

# Low Power RF / Wireless IC design

Presentation at Salland Engineering Test Symposium  
Sept 14<sup>th</sup> 2018

Martin Valfridsson, CEO ShortLink Holding AB

Johan Grumer, Design Engineer ASIC & RF, Production Manager ShortLink AB

## Who are we?

**Swedish based design house offering  
Robust, Low power, Compact size Wireless Electronics**



**ASIC design and supply with expertise in Mixed Signal RF designs  
Discrete electronics HW  
Embedded SW  
Proprietary radio protocols**

Ericsson's first wireless headset, where it all began...



**ERICSSON** 

Features:

Tx average power 30  $\mu$ W  
peak power 10 mW

Rx continuous power 400  $\mu$ W  
average power <10 mW

Freq 433 MHz spread spectrum

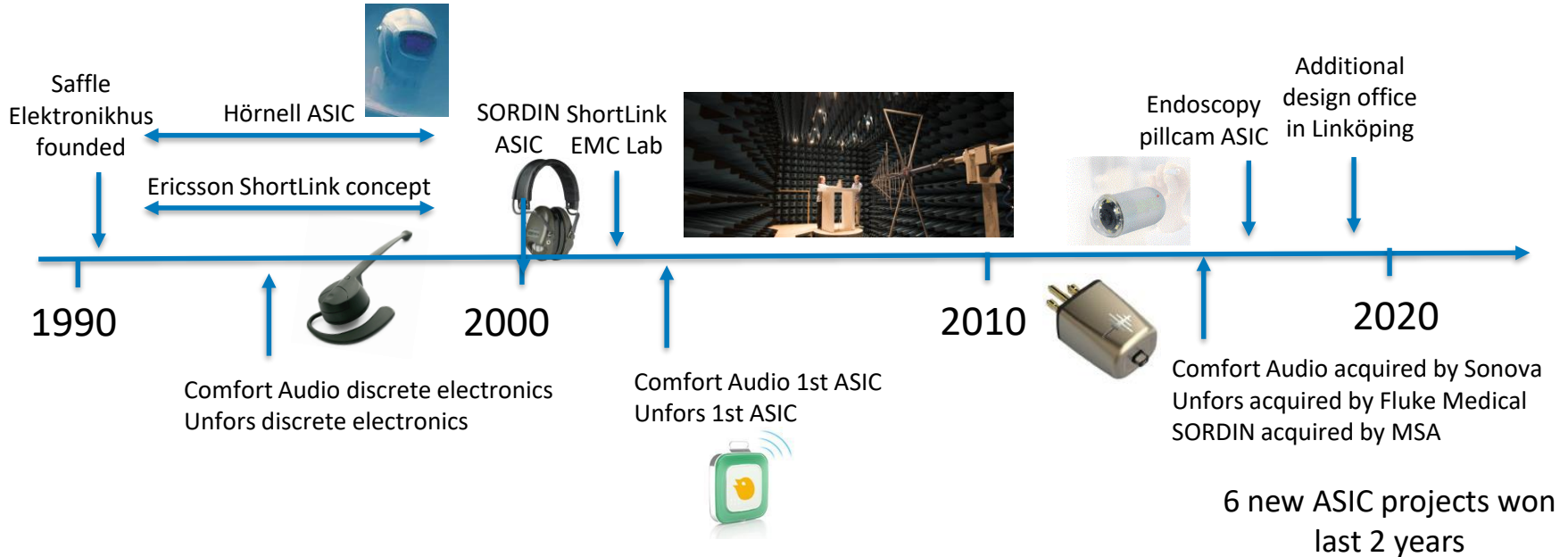
Patents:

Pairing

Digital power amplifier

...

# The 25+ year history of ShortLink



Customer base within Industry, Laboratory, Instrumentation, Monitoring & Surveillance, Medical, Consumer and Space

IP portfolio with wide range of silicon proven designs

ASIC Fab supplier network in North America, Europe and Asia

# Best New Product at Audiology Now, USA Embedded Award, Sweden



Comfort Audio's digital receiver  
World leading – smallest and lowest  
power



## Examples of projects won in 2017/2018

- Surveillance of mechanically stressed structures (**IoT**)
- Radio module for Smart City application, streetlights (**IoT**)
- **ASIC for control of heated fabrics (IoT)**
- **ASIC for transponder**
- **ASIC for ultrasonic application**
- **ASIC for inertial mass navigation system**
- **ASIC for beamforming application**
- **ASIC for diode for X-ray detection**
- System for monitoring of humidity in building infrastructures (**IoT**)
- System utilizing ultrasonic transducer for MedTech application.
- Backboard PC for test of ASIC for space application
- Activity vest used to stall development of Alzheimer's disease
- **Antenna** for Smart Watch for assisting elderly people
- **Antenna** for Smart Watch for sports athletes
- **IoT** project for self scanning within Retail

- *Demand of ASIC design is increasing*
- *IoT has a very promising business potential*
- *Our antenna expertise is a common part of the offer to our customers*



## Electronic wireless dose meters



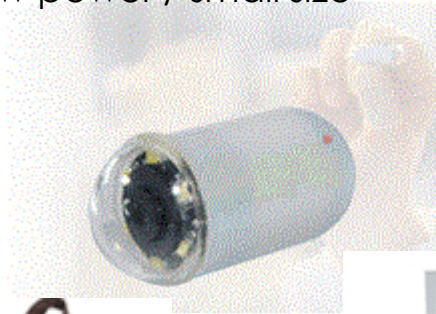
 **RaySafe™**

Market leading real-time dose meters.  
Special design for sensitive X-ray detection.  
Ultra low power → **long battery life time**



## Capsule endoscopy

ShortLink RF development  
RF transceiver high speed video  
Ultra low power / small size





## ShortLink benefits with co-operating with Salland Engineering

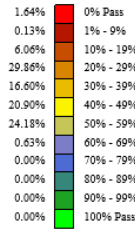
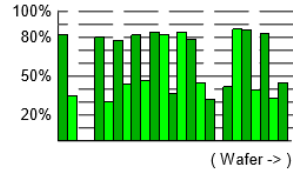
- Salland have been involved in Shortlink ASIC production tests for many years, starting with projects already in the beginning of 2000.
- Salland is involved at very early stage and the co-operation includes;
  - Quotation
  - ETS
  - Implementation
  - Debug
  - Performance Optimization
  - Cost optimization
  - Volume production
  - Result analys
  - Transfer to high volume
- Projects have involved varied levels of complexity
- All projects have resulted in their own challenges.
- Finding a suitable level of test detail and at the same time avoiding tests that is difficult to implement in the volume test environment is challenging.
- Support of the independent development house Salland who have proved experience from many projects and multiple test systems have shown great value to us.

Lot Summary Information

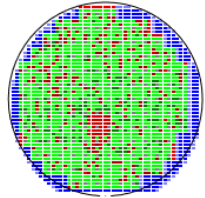
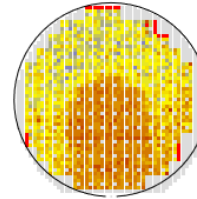
Lot ID  
Product ID  
Configuration  
No. Wafers

Avg. Yield: 60.40%  
Min. Yield: 29.80%  
Max. Yield: 85.73%

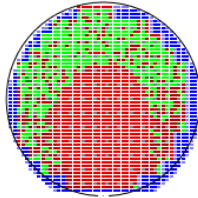
Lot Yield



Lot Composite



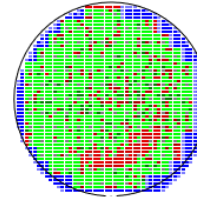
Wafer: 1 - Yield: 82.07%  
MFB: Bin 12 - 4.61%



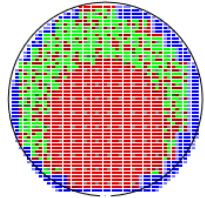
Wafer: 2 - Yield: 34.85%  
MFB: Bin 4 - 37.37%

Wafer: 3  
Map not Available

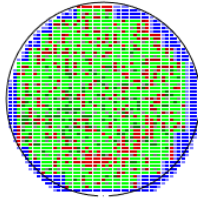
Wafer: 4  
Map not Available



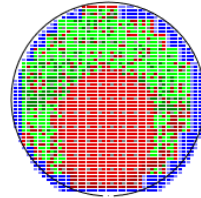
Wafer: 5 - Yield: 79.67%  
MFB: Bin 7 - 5.81%



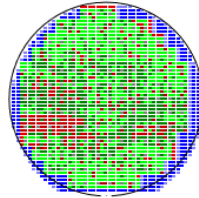
Wafer: 6 - Yield: 29.80%  
MFB: Bin 4 - 47.10%



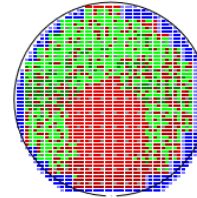
Wafer: 7 - Yield: 77.15%  
MFB: Bin 13 - 7.83%



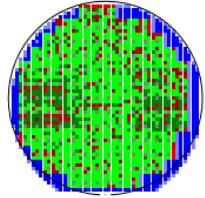
Wafer: 8 - Yield: 43.81%  
MFB: Bin 4 - 34.85%



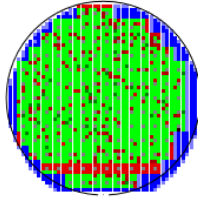
Wafer: 9 - Yield: 81.50%  
MFB: Bin 4 - 8.27%



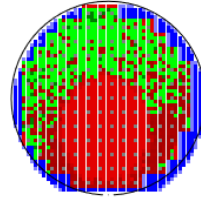
Wafer: 10 - Yield: 45.96%  
MFB: Bin 4 - 21.40%



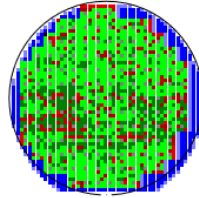
Wafer: 11 - Yield: 83.21%  
MFB: Bin 12 - 4.27%



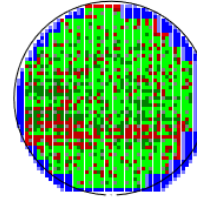
Wafer: 12 - Yield: 82.07%  
MFB: Bin 4 - 4.74%



Wafer: 13 - Yield: 36.74%  
MFB: Bin 4 - 20.27%



Wafer: 14 - Yield: 83.71%  
MFB: Bin 0 - 4.43%



Wafer: 15 - Yield: 78.41%  
MFB: Bin 0 - 6.84%

One example where the test at Salland Engineering clearly pointed out a process defect at the Fab affecting the entire batch.

## Example Silicon Designs

### Audio processing ASIC

Low power audio processing ASIC

Mixed Signal ASIC

Turnkey project Specification → IC in production

Process: 0.18 μm, 6 metal layers

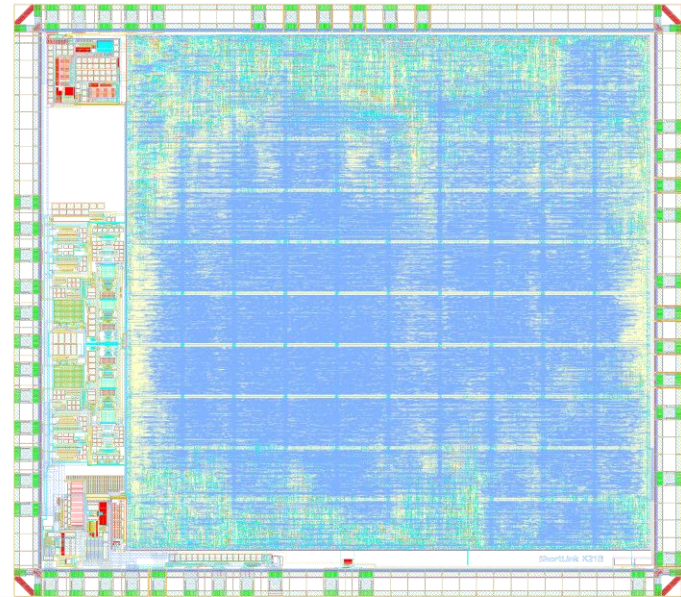
Analogue: amplifiers, ADC, audio, oscillators, DC/DC, AGC

Digital: > 1Mgates, hardware acceleration of audio signal processing algorithms e.g. noise reduction.

External IP: audio processing algorithms

Large digital part together with analogue blocks → extensive digital and mixed-signal verification

First pass success.



## Example Silicon Designs

### Low power RF TRX ASIC for Pill-Cam application

RF and mixed signal ASIC

Turnkey project Specification → IC in production

Process: 0.15 μm

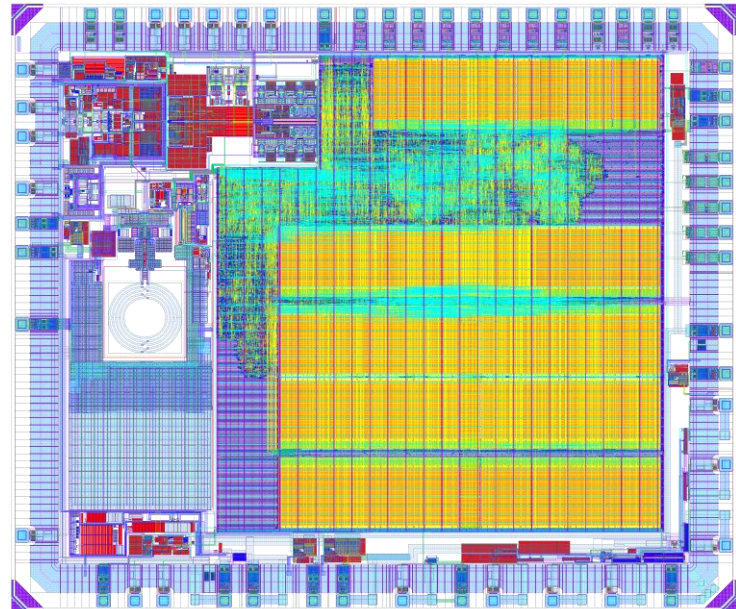
Analogue: RF front-end, PLL synthesizer, ADC, DC/DC

Digital: MCU, control logic, SRAM

External IP: multiple SRAM

Large digital part including multiple external IP blocks  
and RF transceiver → extensive digital and mixed-  
signal verification

First pass success.





**Thank You!**

ShortLink AB  
Hamntorget 1  
SE-652 26 KARLSTAD  
SWEDEN

[www.shortlink.se](http://www.shortlink.se)



IMAGINE TOMORROW