Industry Landscape in Mobile Comupting

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About ST-Ericsson

- ST-Ericsson is 50/50 joint venture uniting the wireless semiconductor division of STMicroelectronics (ST-NXP Wireless) and the mobile platform division of Ericsson (Ericsson Mobile Platforms)

- Incorporated in Switzerland and headquartered in Geneva, the Company employs approximately 8,000 people worldwide, more than 85 percent of whom are in R&D

- ST-Ericsson is a fabless company, with wafer processing performed by an appropriate combination of the front-end facilities of STMicroelectronics, as well as by external foundries

- ST-Ericsson has full access to world-class assembly and test manufacturing facilities located at Calamba (Philippines) and Muar (Malaysia), operated by STMicroelectronics

- ST-Ericsson operations are spread around the world, with main centers in China, Finland, France, Germany, India, Japan, Korea, Netherlands, Norway, Singapore, Sweden, the UK and the USA
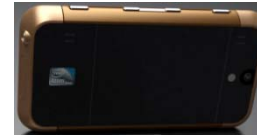
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Phones with ST-Ericsson Inside

i-Mate
Ultimate 6150

Sony Ericsson
M600

Sony Ericsson
P910

Sony Ericsson
W960i

Aava Mobile

Sony Ericsson
Satio

Fujitsu Siemens
LOOX T Series

O2
Xda Flame

Sony Ericsson
P1

Sony Ericsson
W950

Samsung
Magnet

Sony Ericsson
C905

HP
6500/6900 series

i-Mate
Ultimate 8150

Eten
Glofish X800

Eten
Glofish M800

Samsung
T429

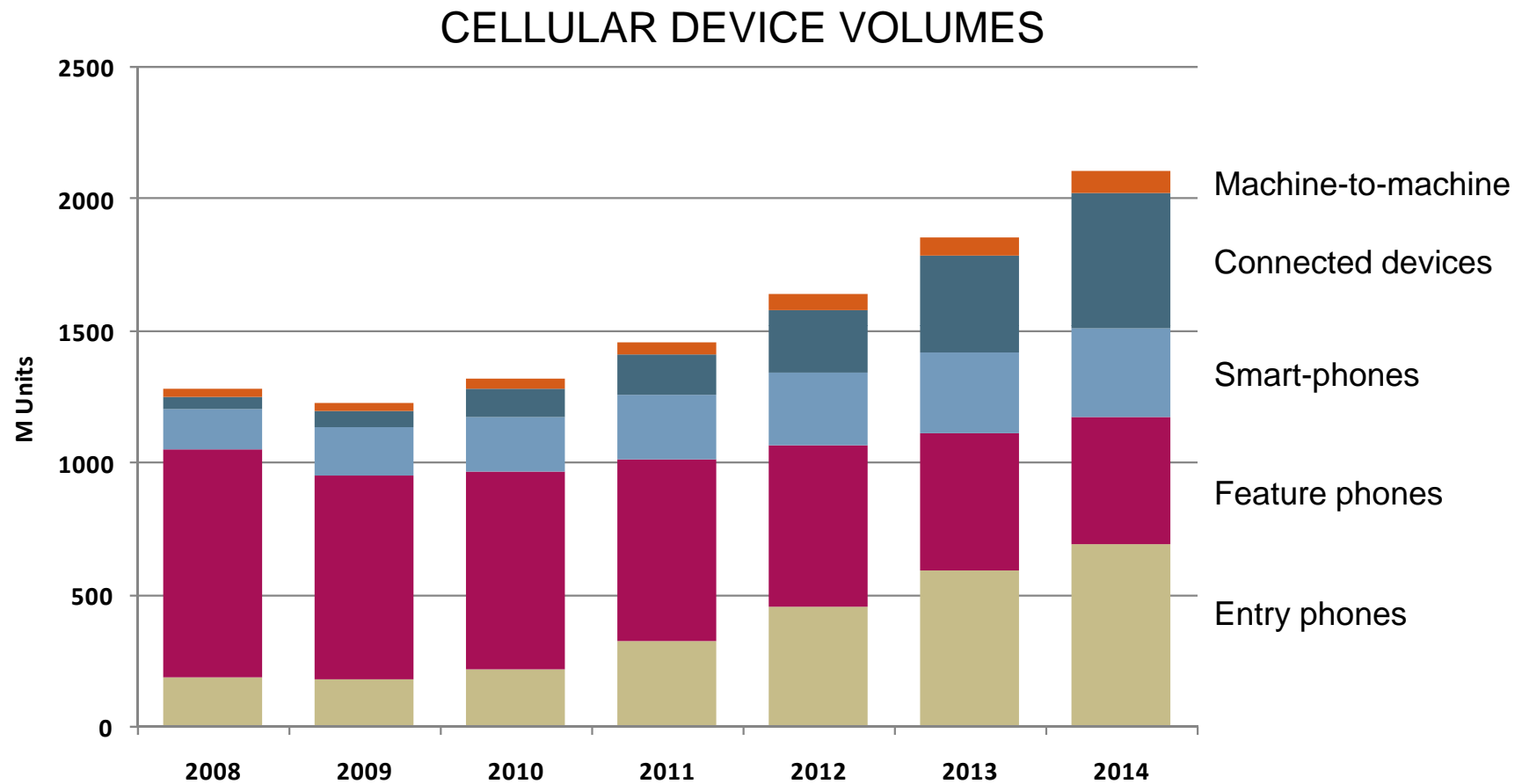**Garmin**
Nuvifone

2/15/2010

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Agenda

- Mobile access technology

  - HSPA

  - LTE

- Smartphone design challenges

- Platforms for mobile

     December 2009

MOBILE ACCESS TECHNOLOGY

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GROWTH IN MOBILE AND WIRELESS

CELLULAR DEVICE VOLUMES

Source: ABI Research 3Q09

 December 8, 2009

# 3GPP Spec Progression

Version	Released	Info
Release 99	2000 Q1	Specified the first UMTS 3G networks, incorporating a WCDMA air interface
Release 4	2001 Q2	Added features, including an all-IP core network
Release 5	2002 Q1	Added IMS and HSDPA
Release 6	2004 Q4	Integrated operation with Wireless LAN networks, added enhanced uplink, MBMS and enhancements to IMS such as Push to Talk over Cellular (PoC)
Release 7	2007 Q4	Added downlink MIMO, reduced latency, improved QoS and improvements to real-time applications like VoIP
Release 8	2009 Q1	Included E-UTRA (LTE) and the Evolved Packet Core (SAE) architecture and further enhancements of HSPA (MIMO with 64QAM modulation and dual carrier with 64QAM modulation)

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Mobile Data Network

Feb 2010
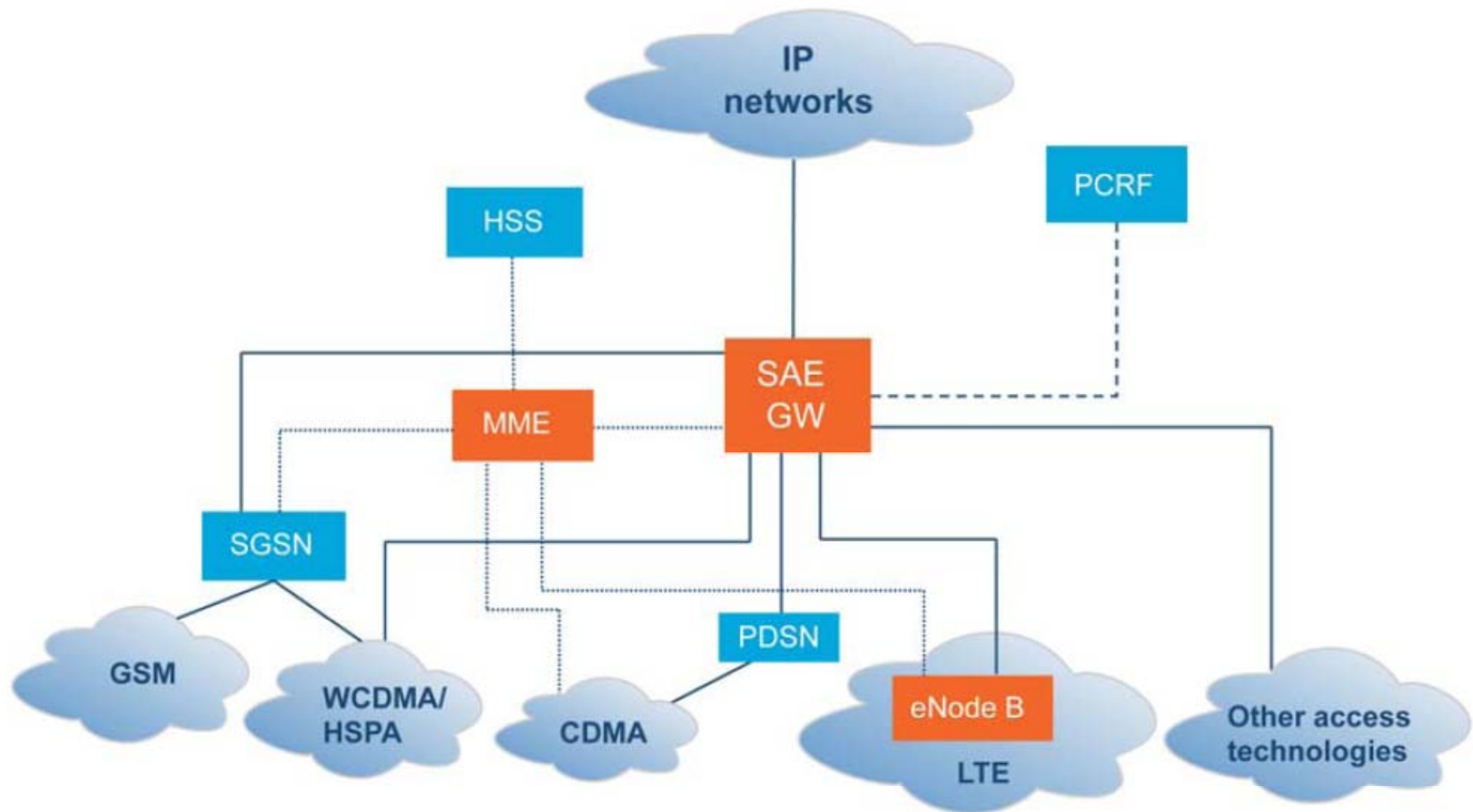
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~6-7 Yrs from Standards Publication to ~50M
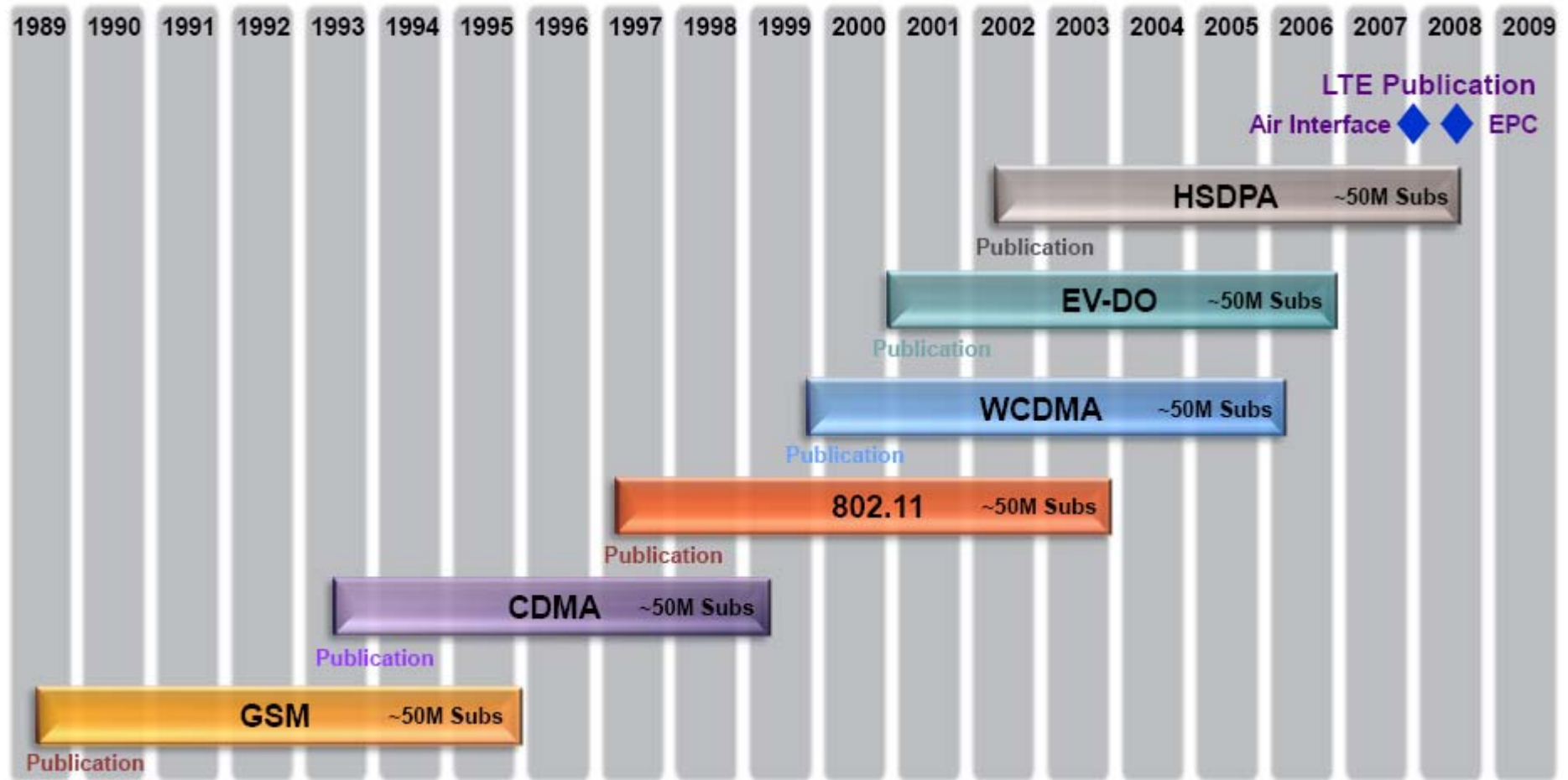
Sources: CDG, Qualcomm, Ericsson, IEEE, 3GPP2 and GSMA. The "first reference publication" date used is the earliest publication date where Qualcomm feels that a set of reasonably complete and consistent specifications were available. Note that the LTE air interface publication date shown is 12/2007, but the core network (EPC) was published mid 2008. A stable ASN.1 code is required for commercial implementation of the standard (LTE R8 ASN.1 freeze expected 1H 2009).

HSPA

CONFIDENTIAL December 2009

What is HSPA?

	HSPA
Physical signal format	DL code aggregation, UL DS-CDMA
Hybrid ARQ with soft combining	Adaptive IR + Chase combining
Multi-level QoS	√
Link adaptation	QPSK, 16QAM, 64QAM Lowest code rate: 1/3
Duplex scheme	FDD
Frequency bands	850MHz to 2,600MHz
Handover	Hard handover, soft handover
Frequency reuse one	√
Advance antenna technologies	• Closed- and open-loop transmit diversity • Spatial multiplexing • Beam forming

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HSPA+²¹ ROLL-OUT IS ACCELERATING

Launched operators with 21Mbps – 2009

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
	- Telstra AUS	- Mobilkom AUT - CSL Limited HKG - StarHub SIN		- Cosmote GRE - Vodafone GRE	- 3 DAN - 3 SWE - Etisalat Misr EGY - Polkomtel POL - TMN POR - Vodafone POR	- eMobile JPN - Turkcell TUR - Avea TUR - Vodafone TUR	- Zain KUW - Optimus POR	- M Tel BOL - Rogers Wireless CAN - PTC Era POL - Zapp ROU - STC Al Jawal KSA - T-Mobile USA	- M1 SIN

Source:GSA

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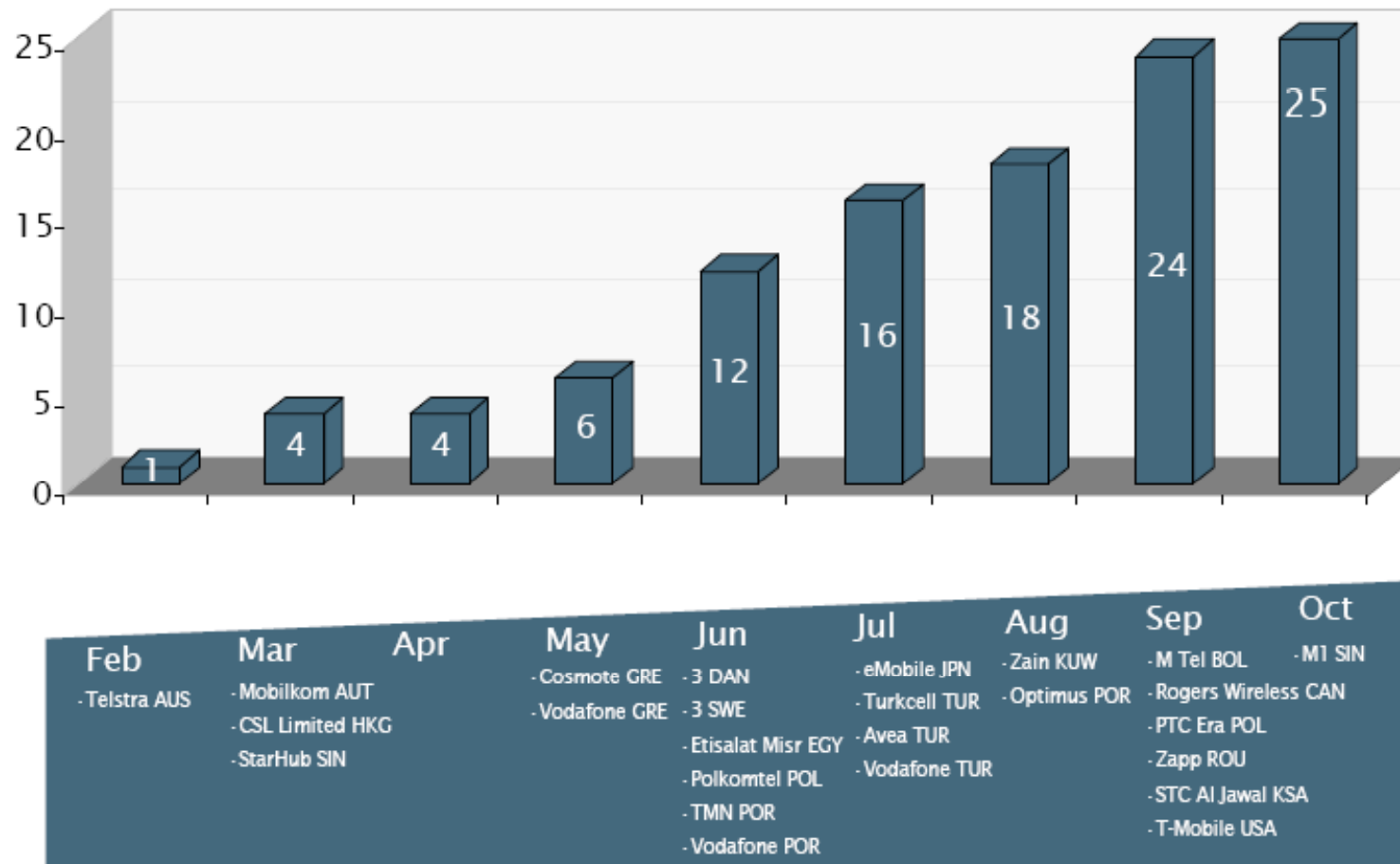
DRIVERS HSPA+[21]

High spectral efficiency and high data rates brings…

- Cost efficient mobile broadband

Smooth network upgrade/evolution with…

- Optimum use of infrastructure, enabling operators to prolong the life of WCDMA systems

Fixed line replacement

- 21 Mbps needed to compete with ADSL and move users to mobile broadband

Drive test	Average throughput (Mbps)
21 Mbps capable	6,97
7.2 Mbps capable	2,97
Comparison	
Typical ADSL at home	2 to 8

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Advanced Antenna

Single Antenna

RX diversity

Same bit stream

TX diversity

TX+RX diversity

MIMO

Different bit streams – on same frequency

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HSPA+ DATA RATES

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LTE

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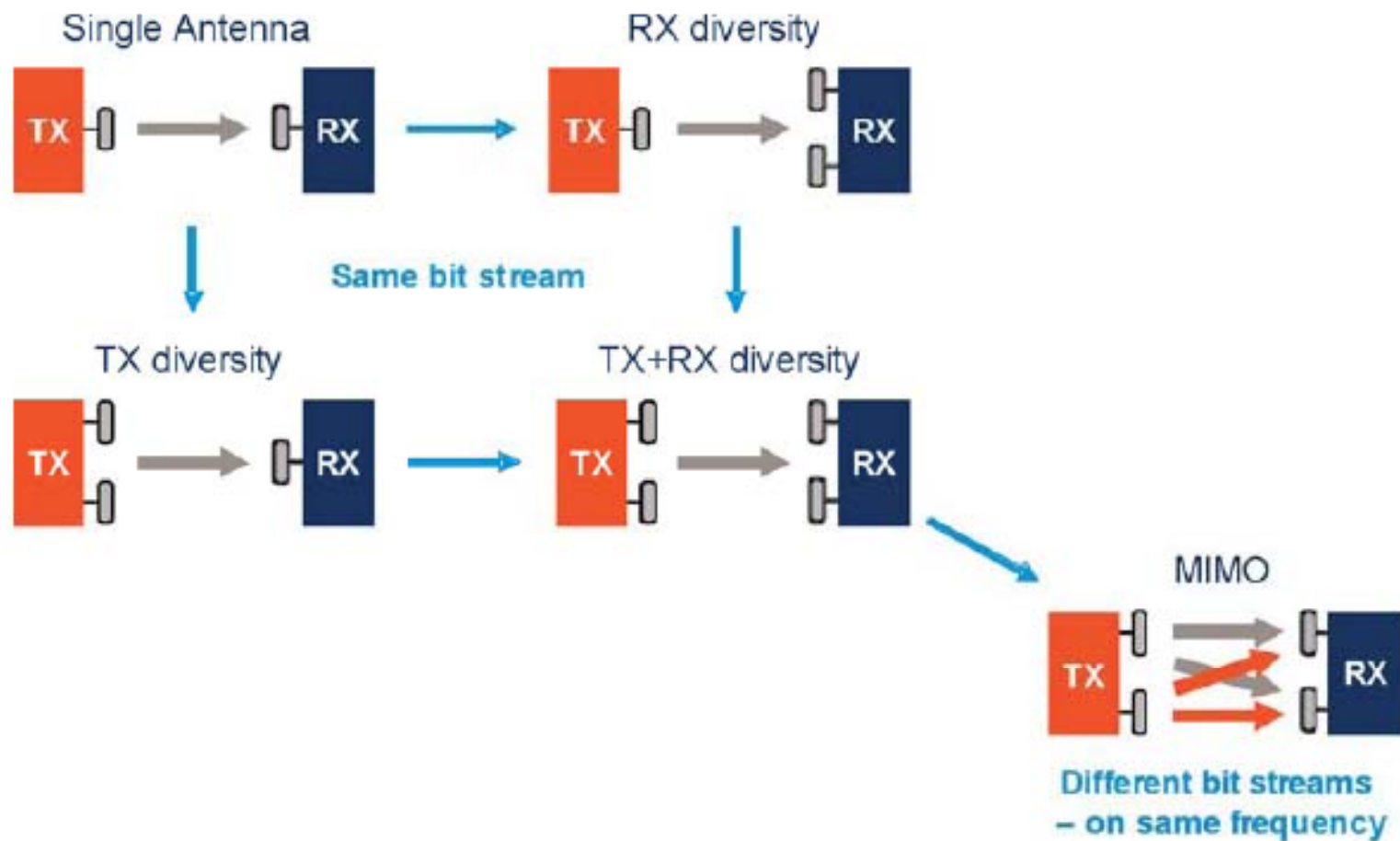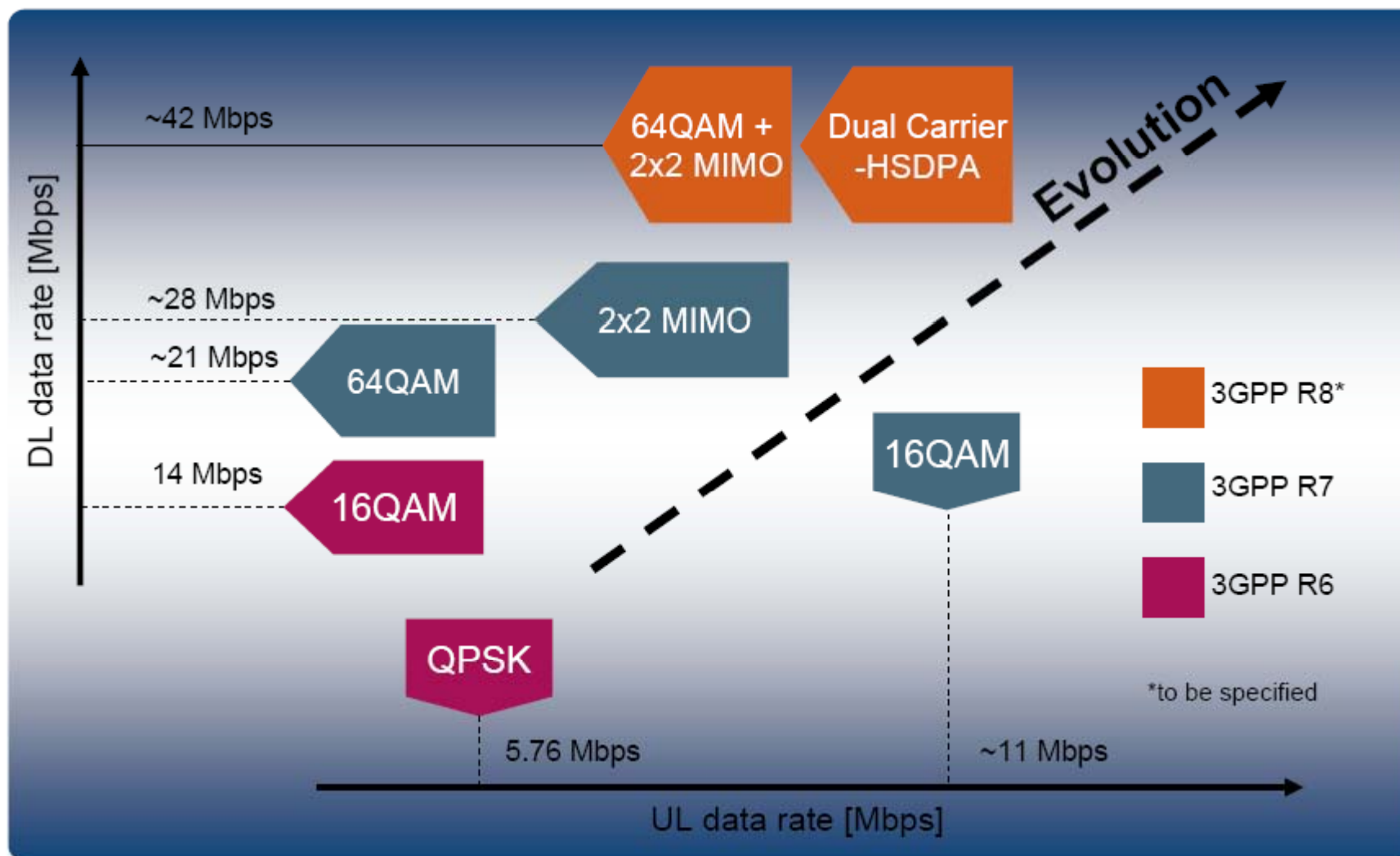
Summary of the 3GPP original LTE requirements

- Increased peak data rates: 100Mbps downlink and 50Mbps uplink.

- Reduction of RAN latency to 10ms.

- Improved spectrum efficiency (two to four times compared with HSPA Release 6).

- Cost-effective migration from Release 6 Universal Terrestrial Radio Access (UTRA) radio interface and architecture.

- Improved broadcasting.

- IP-optimized (focus on services in the packet switched domain).

- Scalable bandwidth of 20MHz, 15MHz, 10MHz, 5MHz, 3MHz and 1.4MHz.

- Support for both paired and unpaired spectrum.

- Support for inter-working with existing 3G systems and non-3GPP specified systems.

What is OFDM?

- OFDM provides spectrum flexibility & enables cost-efficient solutions for wide carriers with high peak rates.
- OFDM is a well-established technology, used in standards such as IEEE 802.11 a/b/g, 802.16, Digital Video Broadcast (DVB) and Digital Audio Broadcast (DAB).

One resource element
QPSK, 2bits
16QAM, 4bits
64QAM, 6bits

$\Delta f = 15kHz$

One resource block
(12x7 = 84 resource elements)

One slot (T_{slot} = 0.5ms, 7 OFDM symbols)

12 sub-carriers, 180kHz

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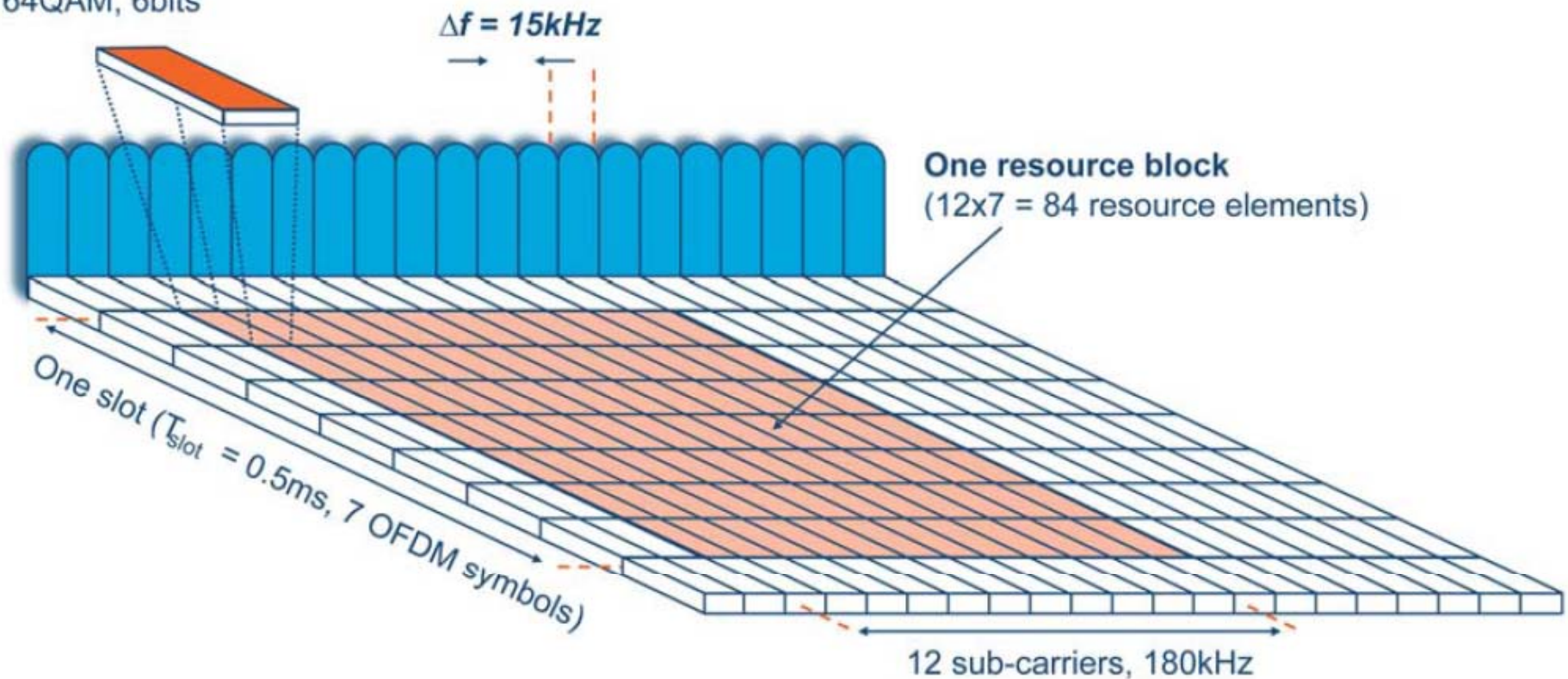
FDD & TDD

Bandwidth flexibility

1.25 MHz

20 MHz

Duplex flexibility

FDD	Half-duplex FDD	TDD
f_{DL}	f_{DL}	$f_{DL/UL}$
f_{UL}	f_{UL}	
Paired spectrum	Reduced UE complexity	Unpaired spectrum
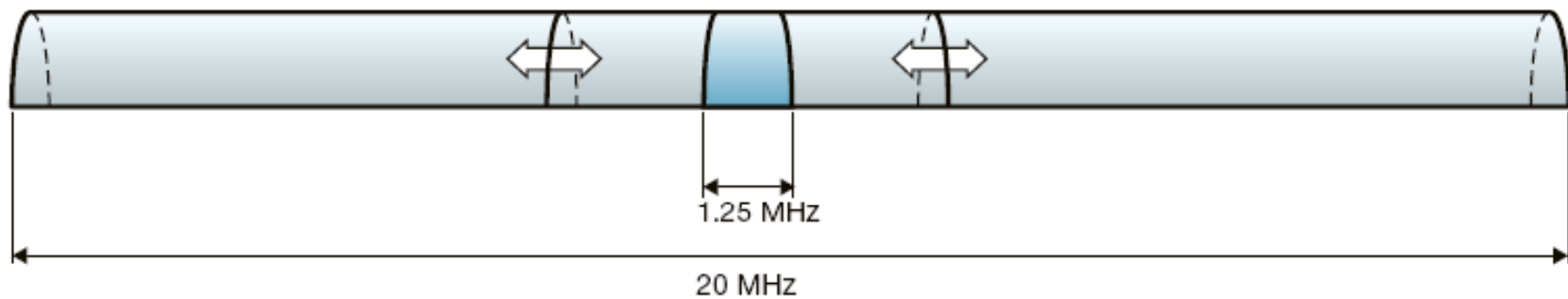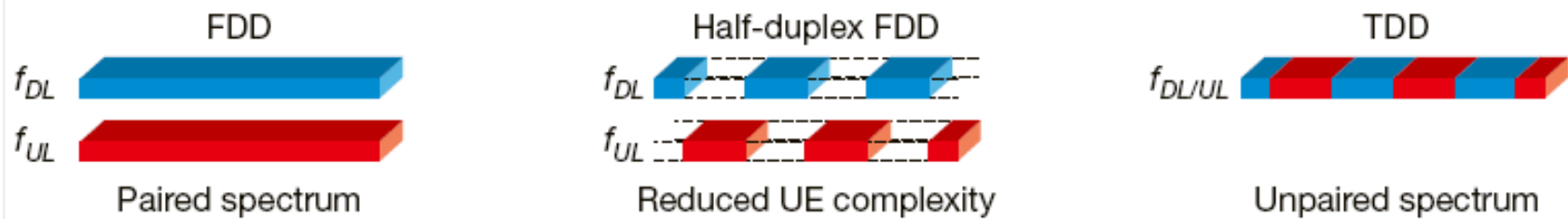
HARMONIZING ACCESS TECHNOLOGIES
Global alignment for WCDMA/HSPA, TD-SCDMA (China) and CDMA

TD Forum

TD-SCDMA

GSM Track (3GPP)

GSM   WCDMA   HSPA

CDMA Track (3GPP2)

CDMA One   EVDO Rev A

LTE
FDD and TDD

2001   2005   2008   2010

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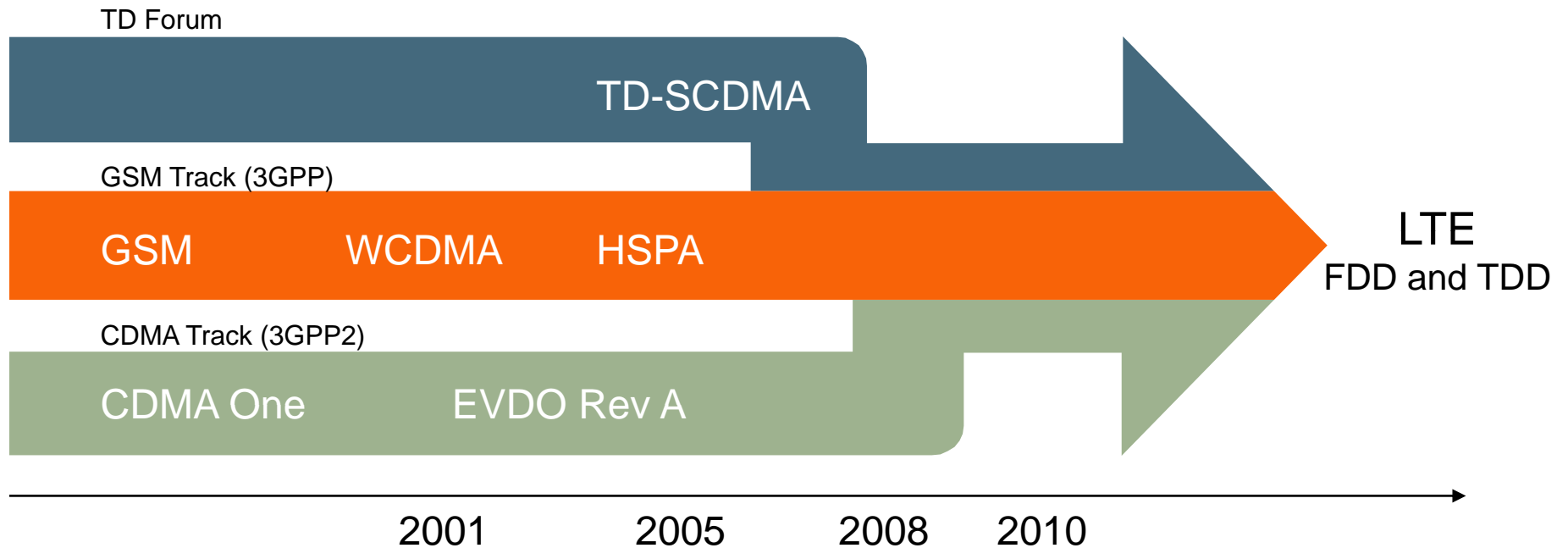
Global LTE Commitments
35+ Operators in over 19 countries

…and more to come

Up to 14 LTE networks are expected to launch commercial services in 2010

Source: Press releases and GSA (26 August, 2009)

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INCREASING NUMBER OF BANDS

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RF COMBINATIONS FOR GLOBAL ROAMING

US version

Core bands:

1	2	4	5/6	8
2100	1900	1700/2100	850	900

| GSM850 | GSM900 | GSM1800 | GSM1900 |

Add-on bands:

12/17	13
700	700

EU version

Core bands:

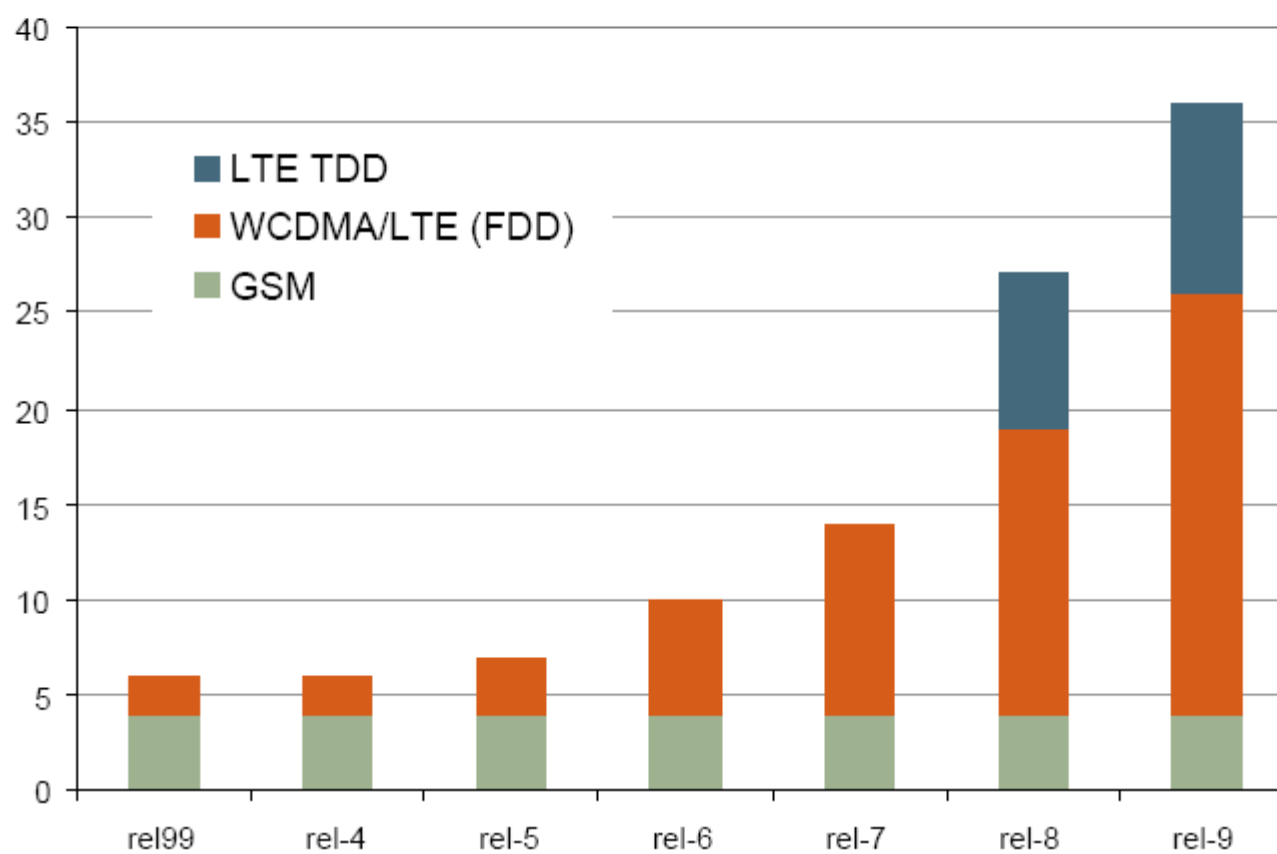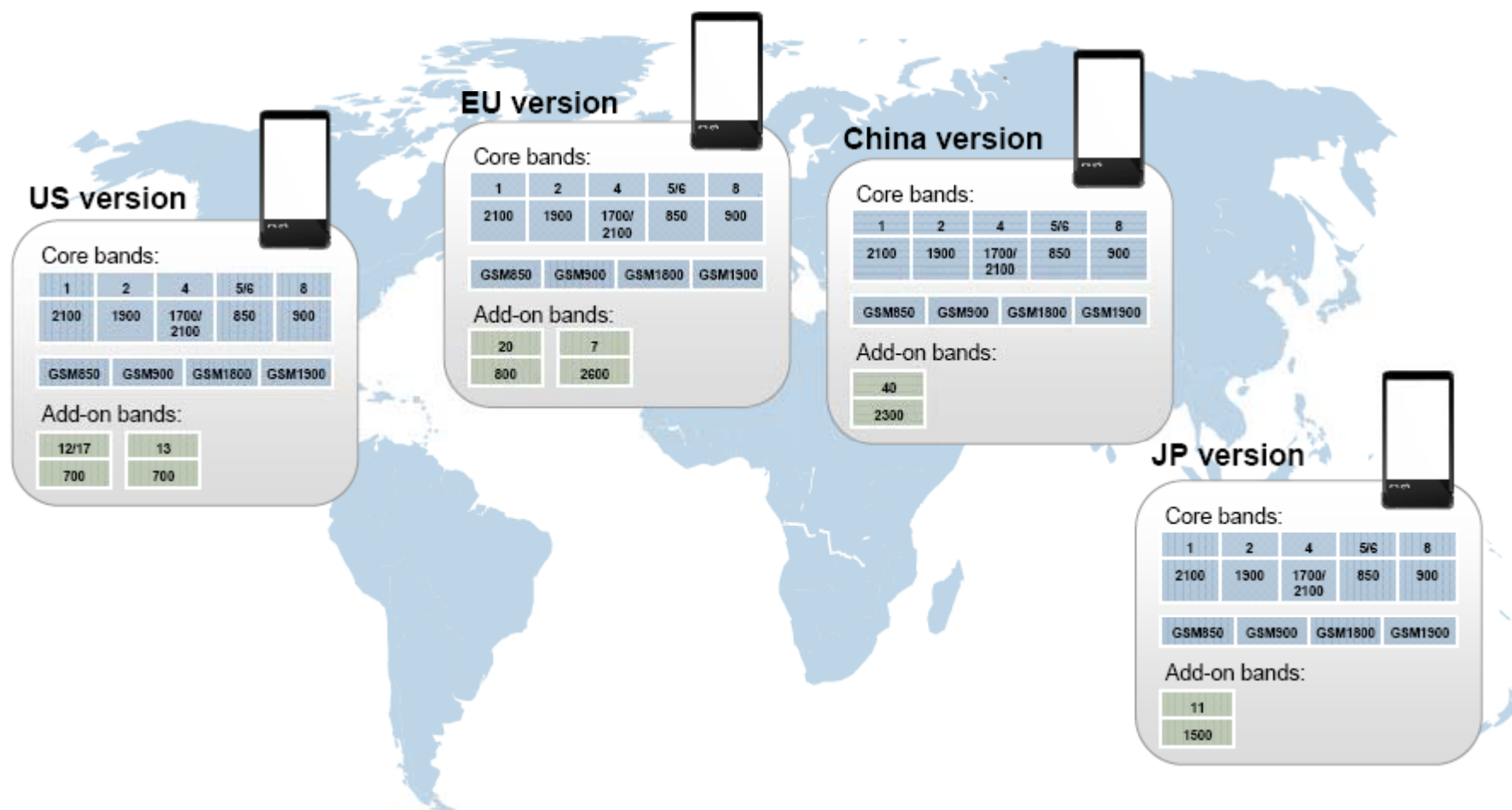| 1	2	4	5/6	8
2100	1900	1700/2100	850	900

| GSM850 | GSM900 | GSM1800 | GSM1900 |

Add-on bands:

20	7
800	2600

China version

Core bands:

1	2	4	5/6	8
2100	1900	1700/2100	850	900

| GSM850 | GSM900 | GSM1800 | GSM1900 |

Add-on bands:

40
2300

JP version

Core bands:

1	2	4	5/6	8
2100	1900	1700/2100	850	900

| GSM850 | GSM900 | GSM1800 | GSM1900 |

Add-on bands:

11
1500

2009-12-05

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SMARTPHONE DESIGN CHALLENGES

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Smartphone Block Diagram

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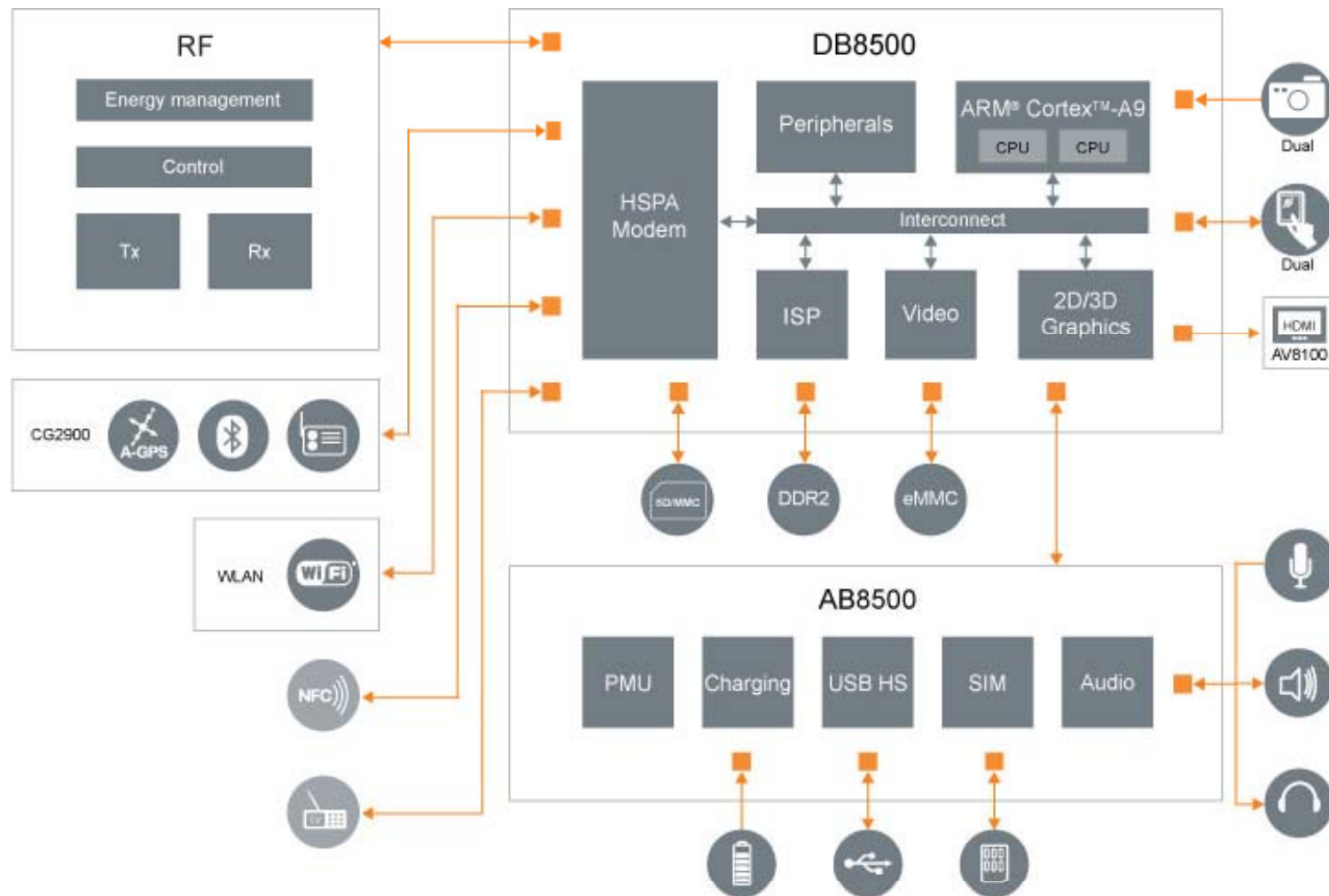
Multi-Core and Ghz Apps Processor

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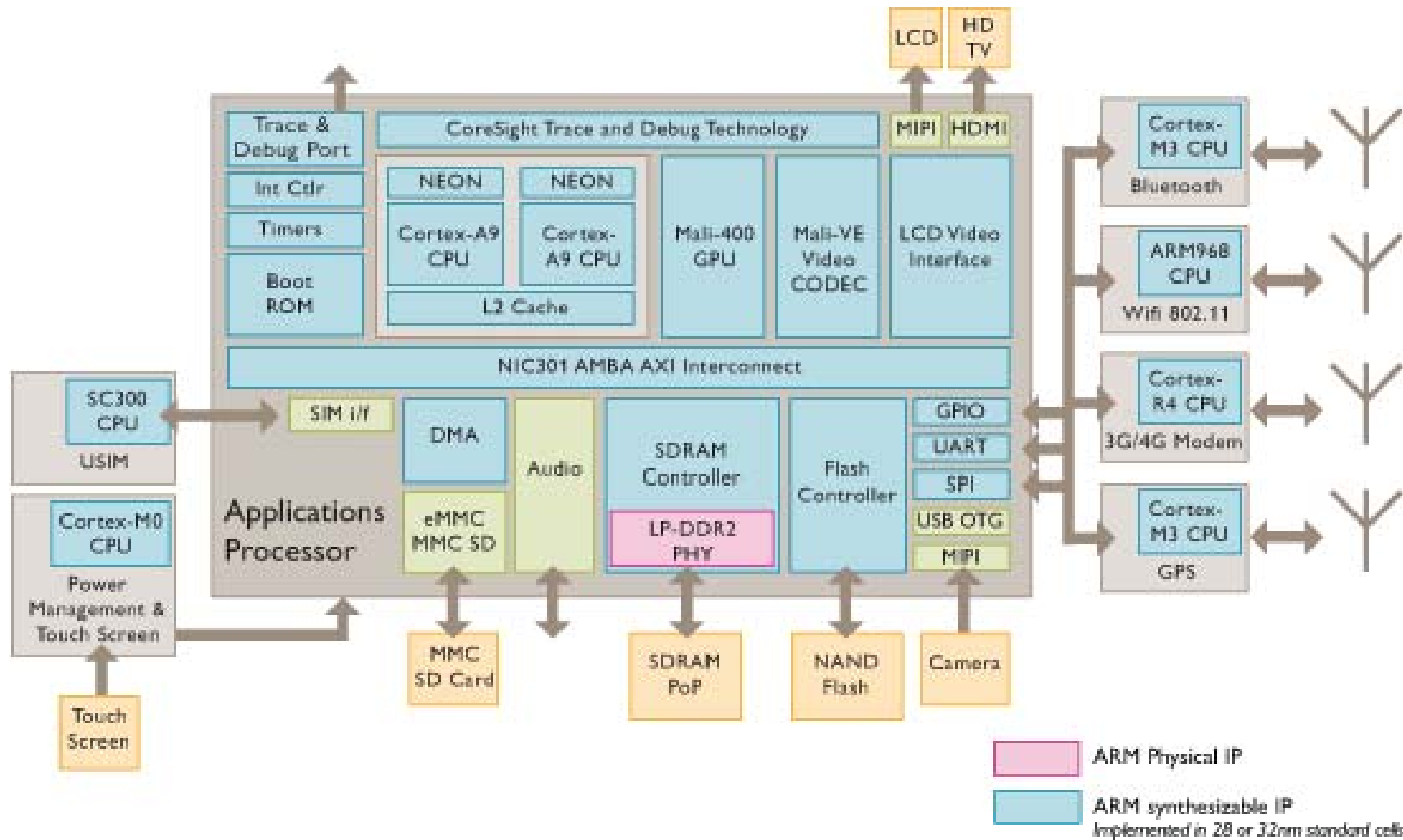
Many Interfaces and SW Options

- Full HD 1080p camcorder, multiple codecs (H264 HP, VC-1, MPEG-4)
- High-resolution, touchscreen display support
- Simultaneous dual display support
- High performance 3D graphics, support for OpenVG 1.1 and OpenGL ES 2.0
- Integrated ISP for Mpix cameras
- Wi-Fi, Bluetooth and GPS
- USB 2.0, HDMI ports
- Multiple operating systems, Symbian, Android and Linux-based platforms
- Mobile TV standards

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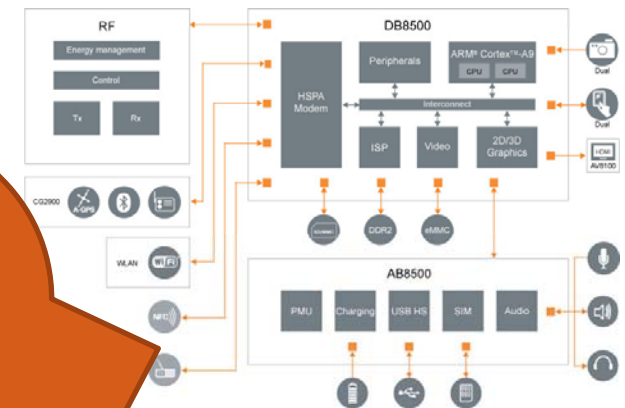
7 Radios in One and Multi-Bands Support

27 bands ranging from 700 Mhz to 2.6 Ghz in Rel 8

2.4 Ghz

100 Mhz

1.6 Ghz

2.4/5 Ghz

13.56 Mhz

700 to 1.5 Ghz

DB8500

Peripherals

ARM® Cortex™-A9

CPU   CPU

HSPA Modem

Interconnect

ISP   Video   2D/3D Graphics

Dual

Dual

HDMI AV8100

DDR2   eMMC

CG2900   A-GPS

WLAN   WiFi

NFC

AB8500

PMU   Charging   USB HS   SIM   Audio

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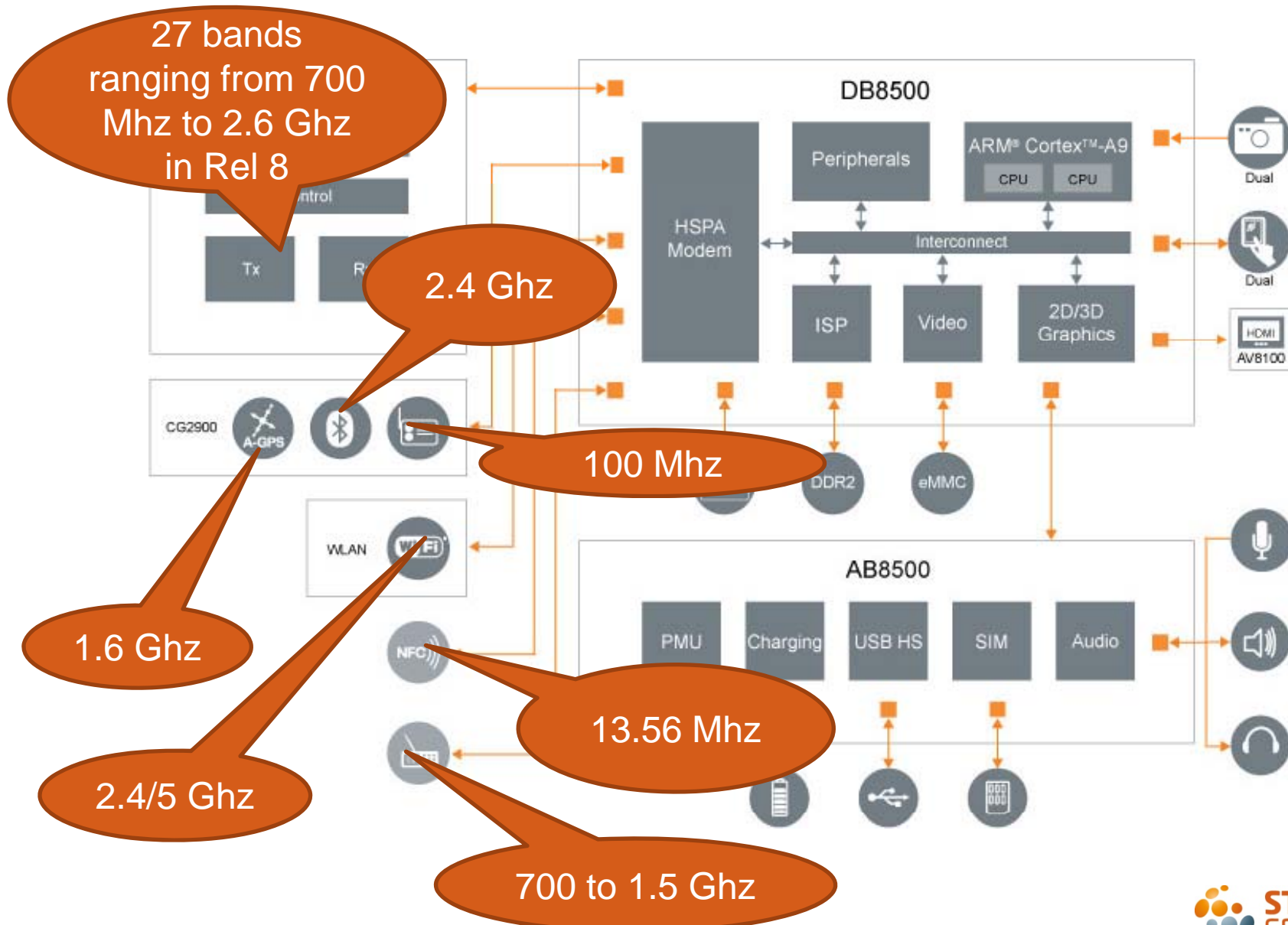
Don't Forget IPR

Technology	Royalty Rate	2005	2006	2007	2008	2009	2010	2011
CDMA	(%)	3.6%	3.8%	3.8%	3.9%	4.0%	4.1%	4.2%
GSM	(%)	4.8%	4.0%	3.8%	3.8%	3.7%	3.7%	3.8%
WCDMA	(%)	10.5%	9.4%	9.4%	9.2%	9.0%	8.7%	8.5%
WCDMA*	(%)	8.6%	7.5%	7.4%	8.1%	7.9%	7.6%	7.4%

*Qualcomm/Nokia WCDMA Royalty Dispute Resolved in Nokia's Favor

Source: ABI Research

PLATFORMS FOR MOBILE

 December 2009

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No One Size Fits All

Embedded Mobility
- Most advanced modems, optimized for application
- *Mobile broadband and M2M devices*

Mobile Computing
- Top performance at low power
- *Mid and High-end smart devices*

Mobile Multimedia
- Multimedia and Smart features at an affordable price
- *Smartphones for All and Feature phones*

Low cost Entry
- Lowest cost with more features
- *Entry markets and lowest cost devices*

Thin Modems

Application Processor & Integrated modem

Entry Platforms

Connectivity and Enhancements

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Platform from ST-E

Legend: LTE · TD-SCDMA · UMTS/HSPA · 2G/EDGE

	In Production	Announced	
Thin Modems	M340 5209 M7211	DEMO M700 NEW M710 DEMO M570 M6718	LTE / HSPA+ Mobility Best combined UL/DL performance Data in every region
Application Processor & Integrated Modem		DEMO U8500	The best Smartphone Platform
Entry Platforms	T7210 U33X 67XX DEMO E4908 490X NEW+Demo U6715	NEW+Demo U68XX E4910 NEW G485X	Smartphones for all Multimedia enabled solutions Single Chip 2G & EDGE
Connectivity and Enhancements	GPS WiFi		Complete Platforms

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PLATFORM PORTFOLIO

	LTE		TD-SCDMA
	UMTS/HSPA		2G/EDGE

In Production	Announced

Thin Modems

Embedded Mobility
- Most advanced modems, optimized for application
- *Mobile broadband and M2M devices*

LTE / HSPA+ Mobility

Best combined UL/DL performance

Data in every region

Application Processor & Integrated Modem

Mobile Computing
- Top performance at low power
- *Mid and High-end smart devices*

The best Smartphone Platform

Entry Platforms

Mobile Multimedia
- Multimedia and Smart features at an affordable price
- *Smartphones for All and Feature phones*

Smartphones for all

Multimedia enabled solutions

Low cost Entry
- Lowest cost with more features
- *Entry markets and lowest cost devices*

Single Chip 2G & EDGE

Connectivity and Enhancements

Complete Platforms

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ENTRY AND LOW COST PHONES

Entry Markets and Lowest Cost devices

Lowest Cost with more features

- Enhanced connectivity and multimedia
- More than voice
- Integration - Single chip
- Best-in-class power consumption
- Industry smallest footprint

NEW

G485X

Single Chip ULC
Dual SIM/Dual Standby
USB Charging

DEMO

E49XX

Quad-band EDGE
850mm2 handset
QVGA & 3Mpix camera

T7210

2 band TD-HSDPA
Quad-band EDGE
QVGA & 3Mpix Camera

67XX

Low cost 3G
HSDPA
Up to 5Mpix Camera

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MOBILE MULTIMEDIA

Smart Multimedia

Linux/Android support

WQVGA screens and H.264 video

HSDPA for fast content sharing

Without compromising on things that matters

Best in class battery life for a 3G Smartphone

High integration for small size

NEW + Demo

U6715

**Affordable Linux/Android
HSPDA
WQVGA & 5Mpix camera**

T7210

**2 band TD-HSDPA
Quad-band EDGE
QVGA & 3Mpix Camera**

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MOBILE COMPUTING

Mid and high-end Smart devices

Top performance at low power

Dual-core processors >1GHz

HD-Multimedia 1080p

Full web browsing experience

Mobile broadband with HSPA+

Powerful 3D Graphics - Open GL ES 2.0

Touch displays, dual screen

Complete solutions with Open OS

DEMO

U8500

Dual-core SMP Cortex A9
1080p HD
Dual Screen support

DEMO

Thin Modems

HSPA+
LTE
TD-HSPA

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EMBEDDED MOBILITY

Mobile Broadband and M2M Devices

Advanced modems

HSPA+, mobile broadband for all devices

LTE, the next evolution for high-speed data

TD-HSPA broadband modems for China

Optimized modems for numerous applications

Modem technology from GSM to LTE

From Smartphones and netbooks to consumer electronics and M2M

NEW

M710

**LTE /HSPA+
Proven hand over
100 Mbps**

DEMO

M570

**HSPA+ 21 Mbps
Simultaneous full speed UL/DL
Best in class thermal heat**

M6718

**Dual mode
TD-HSPA & quad band
EDGE**

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CONNECTIVITY AND ENHANCEMENTS

Integrated into complete platform solutions

GPS
Leading footprint and power

Bluetooth
Fully-integrated single-chip Bluetooth

FM Radio
Over 1 Billion FM radio shipped

WLAN
Outperforms in co-existence with BT

Video
Add HD TV out to your platform

Audio
Extend playtime without reducing quality

Power
Add smart power distribution

CG2900
BT/FM/GPS
First 45nm Combo
Leading footprint size

CW1200
802.11a/b/g/n
< 50mm^2 BOM
Integrated PA, SMPS

AV8100
HDMI/CVBS combo
Full HD 1080p
7.1 audio surround

AV5230
102 dB SNR
Integrated headset AMP
Playback Time Extender

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THANK YOU

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