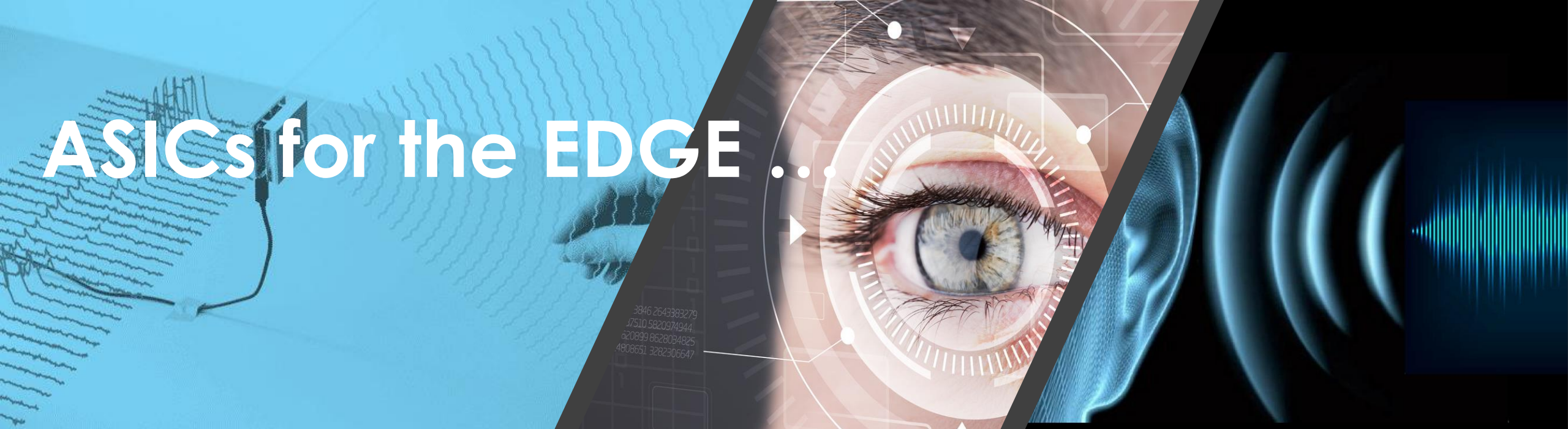


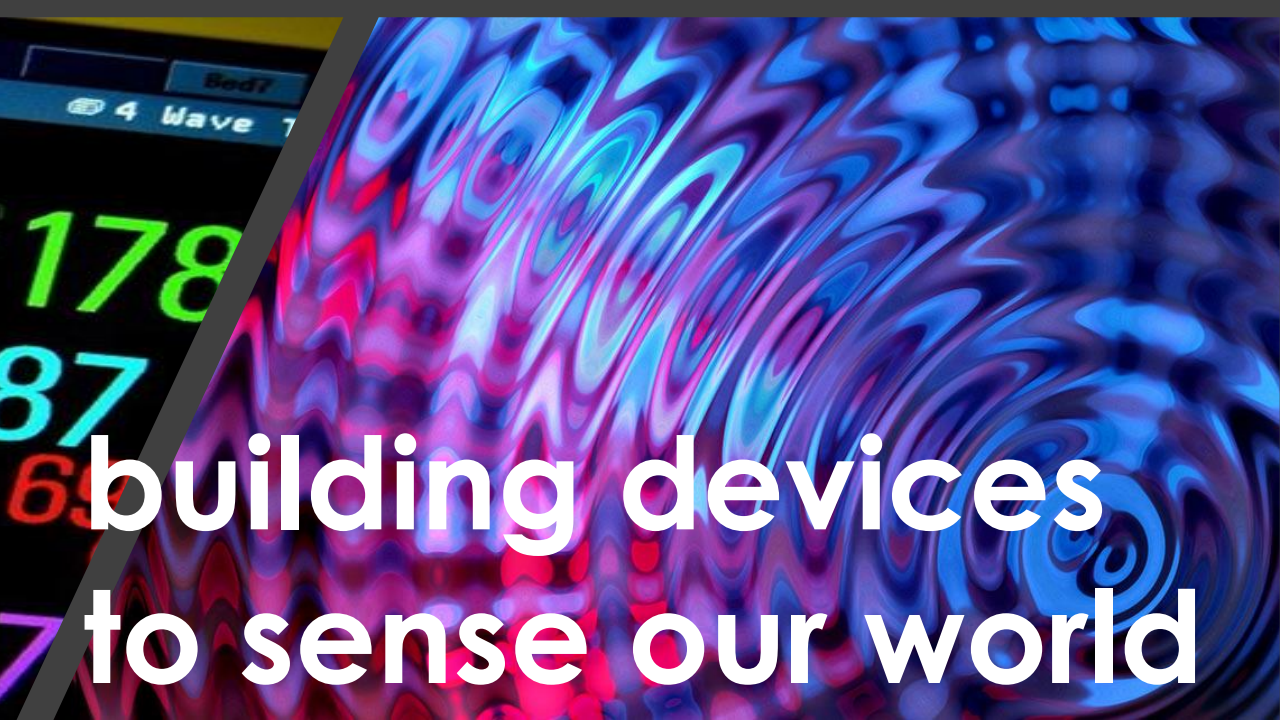
EE426

RADIO FREQUENCY DESIGN TECHNIQUES

ASICs for the EDGE ...



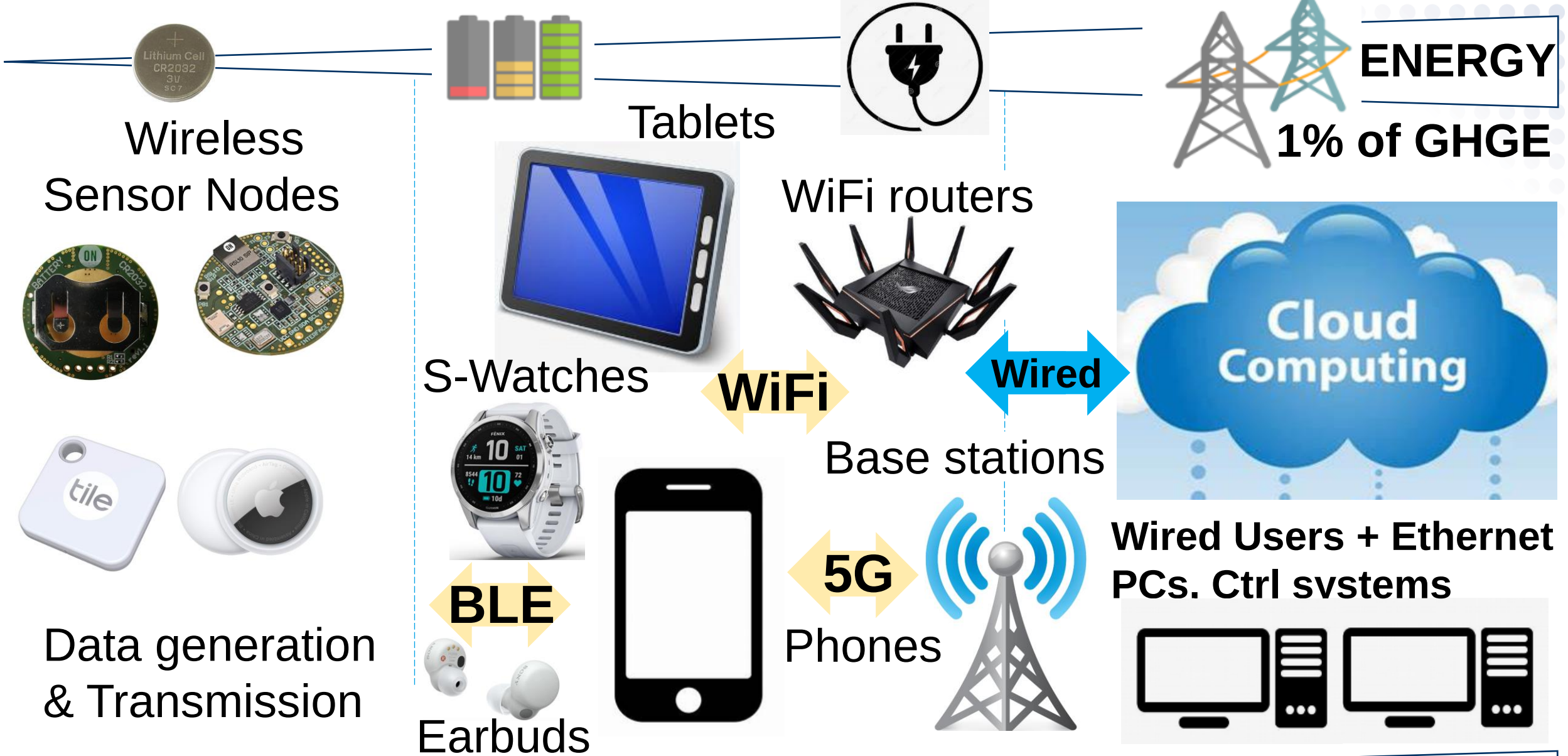
building devices
to sense our world



Extreme EDGE nodes

Middle EDGE nodes

Data Centers

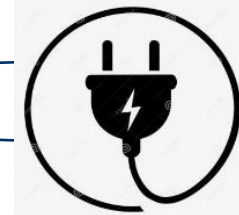


Today: Cloud Centric DATA & Compute

Extreme EDGE nodes



Middle EDGE nodes

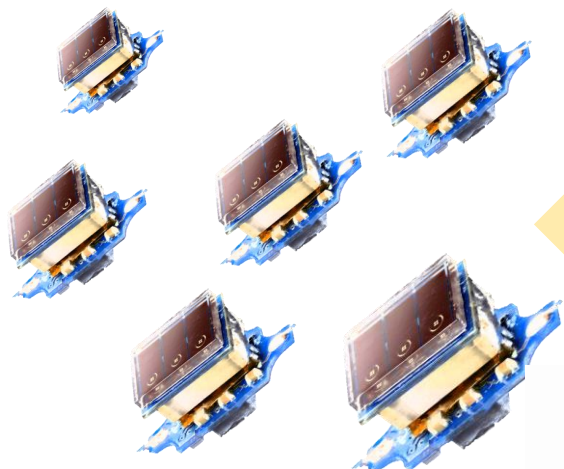


Data Centers



ENERGY

**Cooperative Wireless
Sensor Nodes**



**Decentralized
& Distributed
Intelligence with
DSP @ the EDGE**

BLE

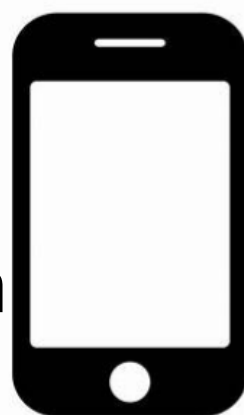


**Data Fusion
& Gateway**

Tablets



WiFi



WiFi routers



Base stations



5G

Phones

**Wired Users + Ethernet
PCs. Ctrl svstems**



Tomorrow:

Edge & Cloud Balanced

DATA & Compute

ENERGY AUTONOMOUS WIRELESS SENSORS

EXG acquisition

- 100pJ/bit

Digital microphone

- 300pJ/bit

Image sensor

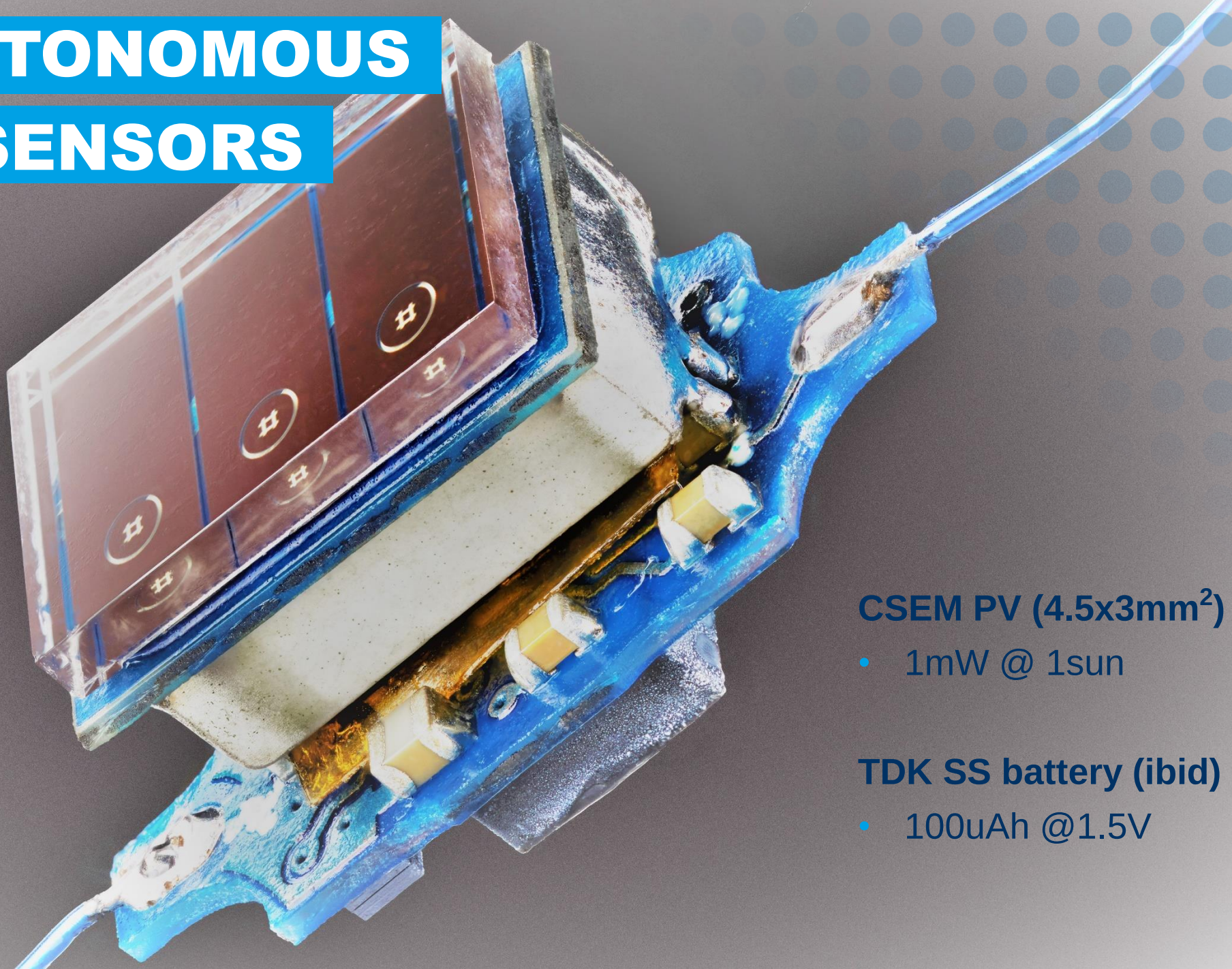
- 30pJ/bit

Processing

- 0.1pJ/bit

BLE TRX 1Mbps

- 5nJ/bit



CSEM PV (4.5x3mm²)

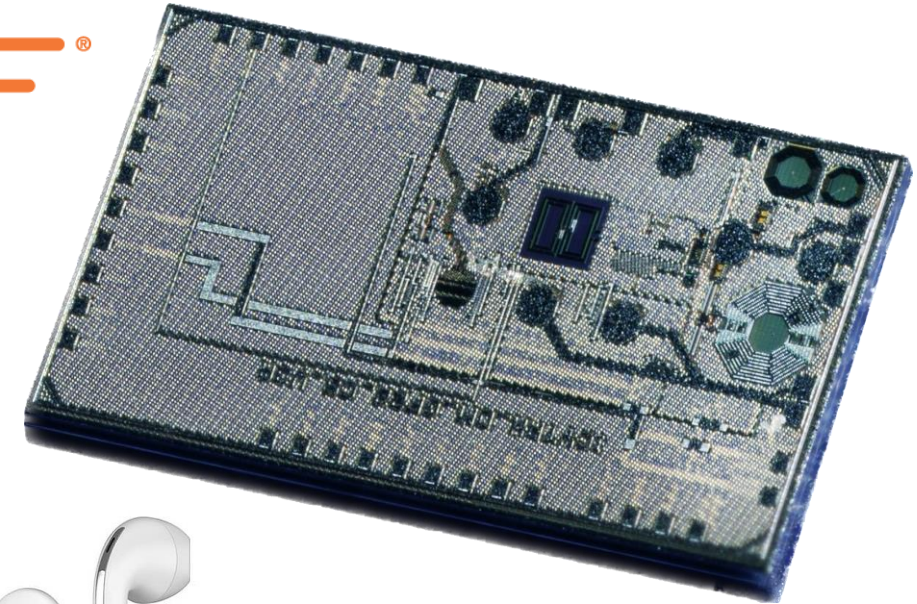
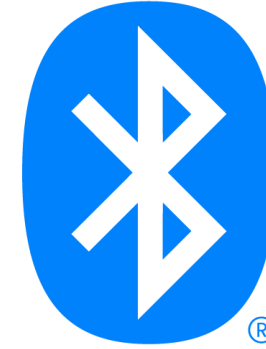
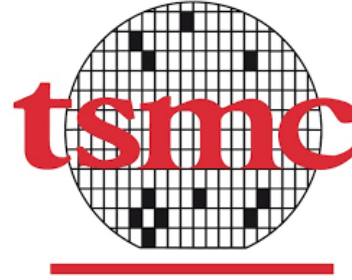
- 1mW @ 1sun

TDK SS battery (ibid)

- 100uAh @1.5V

ICYTRX, -DM, -LE

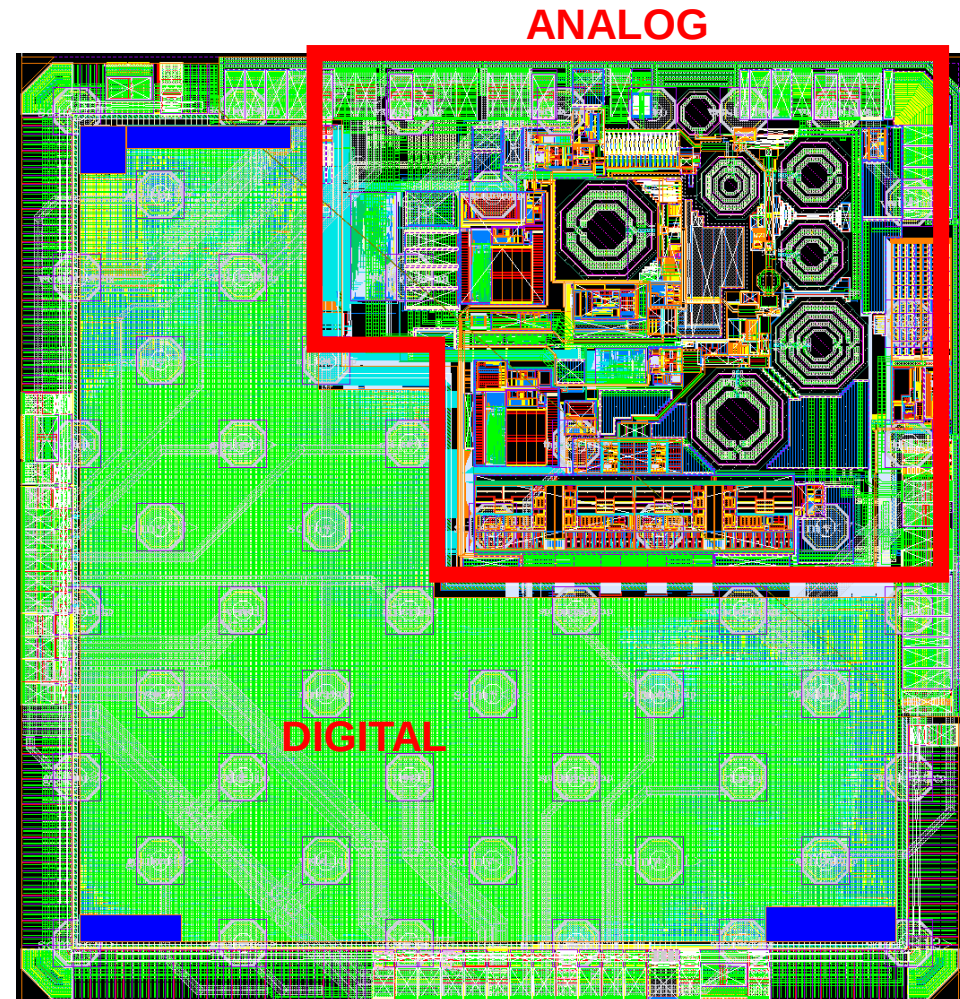
- Bluetooth Radio Transceiver IP
- Bluetooth Low Energy (BLE)
 - Incl. Long Range (LR)
- Bluetooth Classic
 - Basic Rate (BR)
 - Enhanced Data Rate (EDR)
- Dual Mode (DM): BLE + Classic
- Partnership with Globalfoundries (Part of the FDX Network)
- Applications:
 - Hearing aids
 - True Wireless Stereo (TWS) headphones
 - Wireless sensors



IR-UWB RANGING AND LOCALIZATION INNOSUISSE PROJECT WITH



- Ultra low power localisation on IR-UWB 802.15.4z LRP and HRP
 - Secure ranging (1D) for keyless access based Two-Way Time-of-Flight
 - Centimeter-precise positioning (2D/3D) using Time-Difference-Of-Arrival (TDoA) and Direction finding (DF)
- Applications:
 - Secure access and payment
 - Positioning for healthcare, warehouse, retail, asset tracking, agriculture, sports, drones,...



OVER 10M CHIPS ON THE ROAD !

First electrical cars with **provably secure** IEEE 802.15.4z LRP UWB technology

- VW ID.3, VW ID.4, VW Golf 8, Audi A3, Skoda Enyaq, Skoda Octavia, Seat Leon, Cupra, etc

