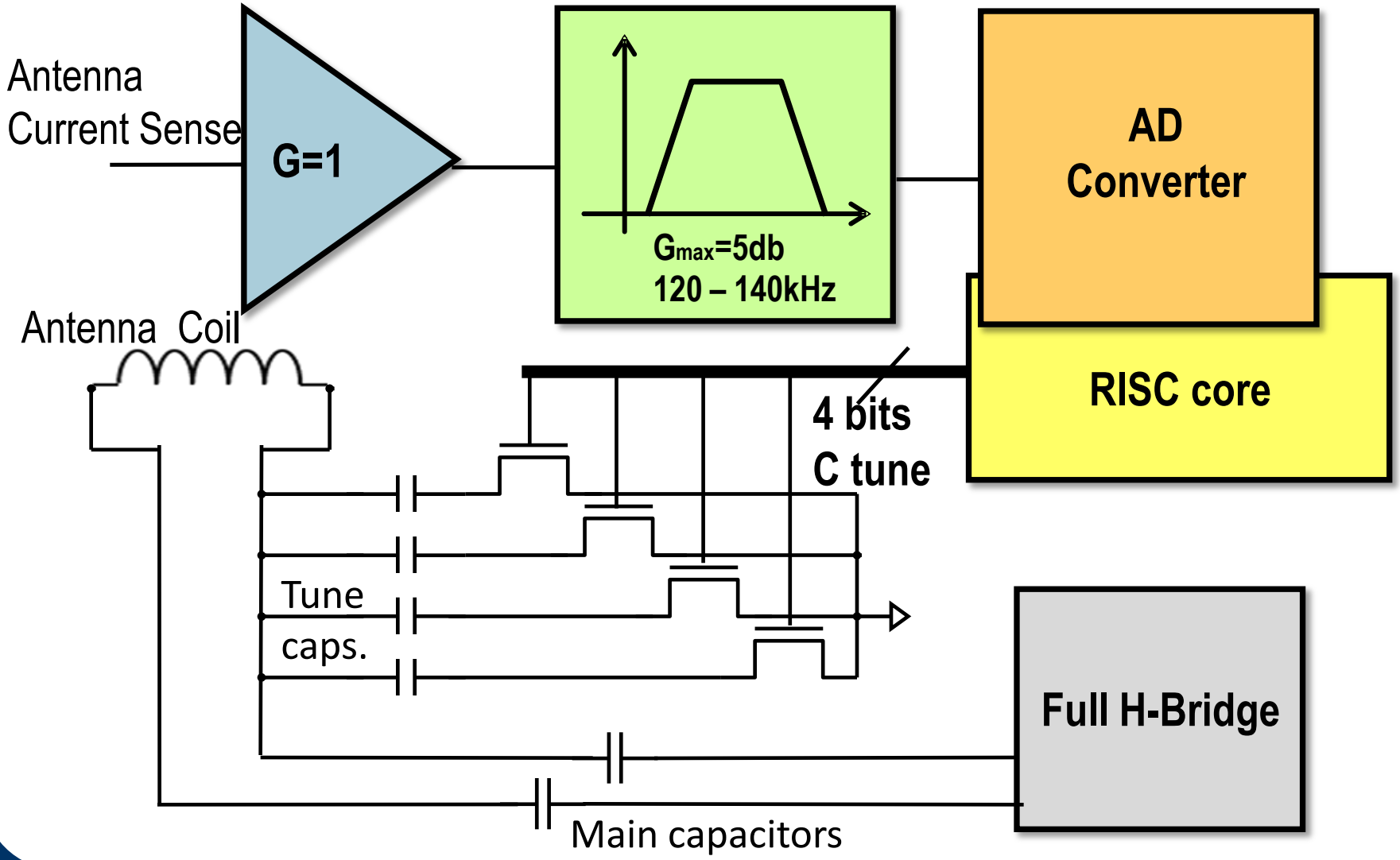
FDX – Decoder configuration

PSOC frontend includes CT differential amplifier, SC filters, AGC + ZCD in the digital domain.



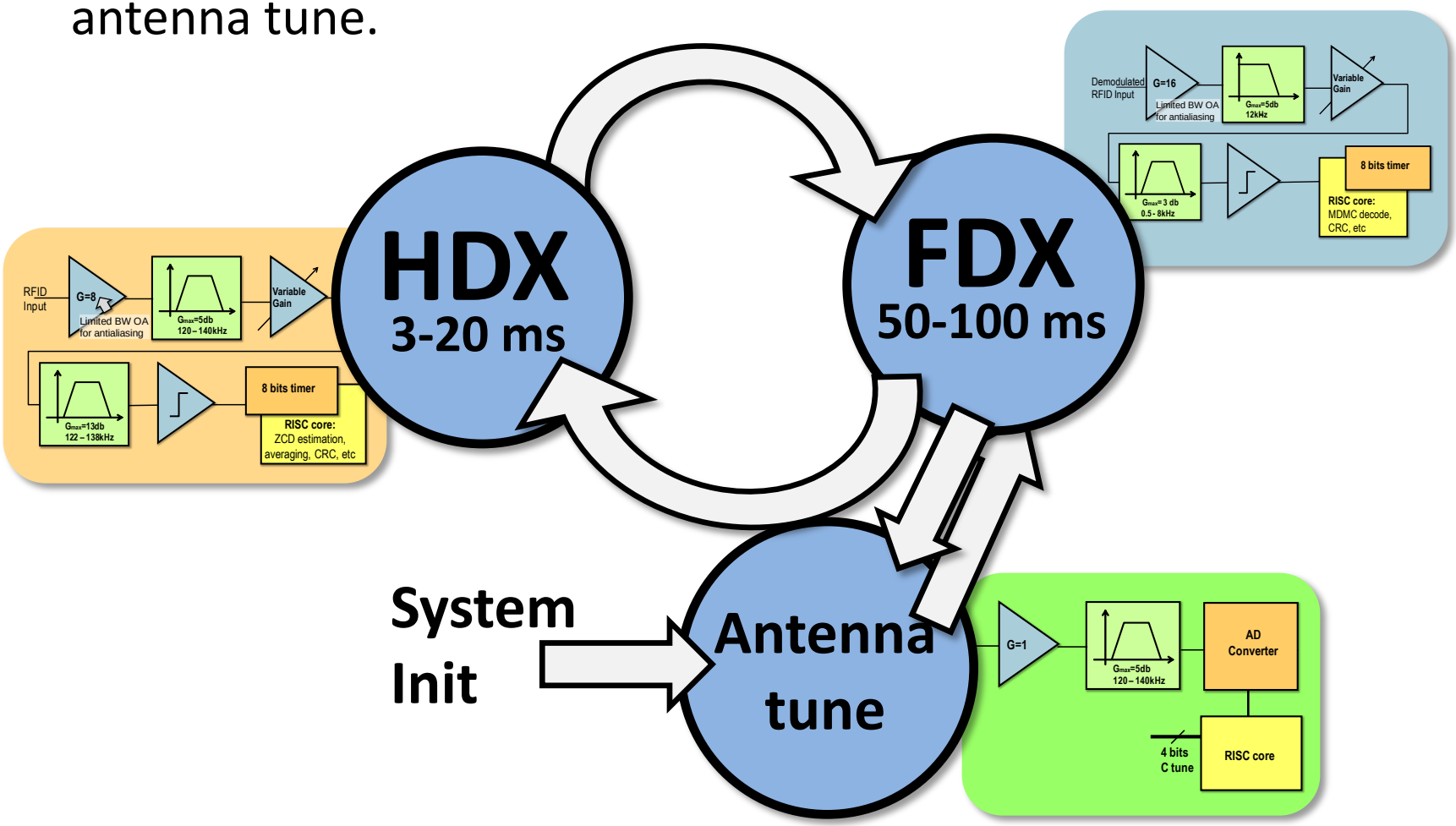
Auto-tuning configuration

Current is sensed with an auxiliary coil, and the amplitude maximized with a 4 bits fine tune.



PSOC is cycling ON THE GO between configurations

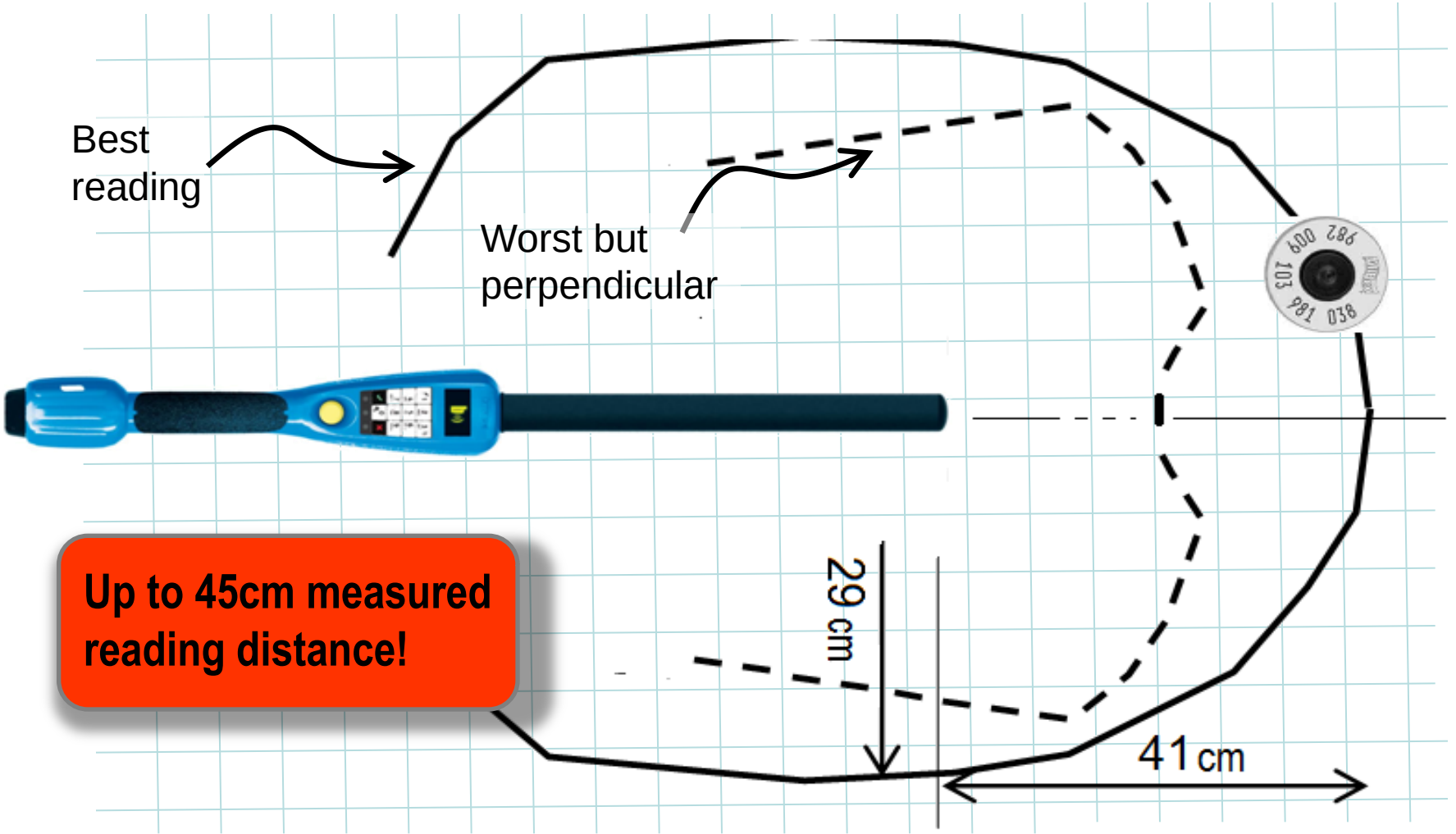
According to precise ISO11784/11785 timing, the RFID reader cycles between FDX and HDX modes and every so often for antenna tune.



Baqueano-Pro
Conclusions & the Future

HDX – Measured reading distance

Among the bests of its class regarding: reading distance, reading speed, best data handling capacity.

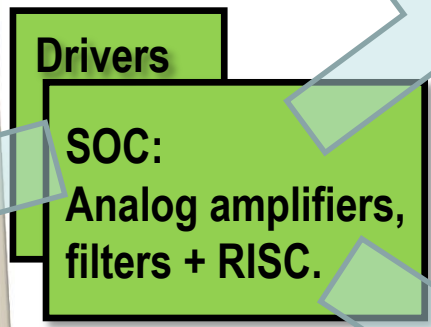


Up to 45cm measured reading distance!

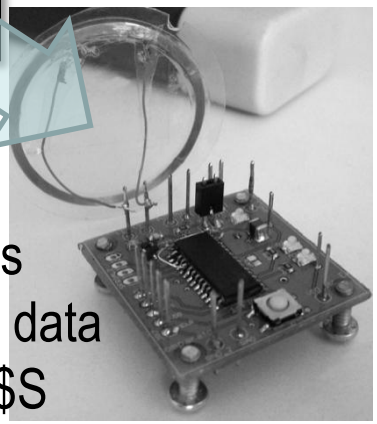
Conclusions I: PSoC RFID engine is a flexible platform

• Programmable SOC results: **low component count**, **fast time to market**. From BQN's experience is a valuable platform in **low volume** products and **low frequency** signal proc., like in medical devices and LF RFID.

• Flexible:
Some BQN applications developed using RFID platform with **almost no HW change**:



125kHz HiTAG reader



A contactless temperature data logger < 1U$S

Conclusions II: TICs for Agribusiness

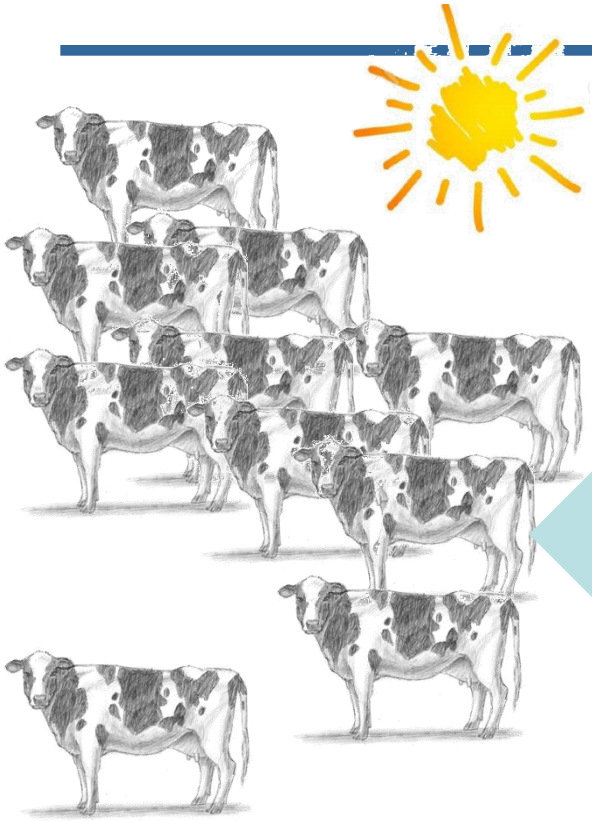
- Baqueano-Pro® **ISO-11784/85** reader, is a **succesful commercial product** in Uruguay, the only country with mandatory RFID traceability, exported to Latin America also.

- There is a **need and an opportunity** to develop rugged but powerful tools for the cattle industry, with a potential **1billion head market**, scaling then to porcines and ovines.

- An opportunity for IOTs, low power RF, cloud computing etc. **TICs in the agribusiness** industry have yet a long path to go. The problem: generic HW does not fit the industry.

- Baqueano-Pro® attacks this niche incorporating memory, SD card, OLED, BT, BC/QR reading, etc. 3G/LTE or GPS if necessary. **Best of its class** connectivity and data processing capacity.

Now at BQN: Tero® - beyond traceability



- Tero® system launched 2Q-2016.
- Cloud cattle management
- A service not a product

- Pick up & analize data in the cattle yards
- Hundreds million animals market

baqueano

Tero

Acknowledgements

BQN wants to especially thank the MPSoC Organizing Committee, Victor Grimblatt, and SYNOPSYS for the opportunity to attend MPSoC, and make the company and it's products known in this forum.

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Precision livestock farming technology