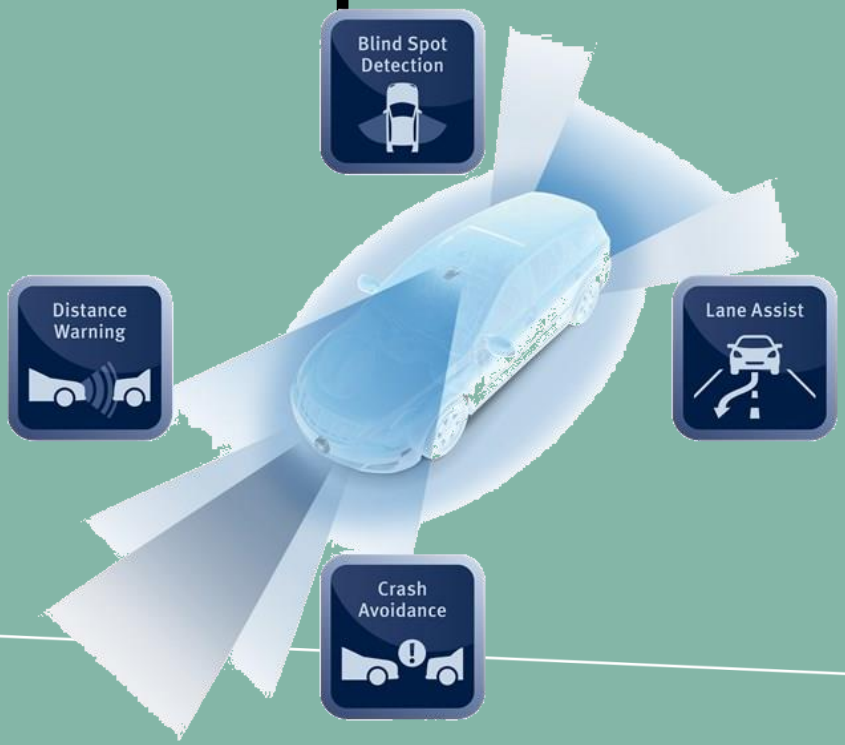
Radar Development at DICE

21.12.2017

Stefan Matzinger
Head of DICE ATV SC CV



DICE GmbH & Co KG
Danube Integrated Circuit Engineering
Freistädter Straße 400
4040 Linz
AUSTRIA

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Introduction

Location Linz: DICE

Danube Integrated Circuit Engineering – DICE "Infineon development center Linz"

J.-Kepler-University Linz
Institute for Communications and Information Engineering
Prof. Dr. R. Weigel 1996

RF Systems &
Circuits
System Simulation
RF Measurements

J.-Kepler-University Linz
Institute for Integrated Circuits
Prof. Dr. R. Hagelauer 1993

Analog Design
Mixed Signal Design
Digital Design

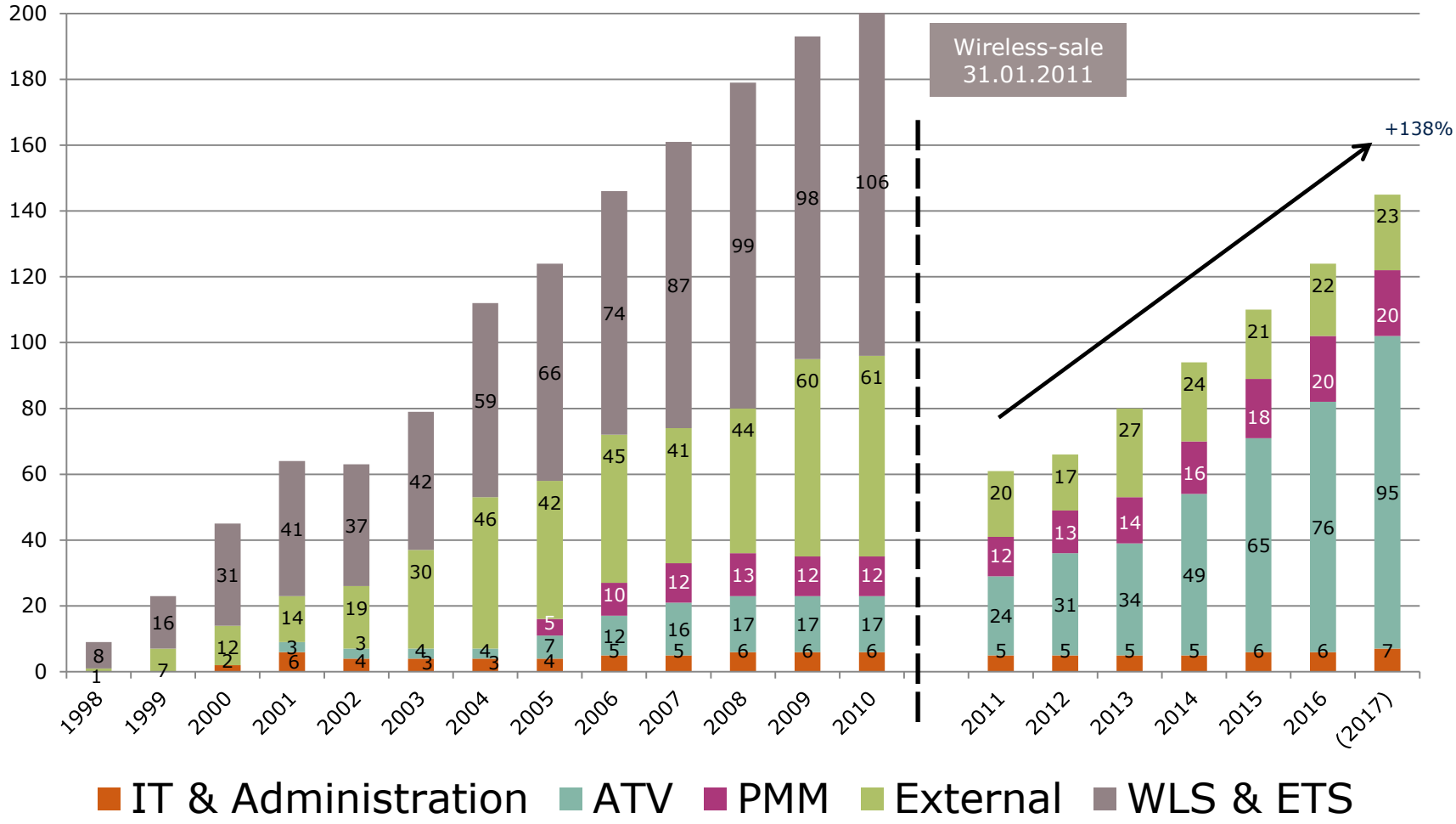
Design Center Linz 1998

August 1999: foundation of DICE
February 2000: employee transfer

January 2000:
IFAT joins DICE

DICE Permanent Staff Members

Growth by 138% since the Wireless-sale



proportion of women ~ 10% (~13% including with students)

Radar

Development Center Linz

What we do @ DICE Linz

- Program/Project Management
- Concept Engineering
- Application Engineering
- Circuit Design Engineering
- Component Verification
- Test Engineering

RADAR at Infineon – Our Partner Sites

Regensburg
SiGe Production Site
Logistics

Dresden
BiCMOS Production Site

Munich
Headquarter ATV SC
Quality Management
Technology Development
Physical Design Engineering
Product Engineering
Test Engineering

Villach
Reliability Engineering
Headquarter IFAT
ADC and Pad development

RADAR at Infineon – Our Partner Sites

Graz
RADAR

Duisburg
SoC Integration

Bucharest
Verification

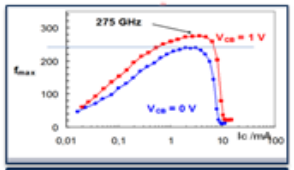
Our Motivation

- In Europe each year about 1.3 million traffic accidents cause:
  - More than 31.000 fatalities (1970: 60.000)!
  - Economic damage of more than 200 billion € per year!
- Human error is involved in over 90% of accidents!

- **ADAS help drivers to**
  - Maintain a safe speed
  - Keep a safe distance
  - Drive within the lane
  - Avoid overtaking in critical situations
  - Safely pass intersections
  - Avoid crashes with vulnerable road user
  - Reduce severity of an accident
  - Drive more efficiently

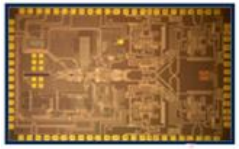
http://ec.europa.eu/information_society/activities/policy_link/brochures/documents/intelligent_car.pdf

Radar history and future at Infineon



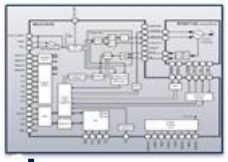
B7HF200 SiGe Technology
f_{max} = 250 GHz

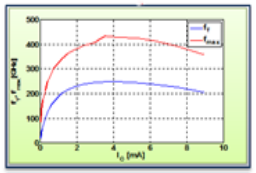
77 GHz
4-Channel TRX
1st SiGe 77 GHz Radar Product



77 GHz in eWLB Package
1st 77 GHz Product in SMD Package

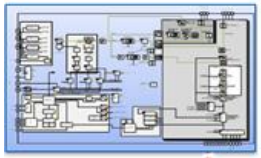
RCC1010
CMOS PLL Companion Chip





Next Generation SiGe BiCMOS Technology
f_{max} = 400 GHz GHz

76-81 GHz TRX
6..7-Channel + Ramp Gen. + ADC
SMD Package

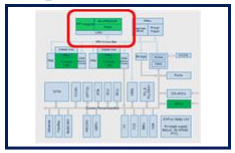


2007

2011

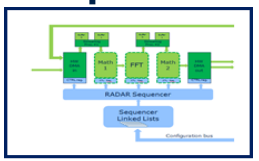
2015

2019



1st AURIX for Radar
65nm eFlash
FFT accelerator

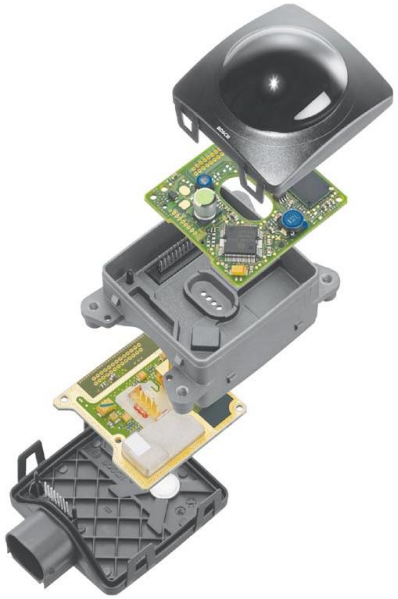
1st Supply for Radar
SPT9
DCDC + safety



AURIX-2G
40nm eFlash
Radar Signal Processing Unit

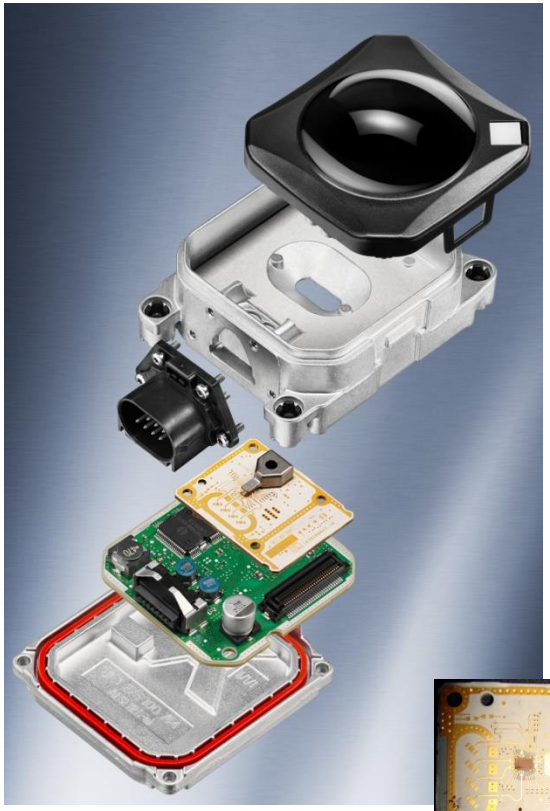
First Commercial SiGe-Based 77GHz Sensor

		Range	Accuracy
Distance/ M	LRR2 (GaAs) LRR3 (SiGe)	2 – 150 0.5 - 250	0.5 0.1
Relative Velocity/ m/s	LRR2 (GaAs) LRR3 (SiGe)	–60 to + 20 -80 to +30	±0.25 ± 0.12
Angle/ °	LRR2 (GaAs) LRR3 (SiGe)	±8 ±15	0.4 0.1

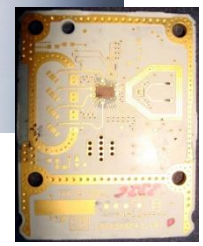


GaAs-based LRR2

62 x 68 mm²

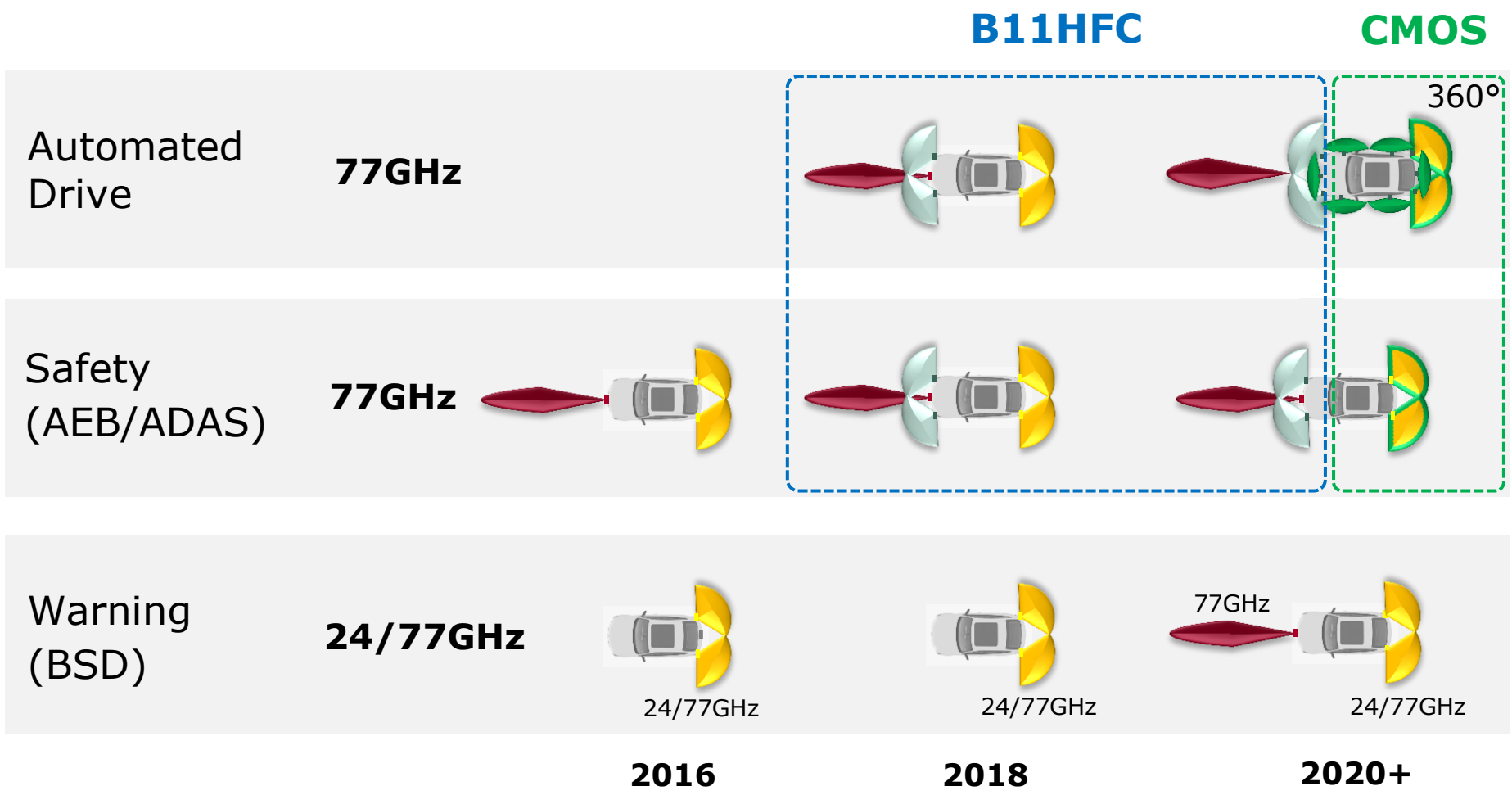


new Si:Ge-based LRR3



25 x 35 mm²

Automated Drive: 360° radar sensing

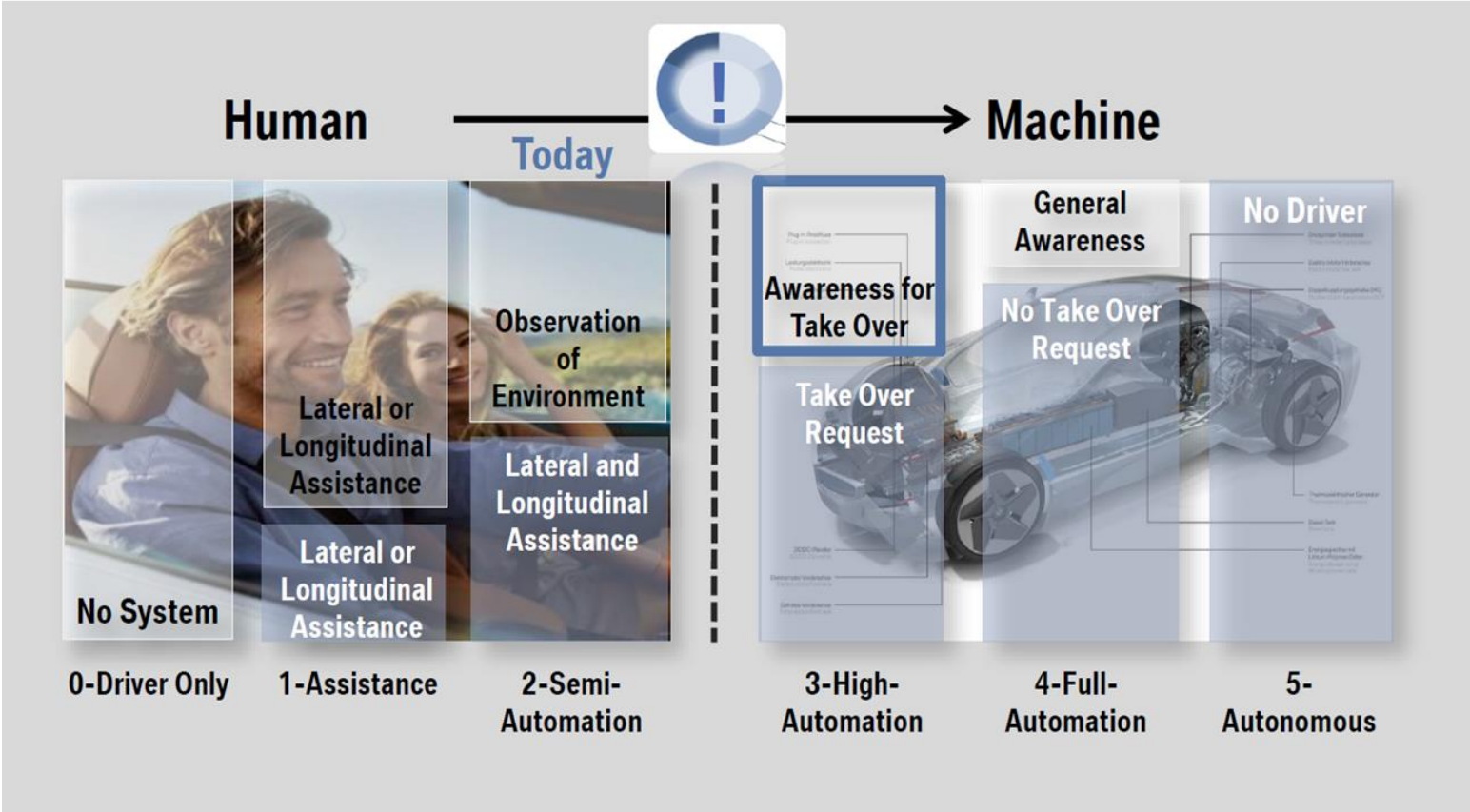


Infineon is well positioned for NCAP AEB and ADAS penetration, CMOS is driven by 360° sensing for Automated Driving

Outlook

Development Center Linz

The next step will be High Automation Machine takes the responsibility



DICE ATV SC CV

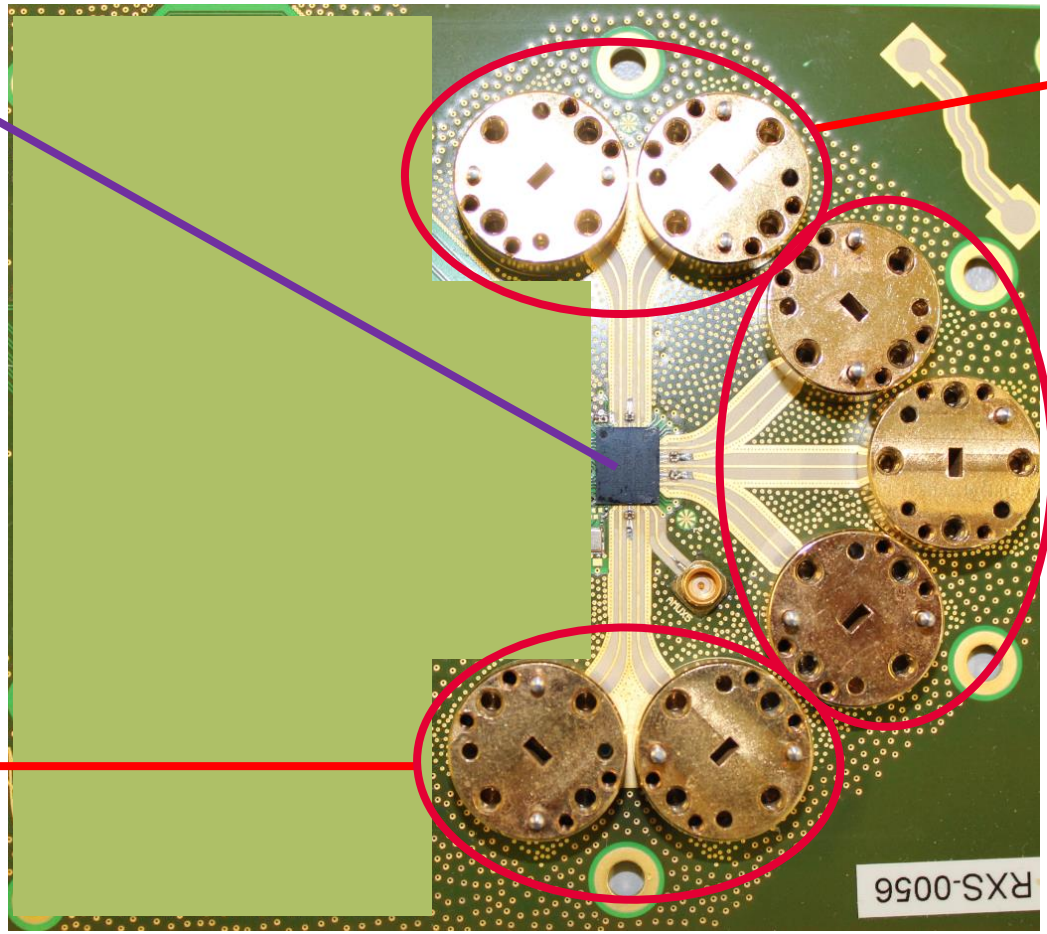
Presentation of group, setups and key competencies
25.11.2016

Awarding laboratory features

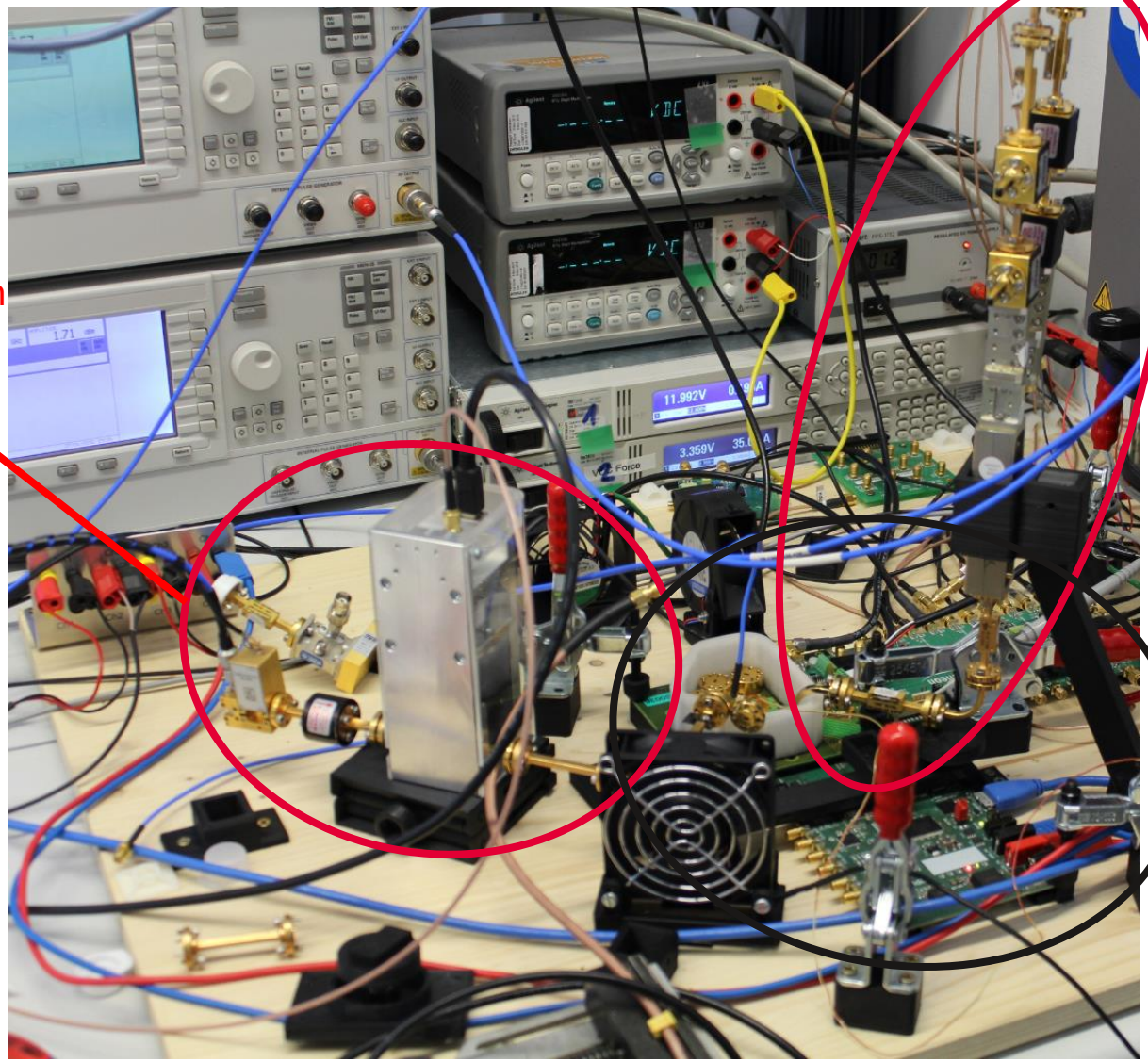
- Measurement direct in E-Band (60-90 GHz) and W-Band (75-110 GHz)
  - Direct TX output power
    - E.g. with E8486A power sensor + N1914A power meter
  - Direct LO & RF input power
    - E.g. with E8257D 50 GHz signal generator + frequency multiplier (*2 / *3) + waveguide amplifier + automated attenuator
  - Direct TX Phase Noise
    - E.g. with external mixer + E5052B signal source analyser
  - Direct TX Spectrum trace
    - E.g. with external mixer + FSW26 spectrum analyser
  - Ramp parameter direct at TX
    - E.g. with external mixer + E5052B signal source analyser
  - Input Matching / Intermodulation / RF-RF-Isolation direct at RF, LO & TX
    - 110 GHz Network Analyser
  - Direct RX Intermodulation
    - E.g. feed 2-tone signal at RX and verify intermodulation products at IF
  - Radar
    - E.g. Radar track in house, Radar Target Simulator, Range Doppler Map

eWLB Board

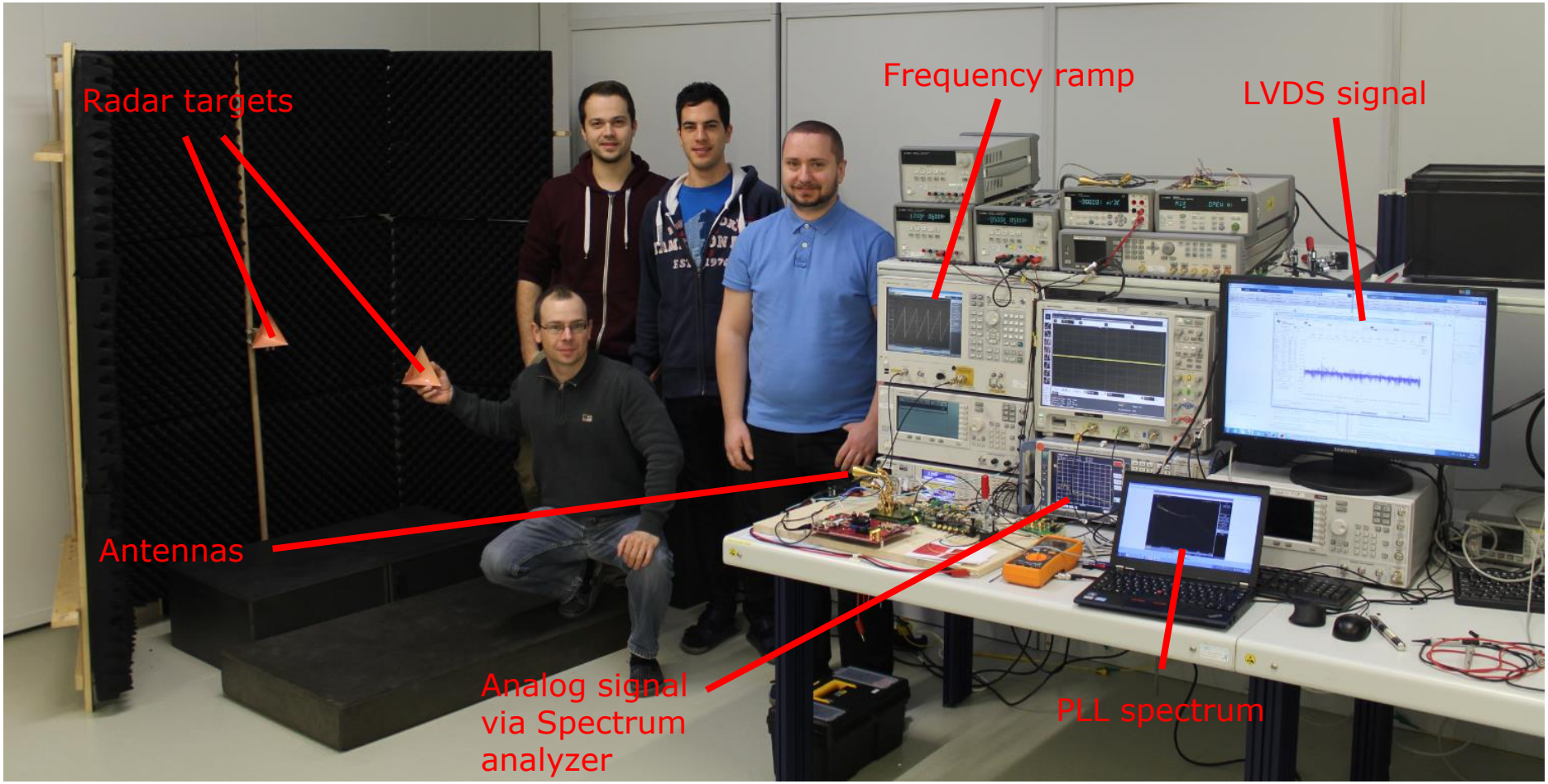
- All CV measurements are done on soldered eWLB samples to get best performance
- Socket boards are not possible for 76-81 GHz signals (measurement uncertainty too high)
- Bare die boards also possible (bonded bare die instead of eWLB sample)



Example
Receiver setup with 2-tone RF signal



Example
Radar measurements @ Use Case Setup



Part of your life. Part of tomorrow.

Infineon