# Infineon Wireless Solutions

MWC, Barcelona, February 17, 2009

Prof. Dr. Hermann Eul
Member of the Management Board
Sales & Marketing, Research & Development

Never stop thinking

# Disclaimer

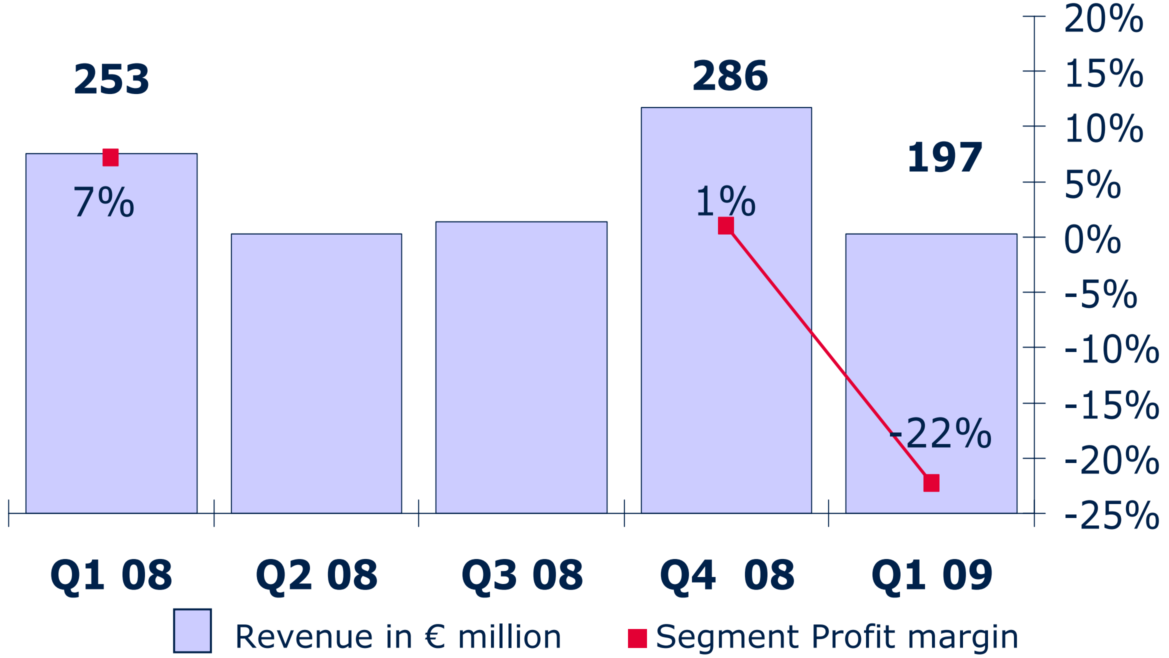
# X-GOLD™101: Winner of the Innovation Award of German industry for the best technological innovation 2008

## More than 100 million devices were sold so far!

FRANKFURTER INNOVATIONSPREIS GESTIFTET VOM WIRTSCHAFTSCLUB RHEIN-M
AIN EV PREISTRÄGER 1980 DR U BOLLERT UND DR M FINKE HOECHST AG 1981 A
UGUST HOHNHOLZ KG H-P PHILIPPSEN 1982 AEG-TELEFUNKEN NACHRICHTENT
ECHNIK GMBH 1983 DORNIER SYSTEM GMBH 1984 ERNST LEITZ WETZLAR GMBH
1985 CARL ZEISS 1986 S+G IMPLANTS GMBH 1987 DEUTSCHE THOMSON-BRA
NDT GMBH 1988 AIXTRON GMBH 1989 MLS MUNICH LASER SYSTEMS GMBH 19
90 KLÖCKNER-HUMBOLDT-DEUTZ AG 1991 IBM DEUTSCHLAND GMBH 1992 N
UKEM GMBH 1993 OPTICON GESELSCHAFT FÜR OPTIK UND ELEKTRONIK MBH
1994 SIEMENS NIXDORF INFORMATIONSSYSTEME AG 1995 BOEHRINGER M
ANNHEIM GMBH 1996 DAIMLER-BENZ AEROSPACE AG 1997 CONT
INENTAL AG 1998 HOECHST MARION ROUSSEL AG 1999 DAIMLER
CHRYSLER AEROSPACE AG 2000 AUDI AG 2001 INFINEON TECHNO
LOGIES AG 2002 MTU AERO ENGINES GMBH 2003 BMW AG
2004 SIEMENS AG 2005 FRESENIUS MEDICAL CARE AG 200
6 CARL ZEISS SMT AG 2007 MAN DIESEL SE 2008 INFINEON
TECHNOLOGIES AG

# Q1 FY09 Financial Figures for Wireless Solutions

## Wireless Solutions – First quarter



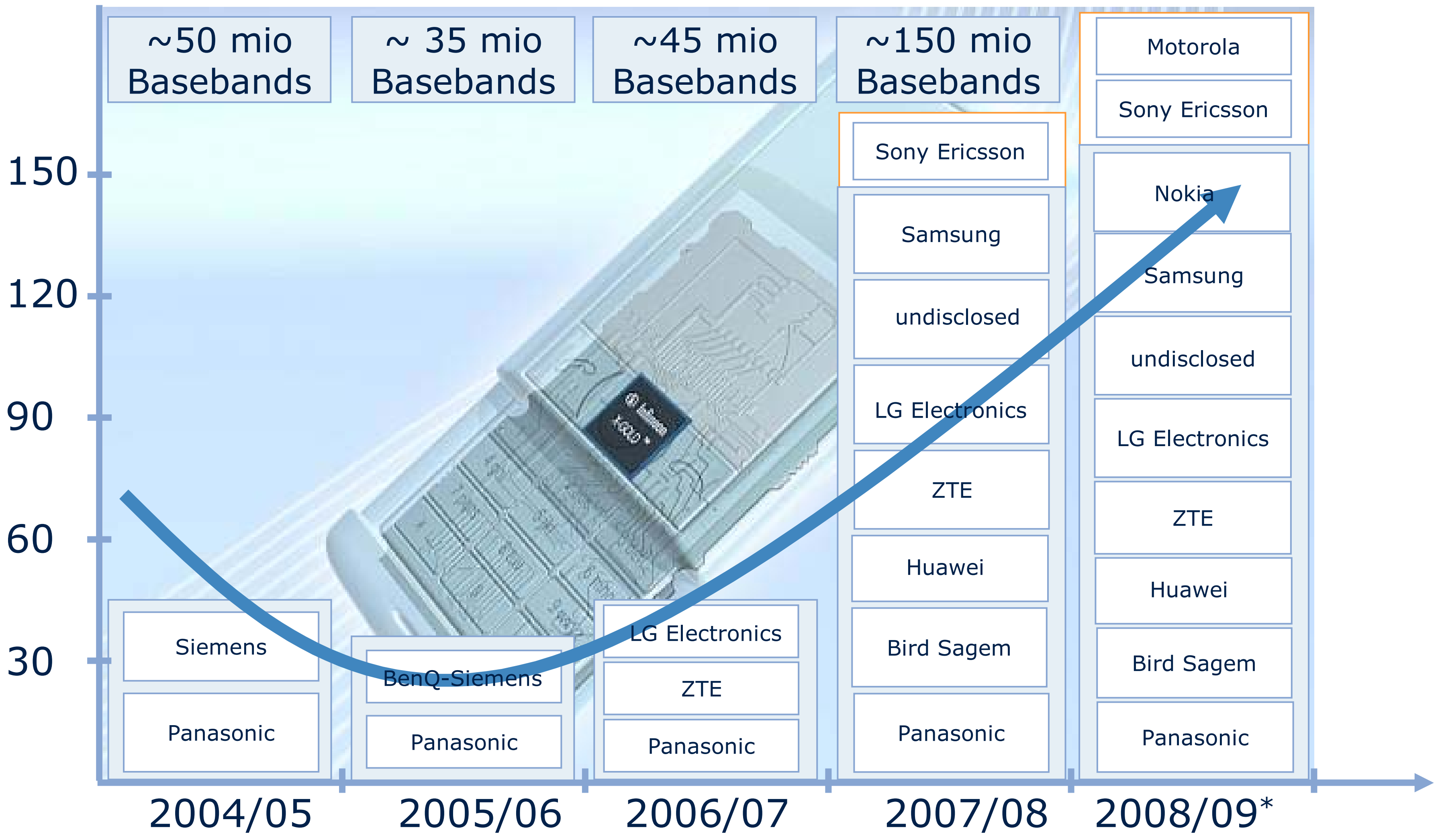
| | Segment Profit [€ m] |
|---|---|
| **Q1 09** | **-44** |
| **Q4 08** | **3** |
| **Q1 08** | **18** |

Note: Figures according to IFRS

## Remarks

- Q4 revenue peak due to high demand of one HSDPA customer.
- Revenue decrease by 31% compared to Q4 FY08 mostly due to given market slow-down and inventory correction.
- Segment Profit: Negative € 44 million due to revenue decline and idle cost.

# Infineon is scaling up customer base and volumes significantly



**2004/05** – ~50 mio Basebands
- Siemens
- Panasonic

**2005/06** – ~ 35 mio Basebands
- BenQ-Siemens
- Panasonic

**2006/07** – ~45 mio Basebands
- LG Electronics
- ZTE
- Panasonic

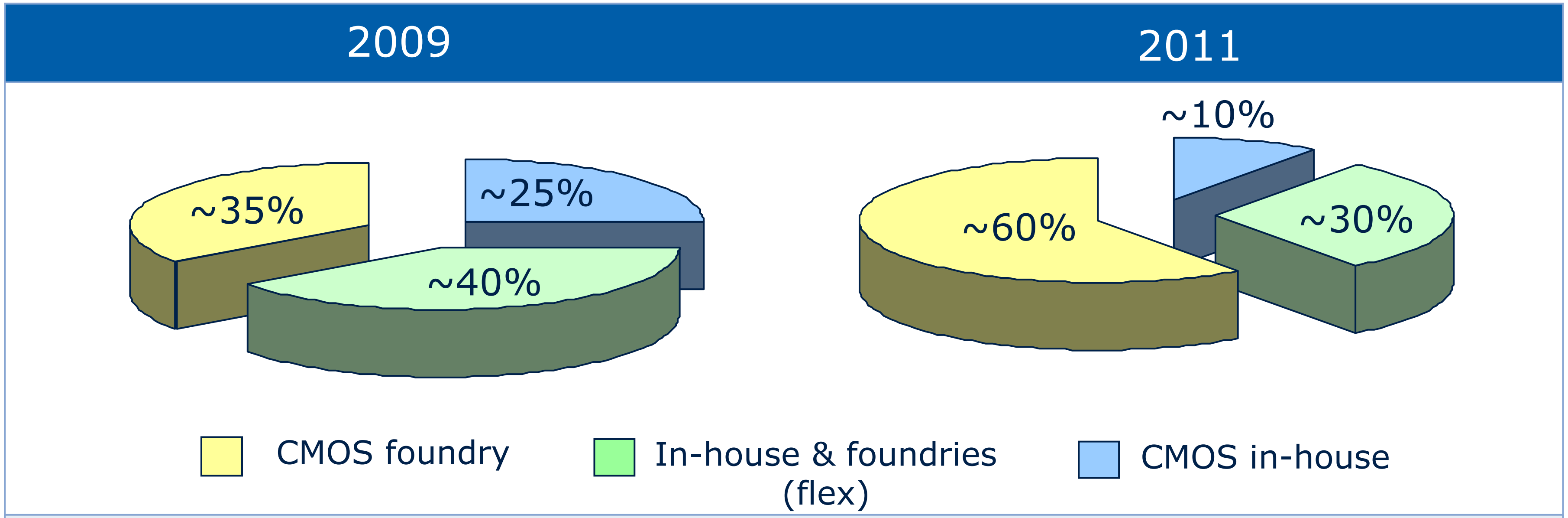
**2007/08** – ~150 mio Basebands
- Sony Ericsson
- Samsung
- undisclosed
- LG Electronics
- ZTE
- Huawei
- Bird Sagem
- Panasonic

**2008/09*** 
- Motorola
- Sony Ericsson
- Nokia
- Samsung
- undisclosed
- LG Electronics
- ZTE
- Huawei
- Bird Sagem
- Panasonic

*estimated

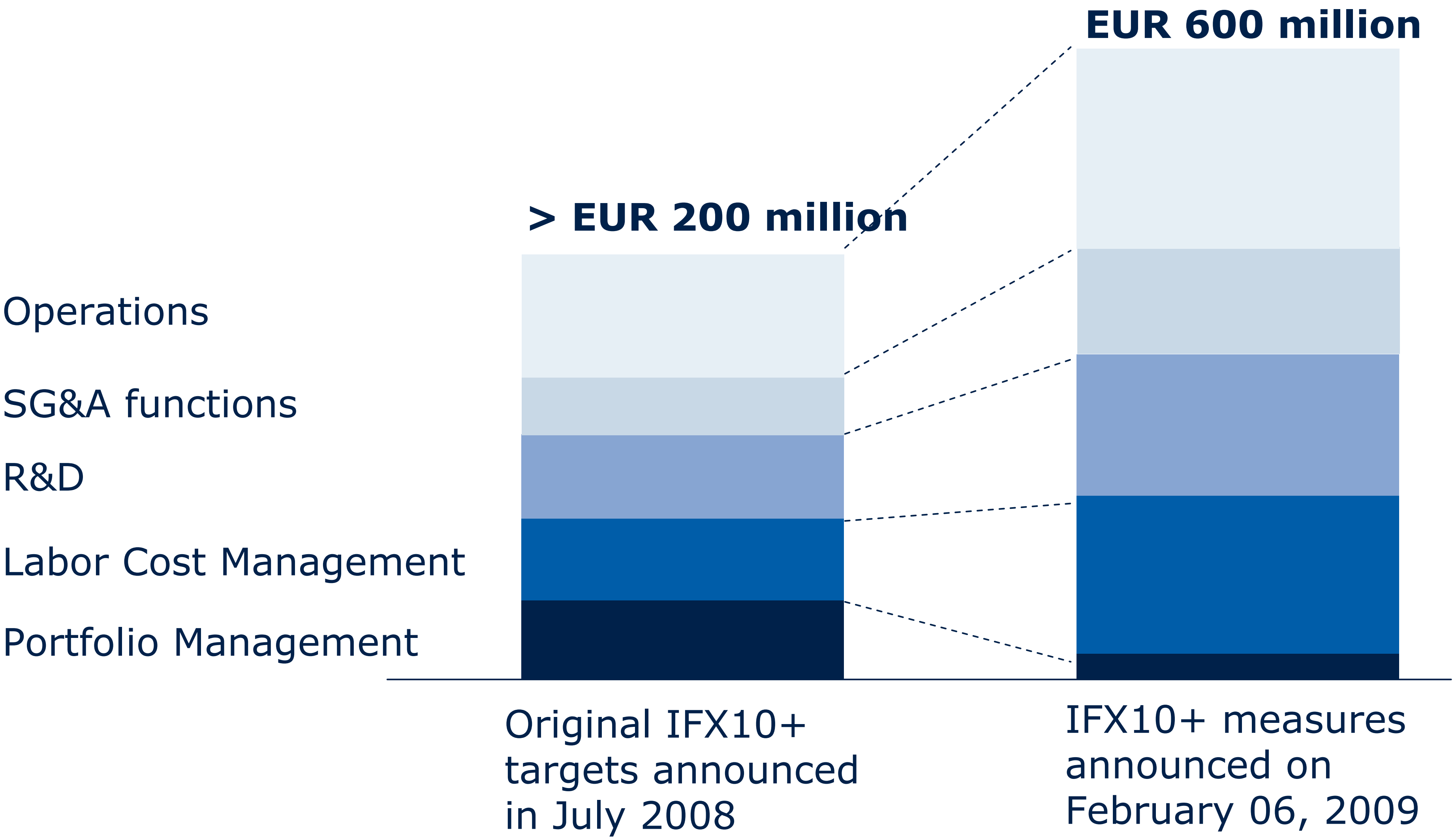
RF transceiver

# Infineon wireless following up consequently on fab-light strategy



- 2009:
  - 130nm and 90nm technologies are in full production and manufactured in-house as well as at silicon foundries.
  - 65nm technology is the first technology only manufactured at silicon foundries; multi-sourcing concept for supply security.
- 2011:
  - 65nm will be in volume production.
  - Next technology node 40nm will be in ramp-up.

# Costs will be reduced further by early implementation of IFX10+

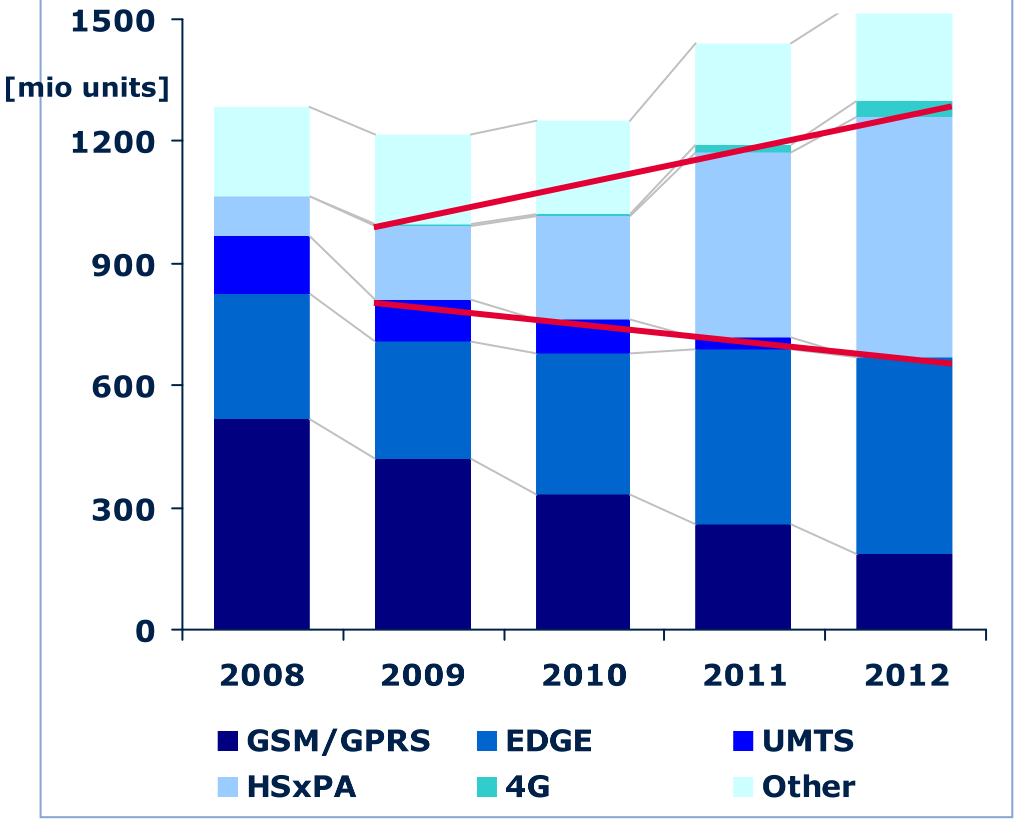


1) Excluding revenue measures

# Handset growth fueled by HSxPA technology while 2/2.5 G still represent 50% of market

## Cellular Handset Market [mio units]

| | | | | | |
|---|---|---|---|---|---|
| **Handset Units** | 1287 | 1215 | 1253 | 1440 | 1547 |
| **y-o-y Growth** | | -6% | 3% | 15% | 7% |



Source: iSuppli, December 2008

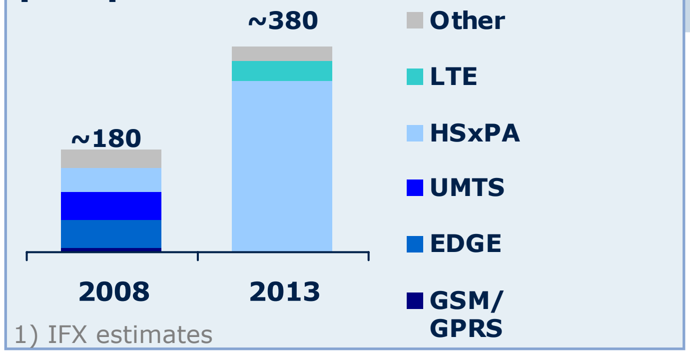
## Comments

- Global handset shipments are forecasted to grow at a 4-year CAGR of 4.7% (2008–2012)
  - HSxPA segment is growing the fastest (57% CAGR) to 38% of all handset shipments by 2012.
  - EDGE segment grows steadily as well, reaching ~480 mio units in 2012.
- The WEDGE segment will decline substantially as the OEMs and operators are focusing on HSxPA handsets.
- Growth of HSxPA is mainly driven by replacement handset sales as feature-rich handsets enabling various data services that require faster data connection.

# High performance slim modems and cost-effective single-chip solutions will experience high demand

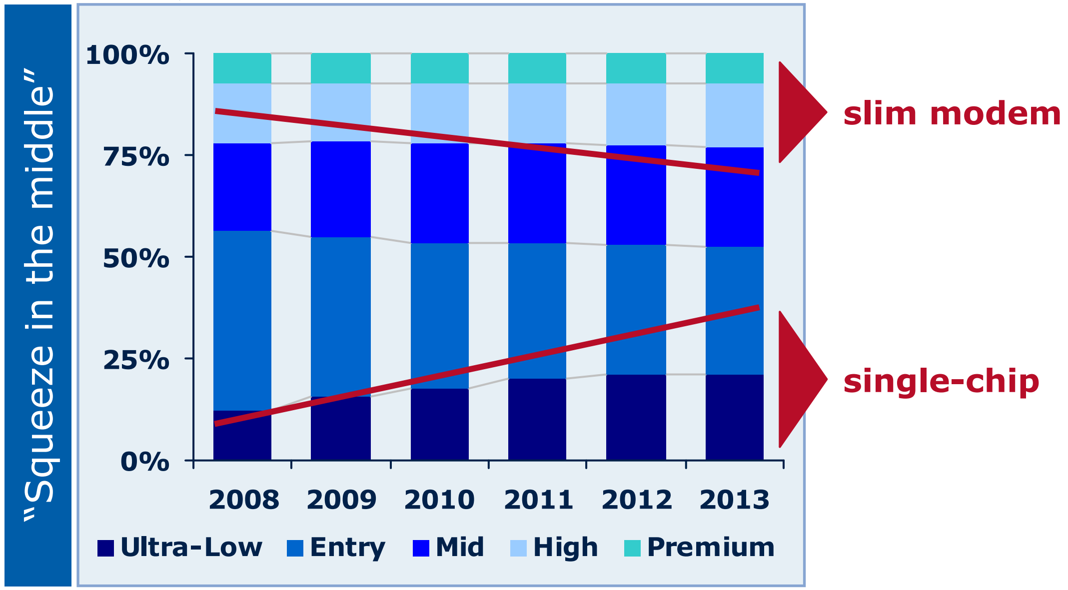
## Mobile internet / Smartphones

**Smart phone shipments**[1]
**[units m]**



1) IFX estimates

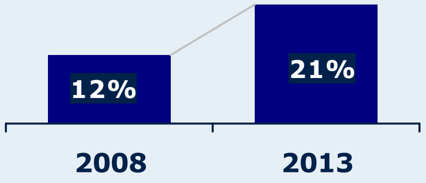
*Strong growth of smartphones driven by operators subsidies due to higher ARPU, attractive user interfaces, etc.*



## Strong growth in low-cost phones

Source: Strategy Analytics, Sep'08

**Share of**
**Ultra low-cost phones**



*Strong growth of ULC phones driven by demand in emerging regions*

# Infineon well positioned for success in the wireless market and prepared for further consolidation

*INFINEON WIRELESS POSITIONING ALONG SUCCESS FACTORS*

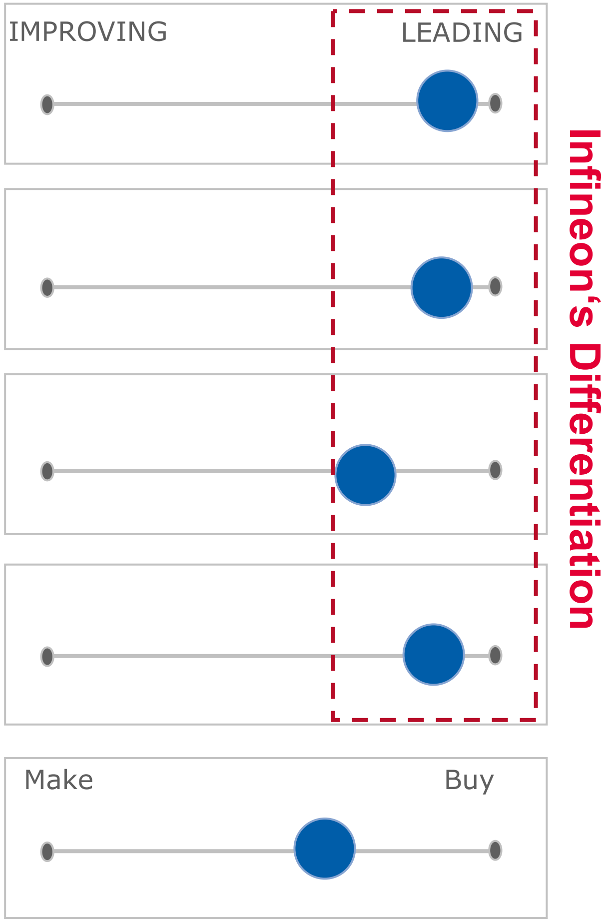
**Major Market Trends**

- OEMs diversify supplier base and migrate from in-house solutions towards merchant market platforms
- Strong growth of HSxPA, Smartphones and ULC segment
- New handset market entries, e.g.
  - Operator/ODM business model
  - Smartphone "pure plays"
- Consolidation of platform supplier base

**Success Factors**

- **RF CMOS Transceiver**
- **RF / Mixed Signal integration capabilities**
- **System & Software competence with focus on HSPA, smart phones and ULC**
- **Top-tier customer access**
- **Connectivity and apps processor, power amplifier**

**Relative Positioning**



# Infineon differentiates through four major success factors

## RF CMOS transceivers (TRx)

- Complete portfolio from GPRS to HSxPA, LTE and WiMax RF transceivers
- Shipped 1.4 billion Cellular RF TRx to date
- World`s first 65nm LTE DigRF TRx sampled

## Customer Base

- Broadest customer base with access to all Tier 1 OEMS
  - LG Electronics
  - Motorola
  - Nokia
  - Panasonic
  - RIM
  - Samsung
  - Sony Ericsson

## RF/mixed-signal integration

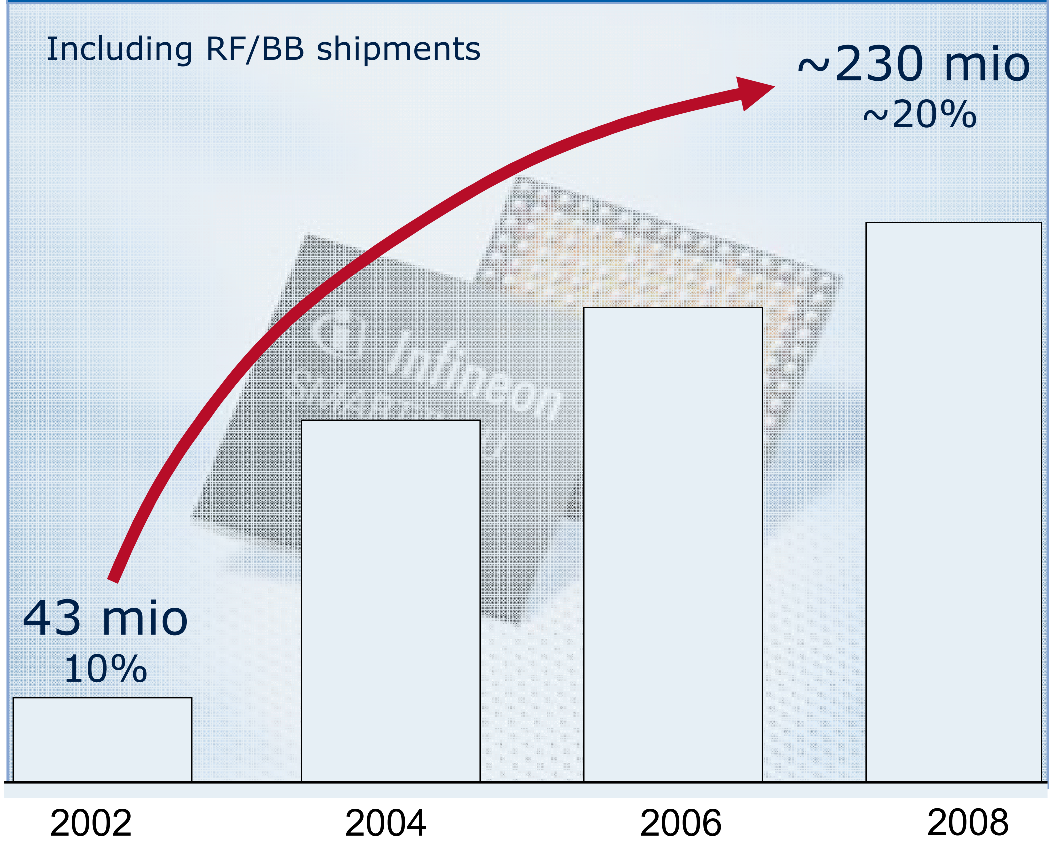
- Shipped > 100 mio X-GOLD™101 in the first year of volume production
- World’s first EDGE single chip in volumes

## Mobile phone platform solutions

- Complete HW/SW platform solutions from GSM to HSDPA in volume production
- Strong system and software competence
- Partner on connectivity and application processor

# Infineon RF Transceivers for cellular applications showed steady growth of market share

## Infineon's volume shipments and market share for RF transceivers



Source: Strategy Analytics, Infineon

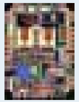
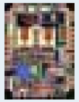
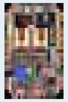
## Major Contributors

- Successful ramp-up of new RF transceivers for major OEMs
- Complete product and roadmap conversion to CMOS technology since 2004
- Leader in RF / BB integration
- Leading cost position
- Excellent RF performance

→ Infineon shipped 1.4 billion cellular RF transceivers to date

# All major wireless standards are addressed by RF CMOS solutions

## RF Transceiver Roadmap

| | In production | Sampling | R&D | IFX position |
|---|---|---|---|---|
| **WiMAX/ LTE** | SMARTi WiMAX | SMARTi LTE<br>SMARTi LU LTE DigRFv4 new | SMARTi LU2 LTE TDD | ■ Strong interest from all Tier1s in world´s first 65nm DigRFv4 LTE/3G/2G transceiver |
| **HSUPA** | SMARTi UE HSPA/ EDGE DigRF<br>SMARTi UE+ HSPA/ EDGE Rx Div. | SMARTi UE micro 3G low cost Q2.09 | SMARTi UE2 65nm<br><br>32nm RF macro | ■ SMARTi™ UEmicro: Lowest Cost 3G (emerg. markets)<br>■ SMARTi™ UE/UE+: DW Motorola ramping 2H CY 2009 |
| **HSDPA/ WCDMA** | SMARTi 3G HSDPA<br>SMARTi 3GE HSDPA/ EDGE | SMARTi 3GE2 DigRF new | | ■ In production at Samsung, Sony Ericsson, LG and RIM<br>■ Multiple DWs with IFX platform |
| **EDGE** | SMARTi PM<br>SMARTi PM+ 3x3 mm | SMARTi PM2 DigRF TRP<br><br>65nm RF macro | | ■ SMARTi™ PM+ in volume production at two Tier-1s<br>■ 65nm RF macro for single chip integration |
| **GSM/ GPRS** | SMARTi SD2 | <br>65nm RF macro | | ■ 65nm RF macro for single chip integration |

# New RF products addressing growth segments 3G low cost and LTE

## LTE Mobile Data

new

- World’s 1st LTE multimode transceiver
- LTE / 3G / 2G single chip RF CMOS
- up to 150 Mbps downlink
- DigRF v4 interface
- 65nm standard CMOS technology

Global Roaming

lte
**150 Mbps**

HSPA+
**Cat 16**

Diversity

mipi
DigRF
**3.09**

mipi
DigRF
**v4**

3GPP
**Rel. 7**

3GPP
**Rel. 8**

## 3G Low Cost

new

- HSPA/EDGE single chip transceiver
- lowest cost 3G for emerging markets
- DigRF v3.09 interface, 1.2s calibration time
- eliminating ext. LNAs and Rx filters
- enabling lowest RF system eBOM USD 6.50
- 130nm standard CMOS technology

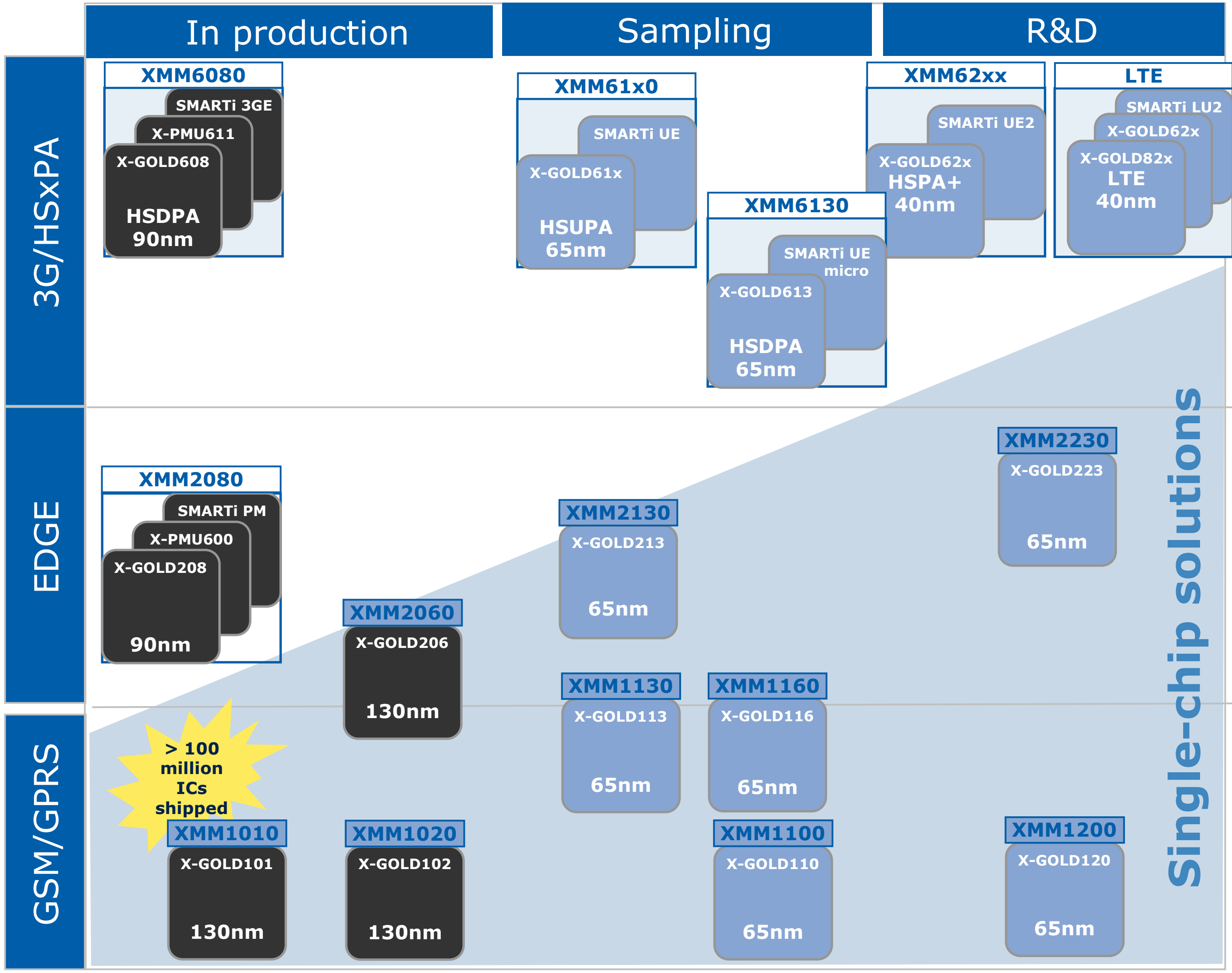
Reference Design

HSDPA
**3.6 Mbps**

mipi
DigRF
**3.09**

**1 sec**
**calibration**

# Infineon drives SoC integration from GSM to full EDGE solutions and beyond



In production | Sampling | R&D

3G/HSxPA

XMM6080: SMARTi 3GE, X-PMU611, X-GOLD608, HSDPA 90nm

XMM61x0: SMARTi UE, X-GOLD61x, HSUPA 65nm

XMM6130: SMARTi UE micro, X-GOLD613, HSDPA 65nm

XMM62xx: SMARTi UE2, X-GOLD62x, HSPA+ 40nm

LTE: SMARTi LU2, X-GOLD62x, X-GOLD82x, LTE 40nm

EDGE

XMM2080: SMARTi PM, X-PMU600, X-GOLD208, 90nm

XMM2060: X-GOLD206, 130nm

XMM2130: X-GOLD213, 65nm

XMM2230: X-GOLD223, 65nm

GSM/GPRS

> 100 million ICs shipped

XMM1010: X-GOLD101, 130nm

XMM1020: X-GOLD102, 130nm

XMM1130: X-GOLD113, 65nm

XMM1160: X-GOLD116, 65nm

XMM1100: X-GOLD110, 65nm

XMM1200: X-GOLD120, 65nm

Single-chip solutions

## IFX position

- HSDPA in production at Samsung and three other major customers
- High-integrated 2nd generation HSxPA (65nm) solutions sampling
- HSPA+ / Rel7 in development (40nm)
- LTE under development

- Integration success continues in EDGE with volume production at key customers

- Award-winning X-Gold™ 101 ULC solution; >100 mio devices shipped so far
- Continuing XMM™1010 success story with our 65nm single chip generation (already sampling)

# Ultra-Low-Cost enables “Voice for All”

GSM/GRRS

## XMM™1200

**X-GOLD120**

**GSM/GPRS**

## ULC Innovation

- Revolutionary ULC system concepts
- Serial Flash
- Dual-feed antenna

GSM/GPRS

## XMM™1100

**X-GOLD110**

**GSM/GPRS**
**65nm**

## ULC and FM Radio single-chip

- Highest available integration 65nm ULC single-chip
- Integrated FM stereo RDS receiver
- USB charging
- MP3, Stereo Audio, Class-D amplifier

GSM / GPRS

## XMM™1020

**X-GOLD102**

**GSM/GPRS**
**130nm**

## ULC Single-chip GSM

- Best-in-class ULC colour single-chip
- MP3
- USB charging
- Dual-SIM (XMM™1028)

Same Software Architecture
Full MMI & Tools re-use

# Entry phones provide “Mobile Internet for All”

HSDPA

## XMM™6130

**X-GOLD613**
**HSDPA 65nm**

**SMARTi-UEmicro**
**HSDPA 130nm**

## Lowest-Cost HSDPA

- Smallest footprint
- ARM11 core
- Audio and video player
- WQVGA display, 3Mpix camera
- USB 2.0 HS, memory card

EDGE

## XMM™2130

**X-GOLD213**
**EDGE 65nm**

## Lowest-Cost Browsing

- Highest available integration level
- ARM11 core
- FM stereo RDS receiver integrated
- Audio and video player
- QVGA display, 2Mpix camera
- USB 2.0 HS, memory card, Stereo
- Integrated power management

GSM / GPRS

## XMM™1130/60

**X-GOLD113**
**GSM/ GPRS 65nm**

## Lowest-cost Messaging

- Highest available integration level
- ARM11 core
- FM stereo RDS receiver integrated
- QVGA display, 1.3Mpix camera (XG116)
- USB 2.0 HS, memory card, Stereo
- Integrated power management, int. SRAM

One Software Architecture
ARM11 HW Architecture

# Smartphones require high-performance modems

LTE

## LTE Demonstrator

**FPGA/DSP**

## LTE smart modem solution

- Rapid algorithm prototyping on DSP/FPGA platforms
- Verified in co-operation with Agilent Techn.
- Key algorithms implemented:
  - LTE MIMO Diversity
  - LTE MIMO Spatial Multiplexing
  - Flexible resource block allocation
  - Channel estim. & baseline MIMO Equalizer

HSUPA

## XMM™6160

**SMARTi™UE**

**X-GOLD™616**

**HSDPA**
**HSUPA**
**65nm**

## HSUPA smart modem solution

- Smallest footprint
- HSDPA cat8 - 7.2 Mbps
- HSUPA cat6 - 5.76 Mbps
- 4 band 3G / 4 band EDGE
- PMU & baseband monolithically integrated
- Lowest power consumption

HSDPA

## XMM™ 6081

**SMARTi™3GE**

**X-PMU™610**

**X-GOLD™608**

**HSDPA**
**90nm**

## HSDPA smart modem solution

- HSDPA cat8 - 7.2 Mbps
- 3 band 3G / 4 band EDGE
- Low power consumption
- Market proven

# Infineon offers complete HW/SW system solutions for all major standards

*INTEGRATED HW AND SW, SYSTEM DESIGN, IOT AND GCF TESTING*

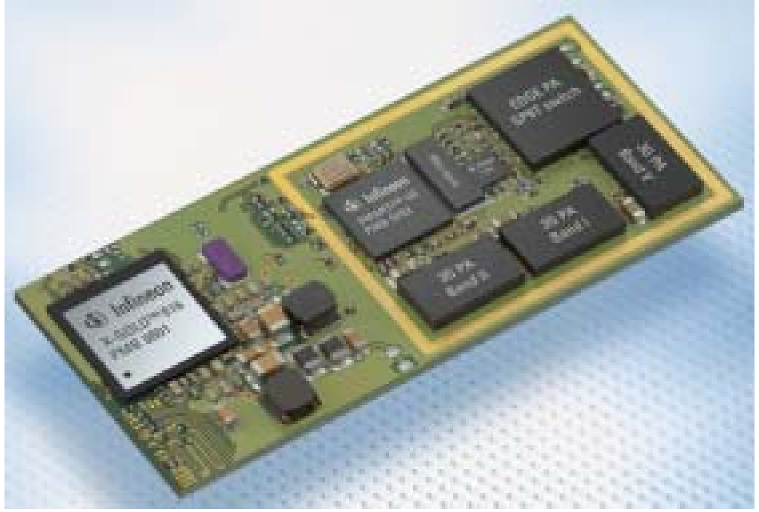
## HW Components

**Baseband**
2G/HSxPA baseband
PMU and analog

**RF transceiver**
EDGE/3G/LTE
Stand-alone / integrated

**Connectivity/Location**
Bluetooth, FM
A-GPS (XPOSYS™)

**Discretes**
Silicon Discretes
(LNAs etc.)



**HSUPA mobile phone platform**
**XMM™ 6160**

## SW Components

**Protocol Stack**
2G – Rel.6 GSM, EDGE
3G – Rel.6 HSxPA

**Pre-GCF**
Automated testing:
24 hours a day
7 days a week

**Pre-IOT**
With all major
infrastructure vendors

IOT = inter-operability test
GCF = global certification forum

Ownership of each platform component simplifies completing lab tests, field tests, and operator approvals, significantly accelerating phone projects

# XPOSYS™ A-GPS single-chip solution offers a sensitivity down to -165 dBm

## XPOSYS™ A-GPS

- Highly integrated single chip 65nm A-GPS
- Integrated high sensitivity LNA
- Package WLB47
  2.8 x 2.9mm²; 0.4mm pitch;
  0.8 mm height

## Key Features

- Highest sensitivity of less than -165 dBm
- Lowest power consumption 9 mW tracking
- TCXO shared with cellular system
- SW for assisted modes:
  C-plane and User-plane (SUPL 2.0)
- Performance margin enables low cost filters and antennas

## Circuit/System

- **Less than 26 mm² board space**
  to maximize design flexibility
- **Only 9 external components**
  to reduce eBOM
- **3GPP, DoCoMo and OMA compliant**
  for fast time-to-market
- **Lowest power consumption 6µW StdBy**
  to successfully interact with multiple LBS applications

# Rich Communication Suite (RCS) based on Comneon's IMS Device Framework

## Rich Communication Suite

- RCS is a standardized sub-set of IMS functions.
- Seamless communication for end users.
- Services include:
  - ☐ Presence enabled Phone Book
  - ☐ Service Capability Exchange
  - ☐ Multimedia Messaging
  - ☐ Chat
  - ☐ File Transfer
  - ☐ Video Share
  - ☐ Image Share

**Comneon is a member of the GSMA RCS Group**

# Infineon serves the top 5 mobile phone OEMs as well as important additional players

*CUSTOMER BASE*

| **OEM Market shares in 2008[1]** | | **IFX platforms** | **IFX RF transceiver (standalone)** | |
|---|---|---|---|---|
| **Nokia** | 39.9% | ■ ULC XMM™101 in volume production | ■ Major RF supplier for GPRS and EDGE | ✓ |
| **Samsung** | 16.2% | ■ Major supplier of GSM/GPRS/ EDGE platforms<br>■ HSDPA in the market | ■ Supplier of EDGE RF and 3G RF | ✓ |
| **Motorola** | 8.7% | | ■ Customized development HSxPA RF transceiver based on SMARTi UE | ✓ |
| **LG Electronics** | 8.3% | ■ Major supplier of GSM single-chip/ EDGE platforms<br>■ HSDPA in the market | ■ Major supplier of EDGE and 3G RF (through IFX platforms) | ✓ |
| **Sony Ericsson** | 8.3% | | ■ Supplier of SMARTi 3G selected by Ericsson Mobile Platforms (EMP) | ✓ |
| **Major other (undisclosed)** | | ■ EDGE and HSDPA in the market | ■ In volume production at key smartphone customers | ✓ |

---

1) Strategy Analytics estimates, December 2008

# Summary

| | |
|---|---|
|  | Focus on Smartphone with slim modems for HSDPA / HSUPA systems and beyond |
|  | Extend leadership position in RF CMOS transceivers into advanced mobile systems |
|  | Expand leading position in SoC integration; lever it to EDGE and low-cost 3G |
|  | Offer complete mobile phone platform solutions out of one hand |
|  | Keep broad customer base and increase share |

We commit.
We innovate.
We partner.
We create value.

Infineon

Never stop thinking