Power & Sensor Systems Business Update
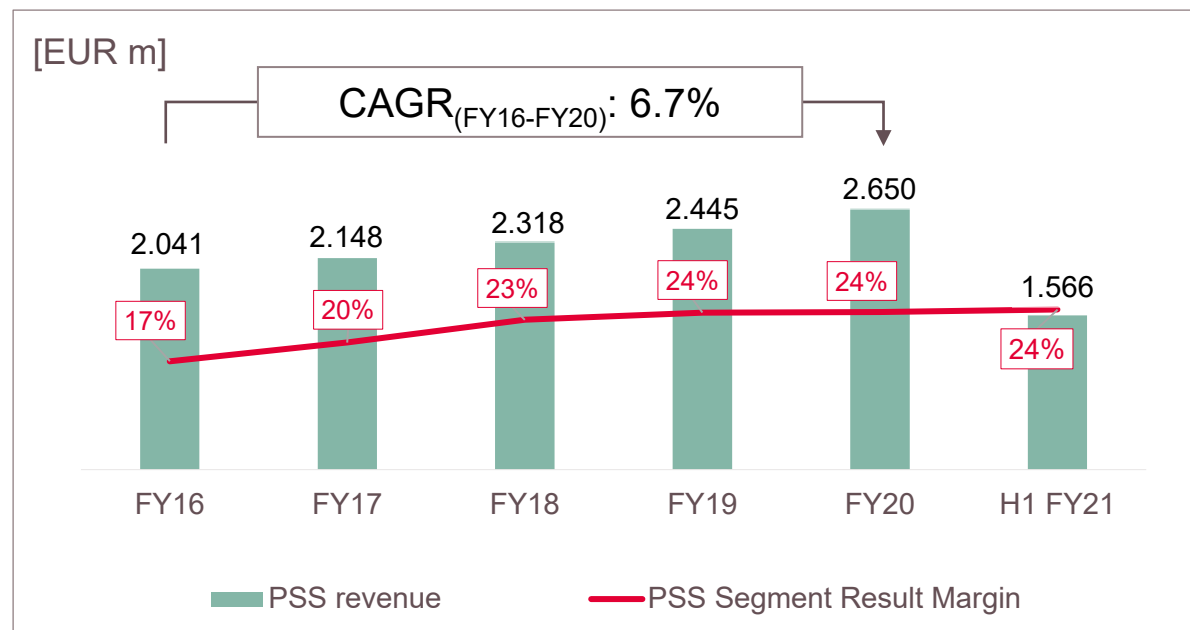
1 July 2021
Andreas Urschitz, Division President Power & Sensor Systems
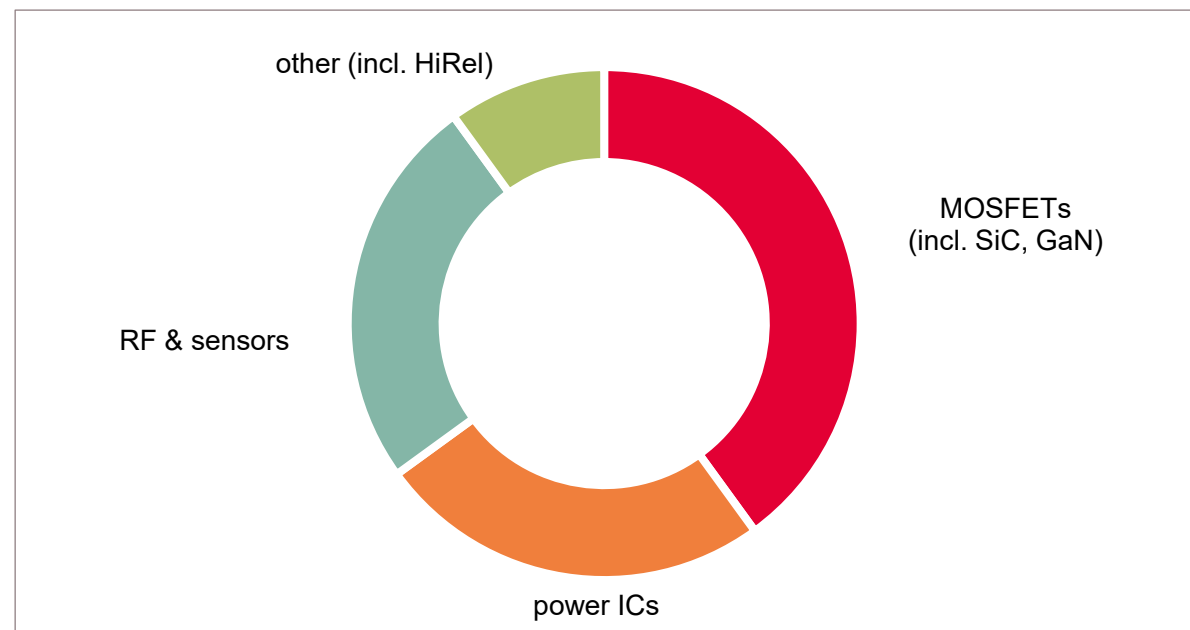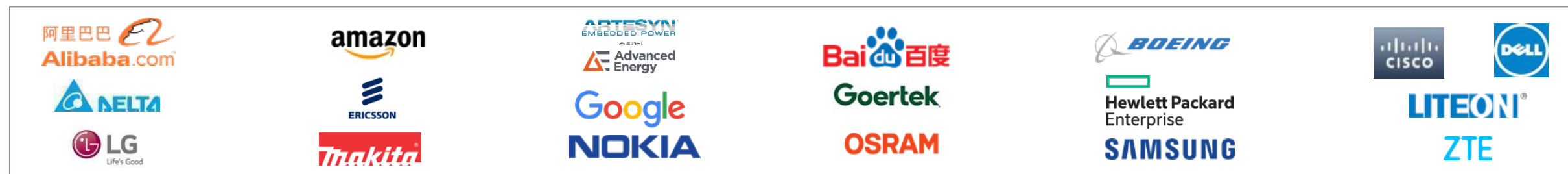
PSS at a glance

PSS revenue and Segment Result Margin

[EUR m]

CAGR(FY16-FY20): 6.7%

	FY16	FY17	FY18	FY19	FY20	H1 FY21
PSS revenue	2.041	2.148	2.318	2.445	2.650	1.566
PSS Segment Result Margin	17%	20%	23%	24%	24%	24%

FY20 revenue split by product group

- other (incl. HiRel)
- MOSFETs (incl. SiC, GaN)
- RF & sensors
- power ICs

Key customers

Alibaba.com · amazon · ARTESYN EMBEDDED POWER · Advanced Energy · Bai du 百度 · BOEING · CISCO · DELL · DELTA · ERICSSON · Google · Goertek · Hewlett Packard Enterprise · LITEON · LG Life's Good · makita · NOKIA · OSRAM · SAMSUNG · ZTE

Market outlook for PSS division's target applications

Applications (% of FY20 segment revenue)*	Market Outlook for H2 CY21	Market Outlook for CY22
Computing ~20%	› Acceleration towards cloud computing to continue › Pandemic-driven stay at home and work at home effects continue to favor notebook sales	› Structural drivers expected to stay in cloud computing and good momentum for enterprise servers › Demand for CY22 supported by limited supply in CY21 (catch-up effects)
Communication ~9%	› In general, long-term drivers due to 5G still intact › However, trade tensions generate some uncertainty around speed of roll-out in China and other regions	› 5G cycle will continue to drive telecom equipment spending in CY22
Smartphones ~19%	› Strong rebound expected driven mainly by economic recovery and migration towards 5G phones › Potential risk due to reduced smartphone growth due to shortages, regional weaker demand (India/ China), 5G slower boost than expected	› 5G replacement cycle expected to continue to drive demand growth
Consumer ~20%	› Consumer electronics, including e.g. game consoles, clear beneficiaries from stay at home › Battery-powered tools continue to show strong momentum › Consumer spending may be re-allocated to more leisure-oriented activities	› Demand expected to decline in some consumer areas as TVs in light of re-allocation of consumer spending
Industrial ~23%	› Automotive and other industrial segments show strong recovery; however, automotive production has taken hits from chip shortages	› Demand in renewable energy, EV charging and automotive expected to be healthy › Tailwinds from stimuli packages for EV and green energy in US and EU
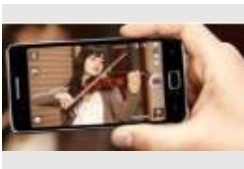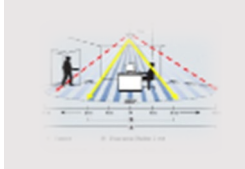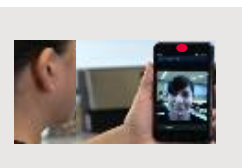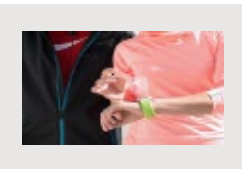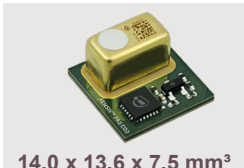
* does not sum up to 100% due to other applications not shown here

PSS – RF and Sensing

Main applications addressed by PSS sensors portfolio

MEMS microphone	3D radar (24/60 GHz)	3D ToF image sensor	Environmental
Best audio performance	Ultra-low power consumption	Best price / performance	High precision and Small form factor
Low power consumption	Presence detection/ Vital Sensing	Face ID (biometrics), VR/AR	Measure CO_2

14.0 x 13.6 x 7.5 mm³

Main applications

› Smartphone › True wireless stereo headsets › Smart speaker › Laptop & Tablet	› Automotive › Smart home › TV › Security camera › Smart building	› Smartphone: world-facing and user-facing › Robotics › Automotive in-cabin sensing › Payment terminals	› Heating, ventilation, air conditioning (HVAC) › Air purifier › Smart thermostat › CO_2/virus risk reduction

Based on our technology leadership in sensors we are providing three different alternatives to our customers

(Single) Sensor System

e.g. presence detection

Sensor Technologies

1 (Single) Sensor

2 (Single) Sensor System

3 (Multi) Sensor System

Software / Machine Learning

SENSOR
e.g. XENSIV™ Radar

MCU
e.g. PSOC

SENSOR
e.g. Microphone

MEMS microphone

3D radar

3D ToF image sensor

CO_2 gas sensor
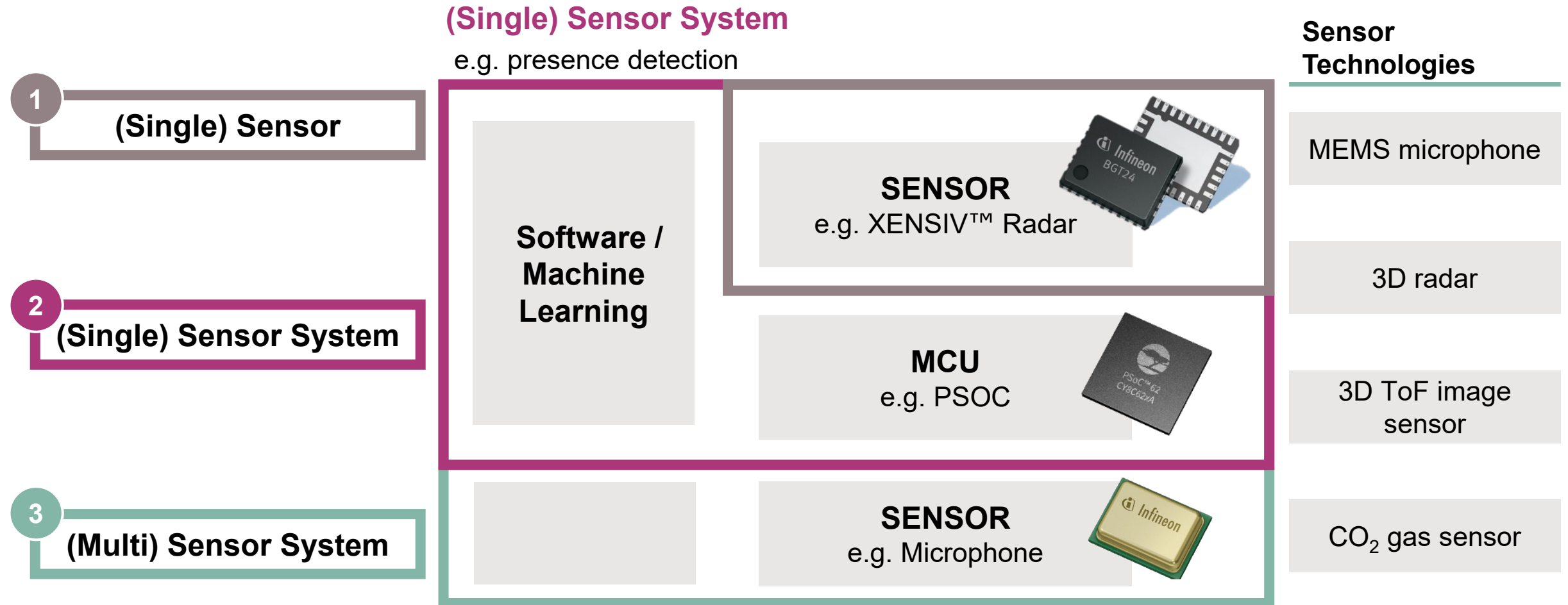
Increasing focus on cooperation with market forming customers

Customers

BOSCH · SAMSUNG · Schneider Electric · eesy INNOVATION · Xiaomi · 阿里巴巴 Alibaba.com

Tencent · Continental · Baidu 百度 · Google · SHARP

Microsoft · amazon · Jabra · f · HONOR · SONY

BOSE

Joint innovations

SONY · eesy INNOVATION · Xiaomi · SAMSUNG

Sony High-End over-ear headset with MEMS microphone
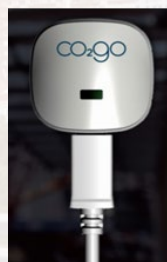
Portable CO_2 measurement enabled by the CO_2Go device

Xiaomi Mijia 1T smart vacuum cleaner

Samsung Frame TV with 60Ghz solution
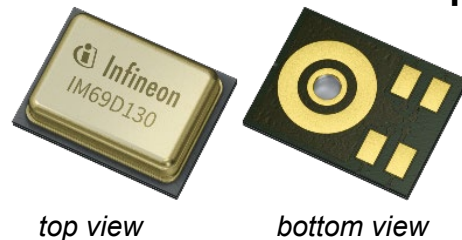
Very good traction with high-end sealed dual-membrane technology in hearables

Infineon's sealed dual-membrane (SDM) XENSIV™ MEMS microphone boosts audio pick-up quality

› Besides high-end smart phones hearables are a major growth driver. Stable and fast growth of hearables market continues

› Projects with OEMs in Europe, US and Japan for true wireless earbuds and over-ear headsets with up to 9 microphones

› Further microphone innovation projects in the pipeline to support hearable trends:

  − Augmented hearing
  − Miniaturization
  − Voice as human machine interface
  − Voice pick-up in very noisy environments
  − 3D recording

True Wireless Stereo (TWS) headsets sales*

[in m units]

CAGR$_{(20-25)}$: +42%

CY	2020	2021	2022	2023	2024	2025
	204	357	538	743	957	1187
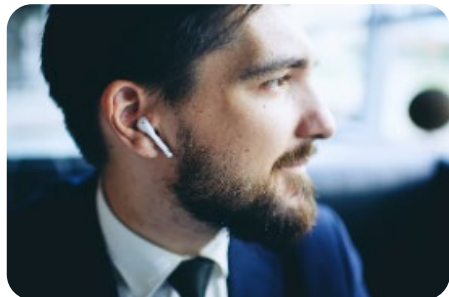
XENSIV™ SDM MEMS microphone

top view — *bottom view*

IM69D130
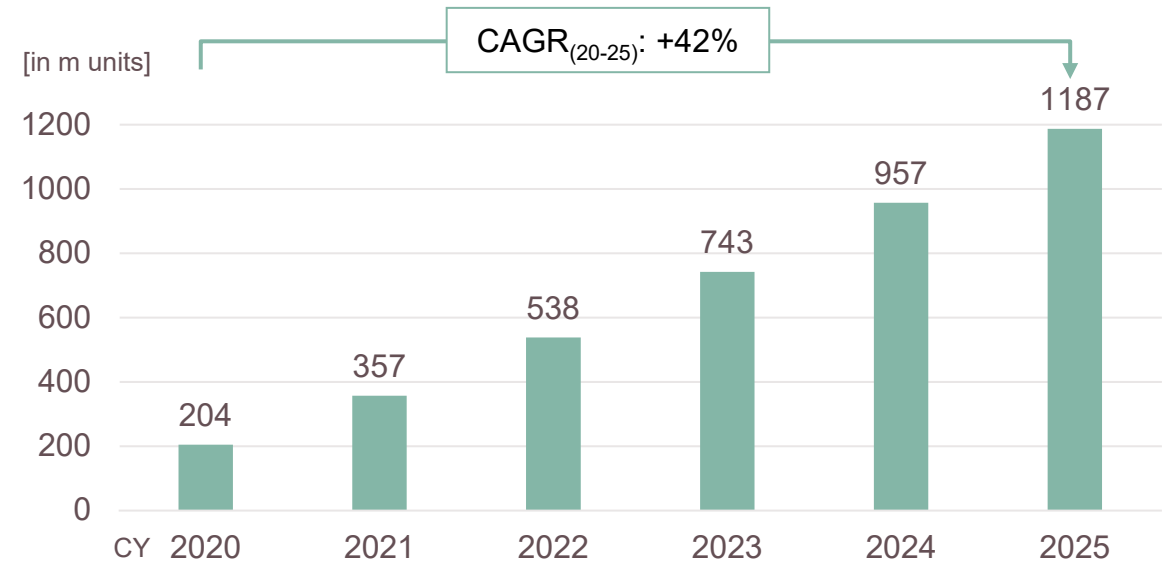
› Popular features like active noise cancellation or transparent hearing require up to 9 microphones. Traditional wired headsets include only 1 microphone

› Product portfolio will be increased by two additional high-end microphones launching this year

* Source: Strategy Analytics: *Global Bluetooth TWS Headset Sales and Revenue Forecast to 2025.* January 2021

For Infineon TWS is a large business opportunity for sensors but also for microcontrollers, connectivity and power

Current use cases / New features and use cases in the future

| Sensors | Microcontroller & Connectivity | Power |

MEMS Speaker
› Music streaming
› Communication
› Navigation info

Gesture sensor
› Volume control

One outer-ear microphone
› Feedforward ANC
› 3D sound recording for environmental awareness
› Audio input for live translation

VPU / Accelerometer
› User voice recording
› Fall detection
› Crash detection

In-ear microphone
› Feedback ANC
› Heart beat detection
› Body temperature monitoring

Microcontroller
› Connection with smartphone or wearables
› Speech recognition
› Compute assist for earbuds (eg off-line live translation)
› GPS
› Memory storage for music

Power stage
› Internal power management
› Wireless charging
› USB charging

Connectivity
› Phone calls
› Cloud communication for live translation, voice assistance and music streaming

Radar offers several use cases for presence detection and health monitoring

Presence detection

› **Room Occupancy Devices**
  e.g. human localization & counting

› **Occupancy based heating and ventilation**
  e.g. reduction of CO_2 level to prevent spreading of diseases

› **Device switch on/off**
  e.g. reduction of energy consumption (e.g. lamp, TV, air conditioning…)

› **Directional audio effects on individuum**
  e.g. to improve audio quality (e.g. smart speaker, TV)

› **Home surveillance**
  e.g. detection of intruders

Health monitoring

› **Sleep monitoring**
  Sleep detection, sleep quality, apnea & snoring detection (radar combined with MEMS microphone)

› **Vital sensing for home Fitness**
  Heart rate and breathing rate measurement (person standing still after exercise)

Segmentation with radar enables smart devices to recognize each person in the room

3D ToF under-display image sensor available in Q4 FY21

› Latest smartphone designs with a full-screen display without a notch or punch-hole are requiring under-display cameras

› Infineon is developing a under-display turnkey-solution for ToF world- and user-facing applications with very high performance

› The gray value and depth data quality of the under-display images are as good as those obtained with traditional over-display concepts for critical applications like secure face ID

› The solution is being developed together with partners. Infineon contributes the high end semiconductor technology, pmd technologies its time-of-flight expertise and imaging specialist Arcsoft the high-end algorithms

› The new under-display solution will be available in the fourth quarter of FY21

Infineon 3D ToF is a versatile technology for many consumer applications

Mobile Phones – User Facing	Face ID	Hand ID	Payment / 3D Gestures
Mobile Phones – World Facing	Bokeh	Virtual Retail	AR Gaming / 3D Scanning
Consumer Robotics	Robot	Last Mile	Collision avoidance / Navigation
Augmented- & Virtual Reality	AR	Control	AR Gaming / Mapping
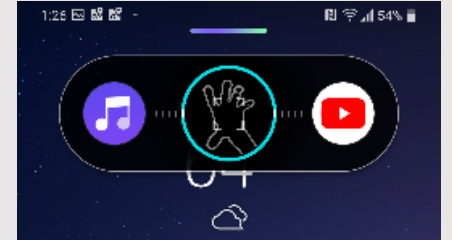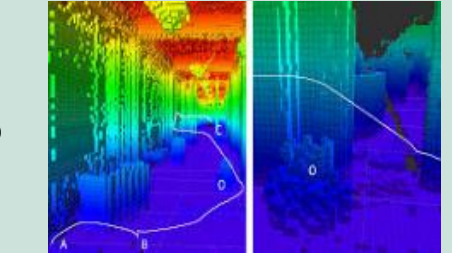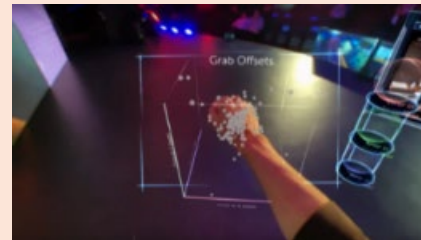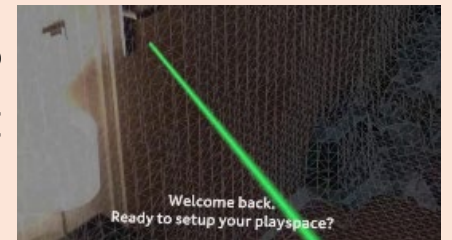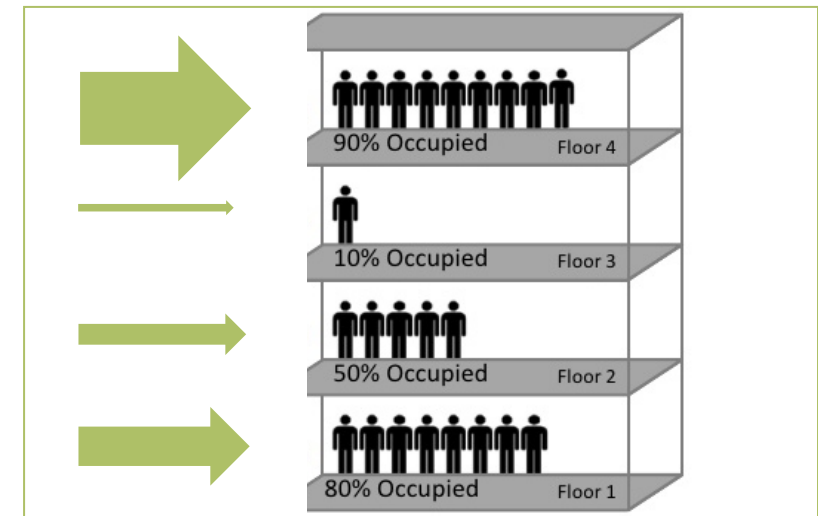
Infineon XENSIV™ PAS CO2 sensor enables highly-precise CO_2 measuring in an extremely small size

Photoacoustic spectroscopy (PAS) technology based on Infineon's high (SNR) signal-to-noise ratio MEMS microphone

› Infineon XENSIV™ PAS CO2 sensor enables highly-precise, cost-effective and space saving CO_2 measuring

› The technology offers an exceptionally small form factor (14 mm x 13.8 mm x 7.5 mm) that is 4x smaller and 3x lighter (2 grams) than the typical NDIR (non-dispersive infrared) sensor, allowing for more than 75% space savings in customer systems

› The SMD package ensures compatibility with high-volume manufacturing standards, enabling cost-effective, fast assembly and system integration

› Advanced compensation and configuration algorithms enable a plug-&-play sensor performance and fast design-to-market

XENSIV™ PAS CO2 leads to demand-oriented & energy efficient control of air conditioning systems

XENSIV™ PAS CO2 sensor measures the CO_2 level
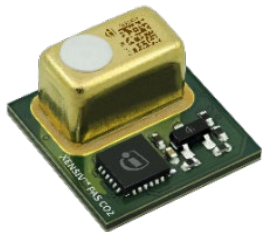
Infineon's product portfolio perfectly fits into existing key elements of a Smart Building

Lighting

› LED drivers, lighting control, sensor solutions for presence detection

Network Power Infrastructure
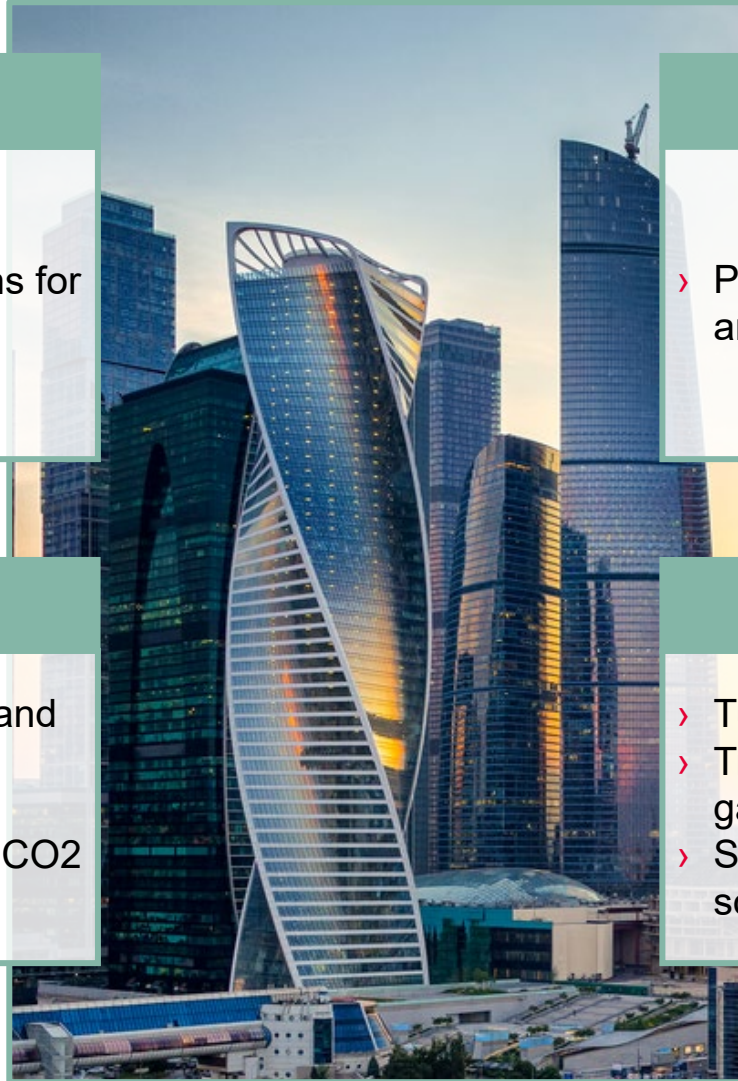
› Power MOSFETs, power control ICs for reliable and power efficient network power infrastructure

HVAC systems

› Intelligent power modules for motor control and sensor portfolio for airflow & air quality measurement and IoT use cases such as zoning or predictive maintenance (e.g. PAS CO_2 sensor, pressure sensor, radar sensor)

Access control systems

› Turnkey smart card security solutions
› Trusted platform modules (TPMs) for security gateways
› Secure elements for embedded access control solutions
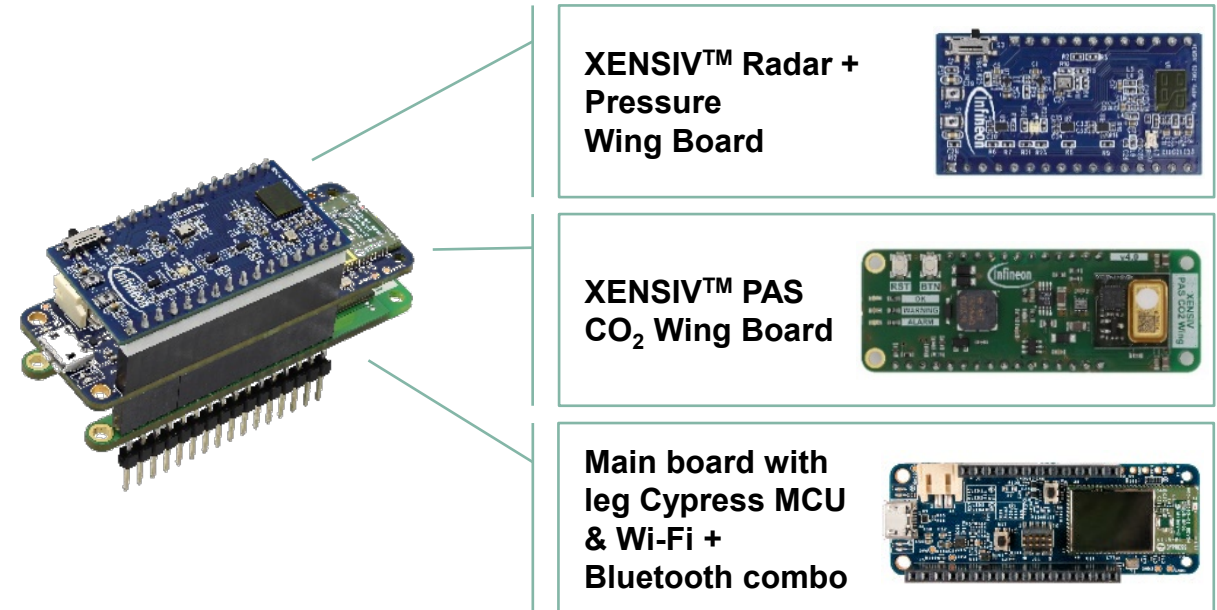
Infineon system solution addresses IoT market via combining XENSIV™ sensors, PSoC™ 6 MCU & connectivity

Key facts

› Infineon offers system solutions comprising of sensor, MCU, connectivity and software libraries (apps, SDKs)

› BLE functionality monolithically integrated on MCU

› IoT target applications for radar: entrance control or presence detection for smart home and smart building

› Radar solutions are anonymous and therefore respecting privacy

› First orders for presence detection received from several Asian customers

› Radar solution can perfectly be combined with Infineon's XENSIV™ PAS CO2 sensor for air quality monitoring

Example offering: Combination of sensors, microcontrollers and connectivity in development kit

XENSIV™ Radar + Pressure Wing Board

XENSIV™ PAS CO_2 Wing Board

Main board with leg Cypress MCU & Wi-Fi + Bluetooth combo

Advantages of radar over passive infrared

› super compact design; smaller system sizes
› determination of person's direction, speed, distance
› programmable; can flexibly be adapted to the target application
› higher accuracy; more precise measurements of detected objects

Sensor markets targeted by PSS offer attractive growth potential

MEMS microphone market

[EUR m]

FY	2021	2022	2023	2024	2025
	1.251	1.494	1.641	1.841	1.920
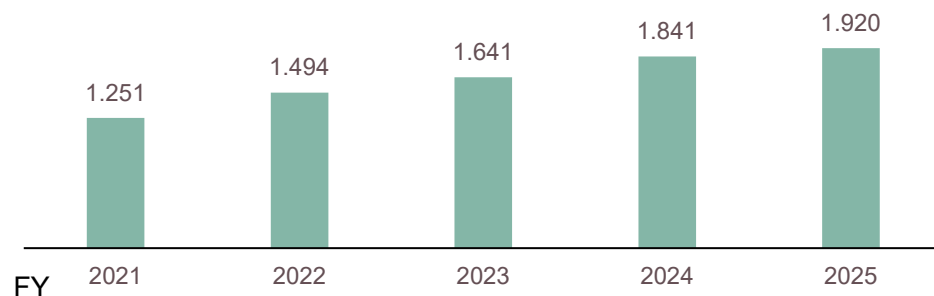
Source: Infineon estimates

Radar IC market (24 GHz and 60 GHz only)

[EUR m]

FY	2021	2022	2023	2024	2025
	154	219	347	467	601
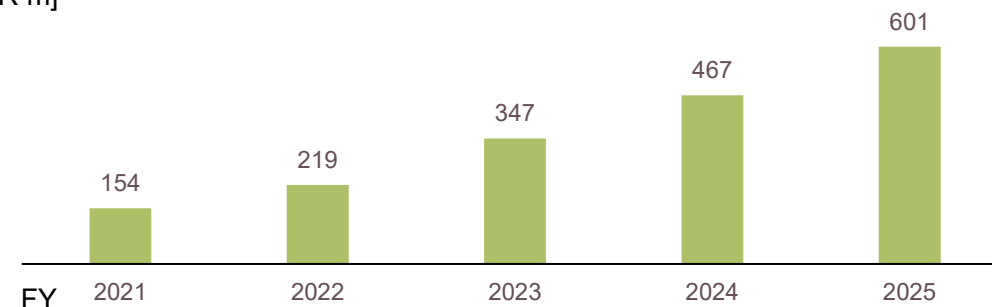
Source: Infineon estimates

3D ToF image sensor market

[EUR m]

FY	2021	2022	2023	2024	2025
	171	476	908	1282	1475
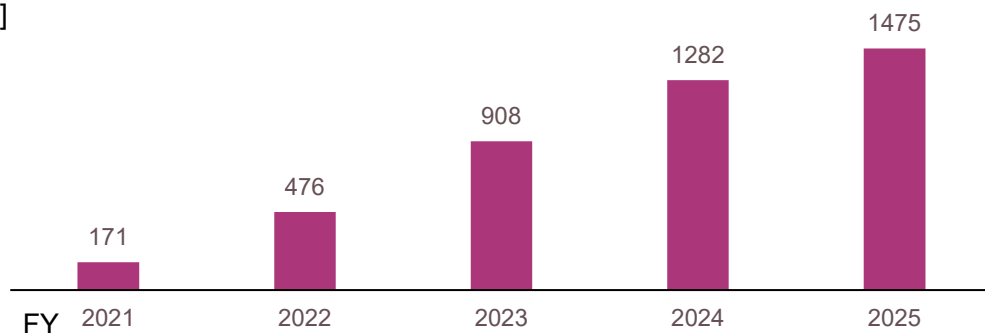
Source: Infineon estimates

Environmental sensor market*

[EUR m]

FY	2021	2022	2023	2024	2025
	285	361	456	559	700
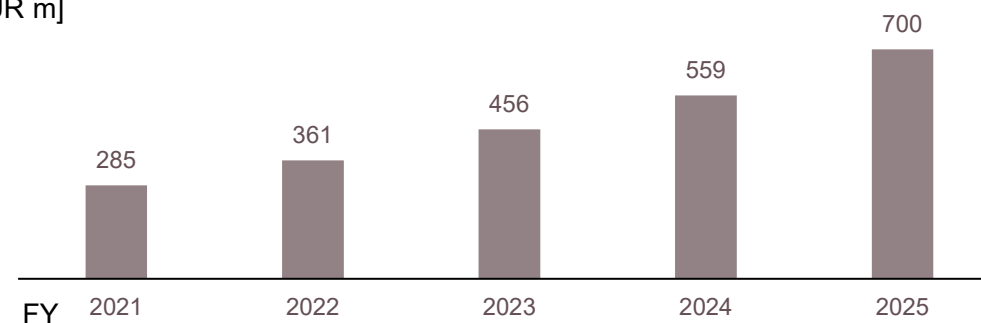
* Infineon is addressing smart building, smart home, smart appliances, consumer IoT devices and automotive.
Source: Infineon estimates

Part of your life. Part of tomorrow.

Andreas Urschitz, Division President Power & Sensor Systems

> › Born in 1972 in Klagenfurt, Austria

> › Studies of Commercial Science at WU Vienna

> › First position within Infineon in product planning & strategy

> › Further positions in production, sales and marketing

> › Since 2012: Division President Power & Sensor Systems (PSS) (formerly PMM)

> − Since 2012, PSS revenue grew by a factor of three and PSS' market share in the area of power semiconductors (MOSFETs) more than doubled*

> − PSS results FY20: Revenue: €2,650 million, Segment result: €636 million, Segment result margin: 24%*

* Source: Infineon Annual Report, 2012 and 2020

Glossary

ANC	adaptive noise cancellation		PSoC	programmable system-on-chip
AR	augmented reality		RF	radio frequency
BLE	Bluetooth Low Energy		SDM	sealed dual-membrane
CAGR	compound annual growth rate		Si	silicon
GaN	gallium nitride		SiC	silicon carbide
GPS	global positioning system		SMD	surface-mounted device
HVAC	heating, ventilation, air conditioning		SNR	signal-to-noise ratio
IC	integrated circuit		SoC	system-on-chip
ID	Identification		ToF	time-of-flight
IoT	Internet of Things		TPM	trusted platform module
MCU	microcontroller unit		TWS	true wireless stereo
MEMS	micro electro-mechanical systems		USB	universal serial bus
MOSFET	metal-oxide silicon field-effect transistor		VPU	voice processing unit
NDIR	non-dispersive infrared		VR	virtual reality
OEM	original equipment manufacturer		Wi-Fi	wireless fidelity
PAS	photoacoustic spectroscopy			

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