New IEEE Standards for Wireless Sensor Networks

DWA – Company Overview

Position

Leading provider of the most competitive wireless solution for Data and Voice Applications

Milestones

Established global wireless standards 802.15.4b for building automation.

Developed highly integrated wireless IP solutions for Building Automation

Establish strategic alliances with Danfoss, Funkwerk, Frauenhofer Institute, FHTW, Samsung and Eaton

Consulted Projects with IP Know-How Based on WLAN, WPAN, DECT, GSM/UMTS, Bluetooth and Tetra

Description

Established	Since August 1992
Headquarters	Berlin, Germany Since September 2003
Team	5 Fulltime; 5 Temporary
Core Competency	Wireless IP Standard RF Chip, SoC and PCB Solutions
Target Applications	Building Automation High Speed Data Wireless Voice (oIP)

Spectral Density is the Foundation of Wireless Communication

Data Streaming (Access Points)

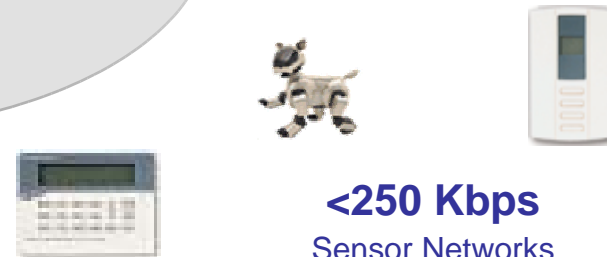**250 – 100.000 Kbps**
Voice & Data Communications

Voice & Video Streaming

5Mbps – 1Gbps
MuiltMedia

Bandwidth
Spectral Density

< 2.000 Kbps
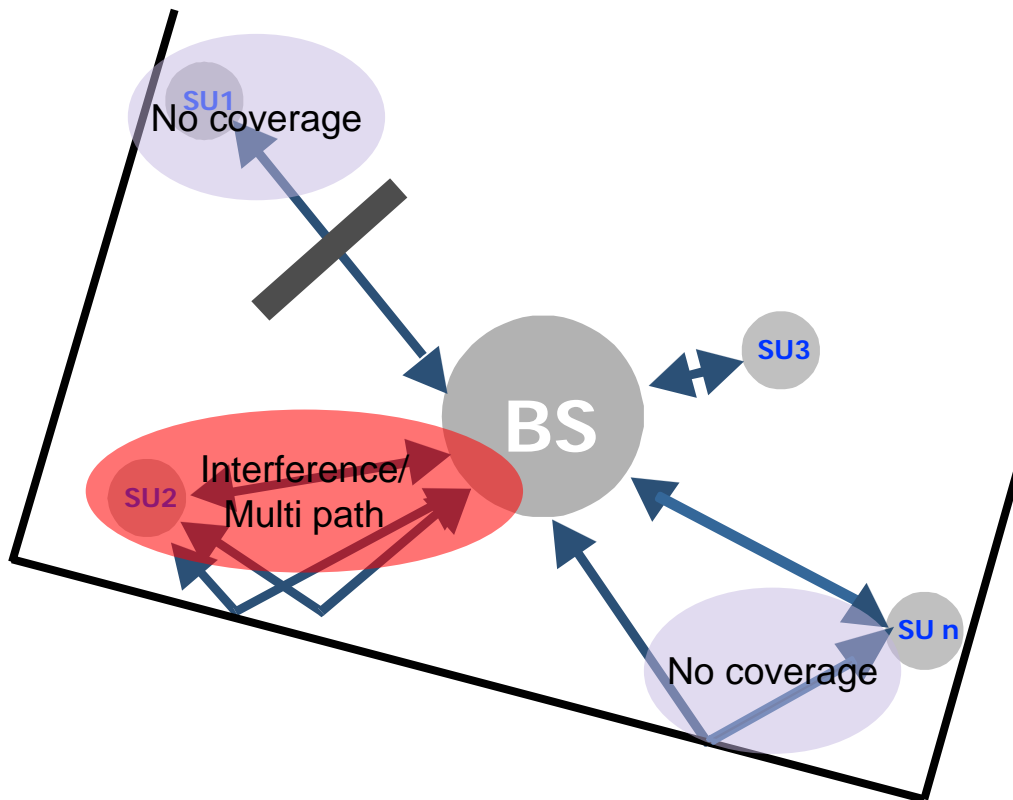Voice Communications

Mobile Handsets (Voice)

<250 Kbps
Sensor Networks
Building Automation

Building Automation

Wireless Application Challenges

Real wireless applications (especially indoor) are challenged by various issues

Challenging Issues:

- **Interference**
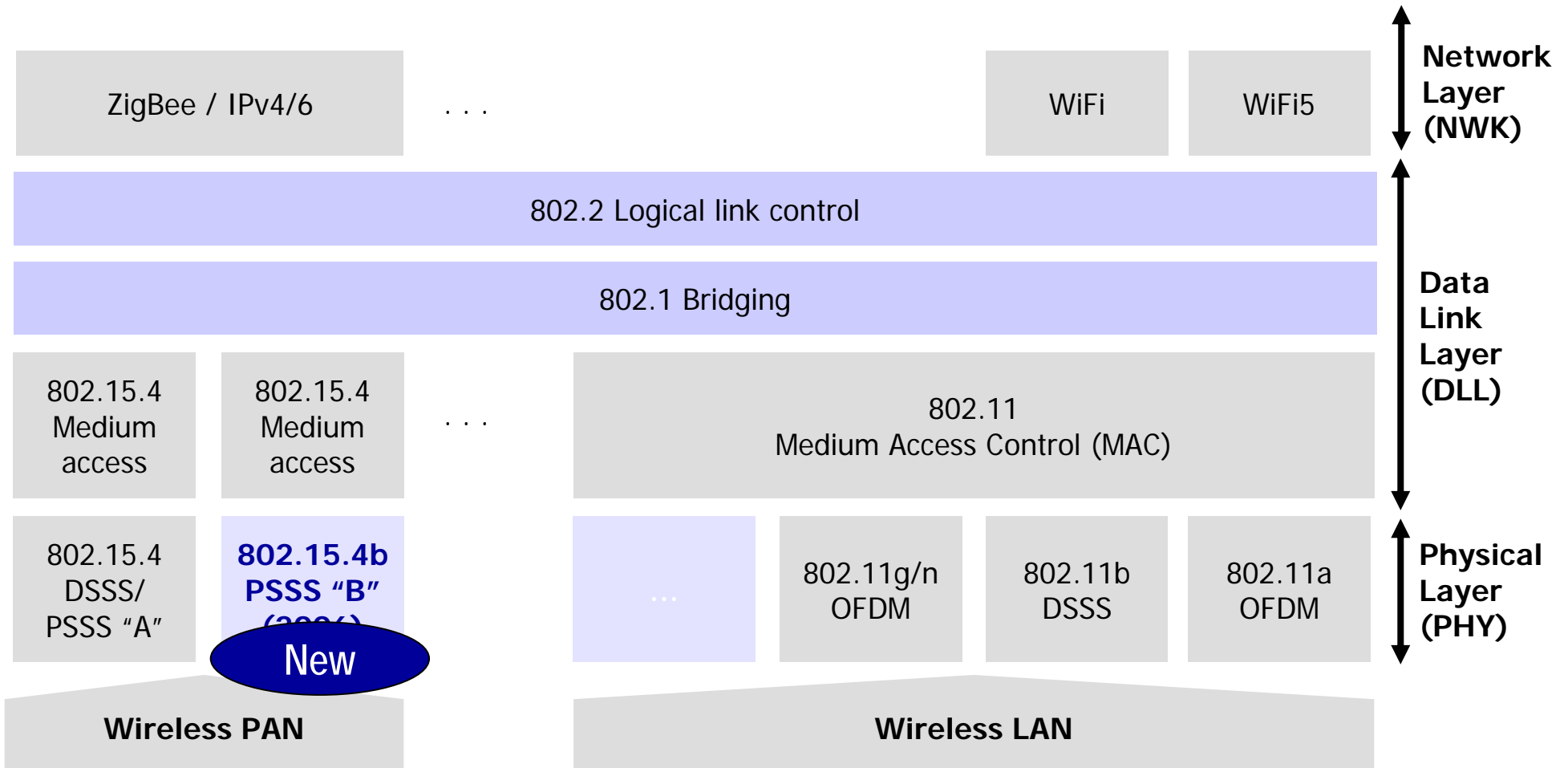- **Multi-path fading**
- **Range & coverage**
- **NLOS**
- **Spectral density (data rate)**

Application demands:

- **Highest reliability / data rate (QoS)**
- **Long range / Full coverage**
- **Many subscribers (nodes)**
- **Low power consumption**
- **Low system cost**
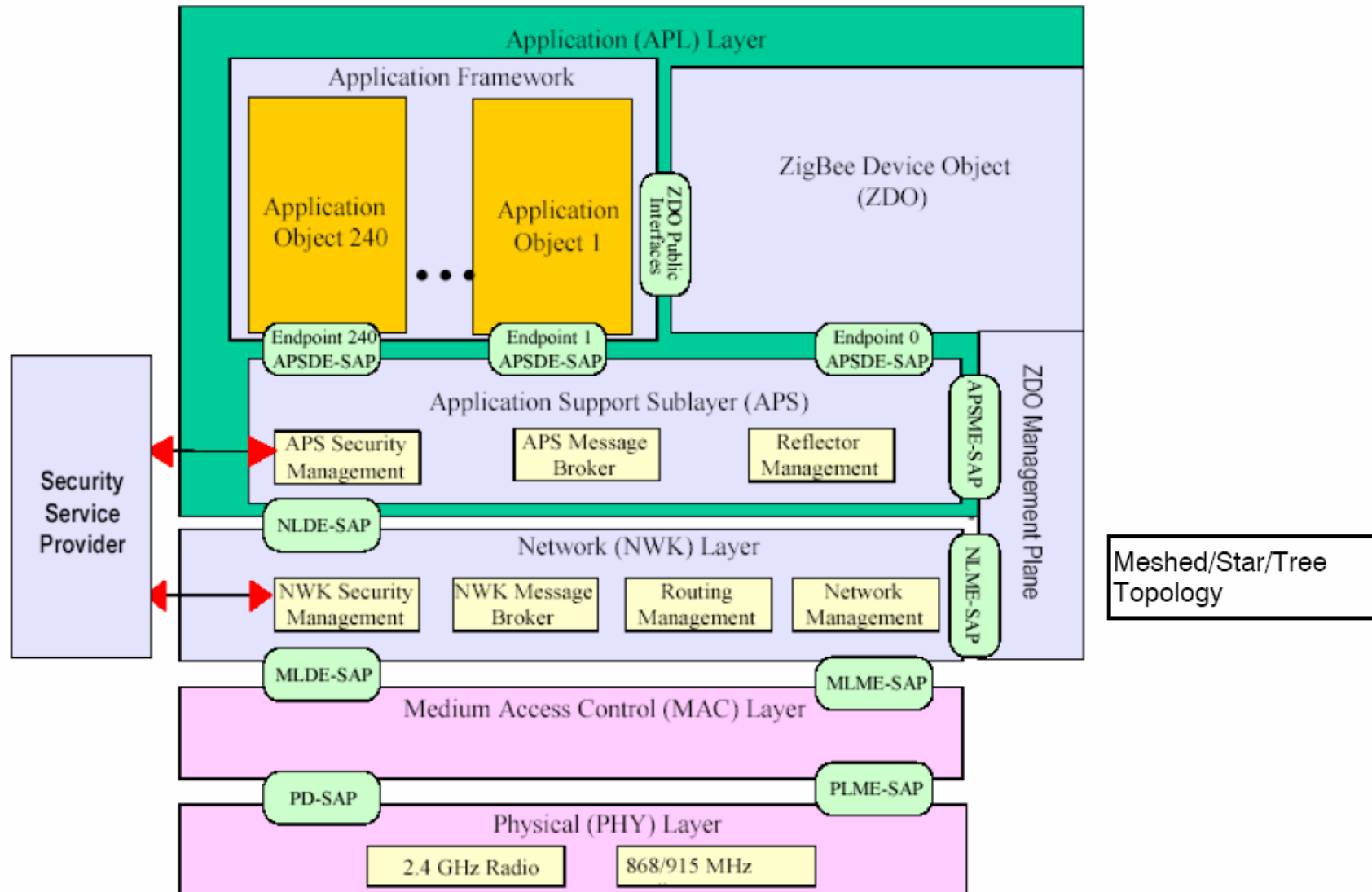- **Co-Existence with e.g. WLAN, Bluetooth**

SU1
No coverage

SU3

BS

SU2
Interference/
Multi path

SU n
No coverage

DWA WIRELESS GMBH

IEEE Solutions
IEEE Standards of 802.15.4b PHYs

ZigBee / IPv4/6	. . .			WiFi	WiFi5	**Network Layer (NWK)**
802.2 Logical link control						
802.1 Bridging						**Data Link Layer (DLL)**
802.15.4 Medium access	802.15.4 Medium access	. . .	802.11 Medium Access Control (MAC)			
802.15.4 DSSS/ PSSS "A"	**802.15.4b PSSS "B" (2006)**	...	802.11g/n OFDM	802.11b DSSS	802.11a OFDM	**Physical Layer (PHY)**

New

Wireless PAN

Wireless LAN

PSSS: Parallel Sequence Spread Spectrum

ZigBee Standard

Source: White Paper ZigBee, www.zigbee.org

Meshed Network Topology

Bridge / Gateway

Mobile Handset
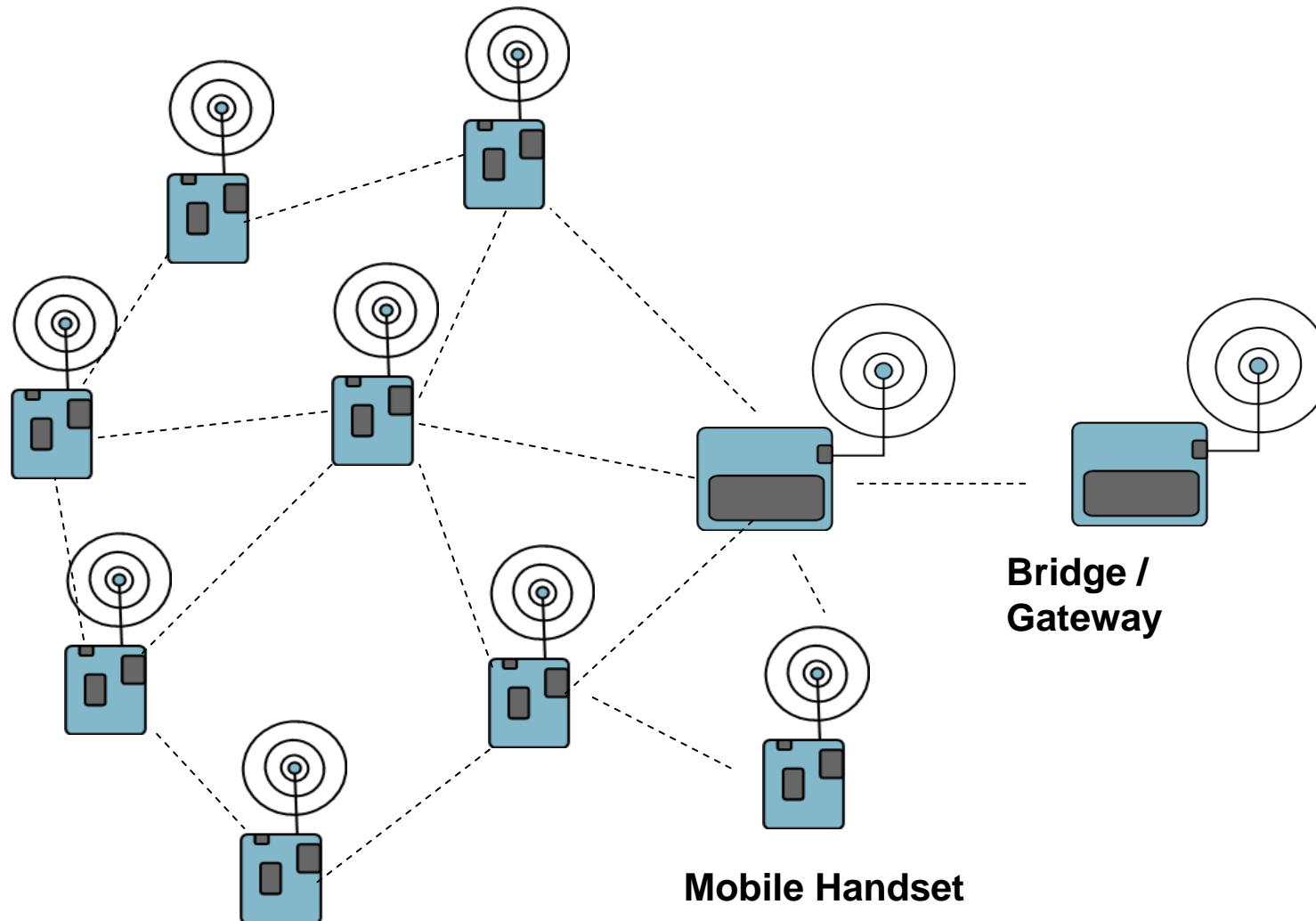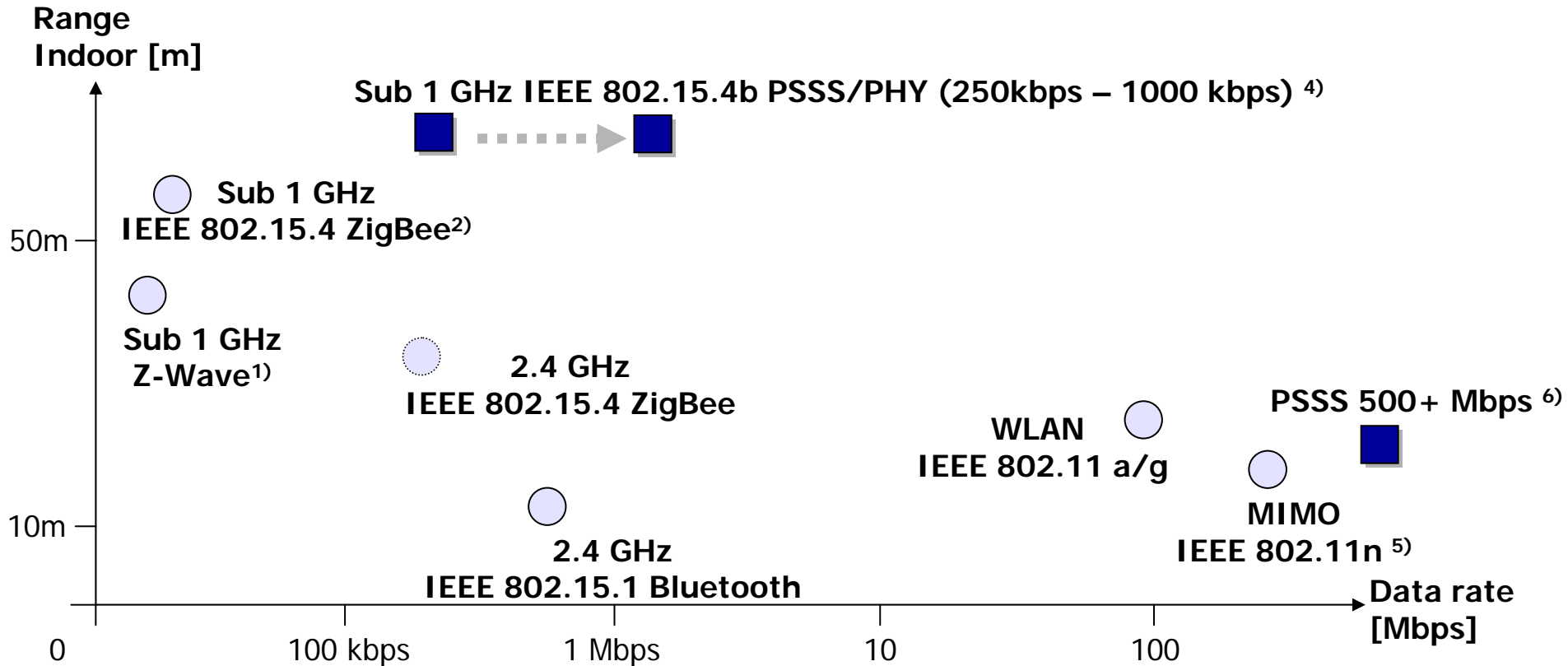
IEEE Standards
Data Rate vs. Range

802.15.4b PSSS/PHY solution improves existing wireless IC solutions from 20 kbps to 250 kbps – with performance mode up to 1000 kbps.

**Range
Indoor [m]**

Sub 1 GHz IEEE 802.15.4b PSSS/PHY (250kbps – 1000 kbps) [4]

**Sub 1 GHz
IEEE 802.15.4 ZigBee[2]**

50m

**Sub 1 GHz
Z-Wave[1]**

**2.4 GHz
IEEE 802.15.4 ZigBee**

PSSS 500+ Mbps [6]

**WLAN
IEEE 802.11 a/g**

**MIMO
IEEE 802.11n [5]**

10m

**2.4 GHz
IEEE 802.15.1 Bluetooth**

**Data rate
[Mbps]**

0   100 kbps   1 Mbps   10   100

1)   Z-Wave FSK based 10/40 kbps EU/US. No IEEE Standard.
2)   IEEE 802.15.4 868/915 MHz system 20/40 kbps EU/US.
3)   In combination with OFDM (high complexity of IC).
4)   1 Mbps proprietary.
5)   Draft IEEE Standard.
6)   Factor 10 less complex (gate count) then Mimo OFDM. Could be build with today in mass markets available components.
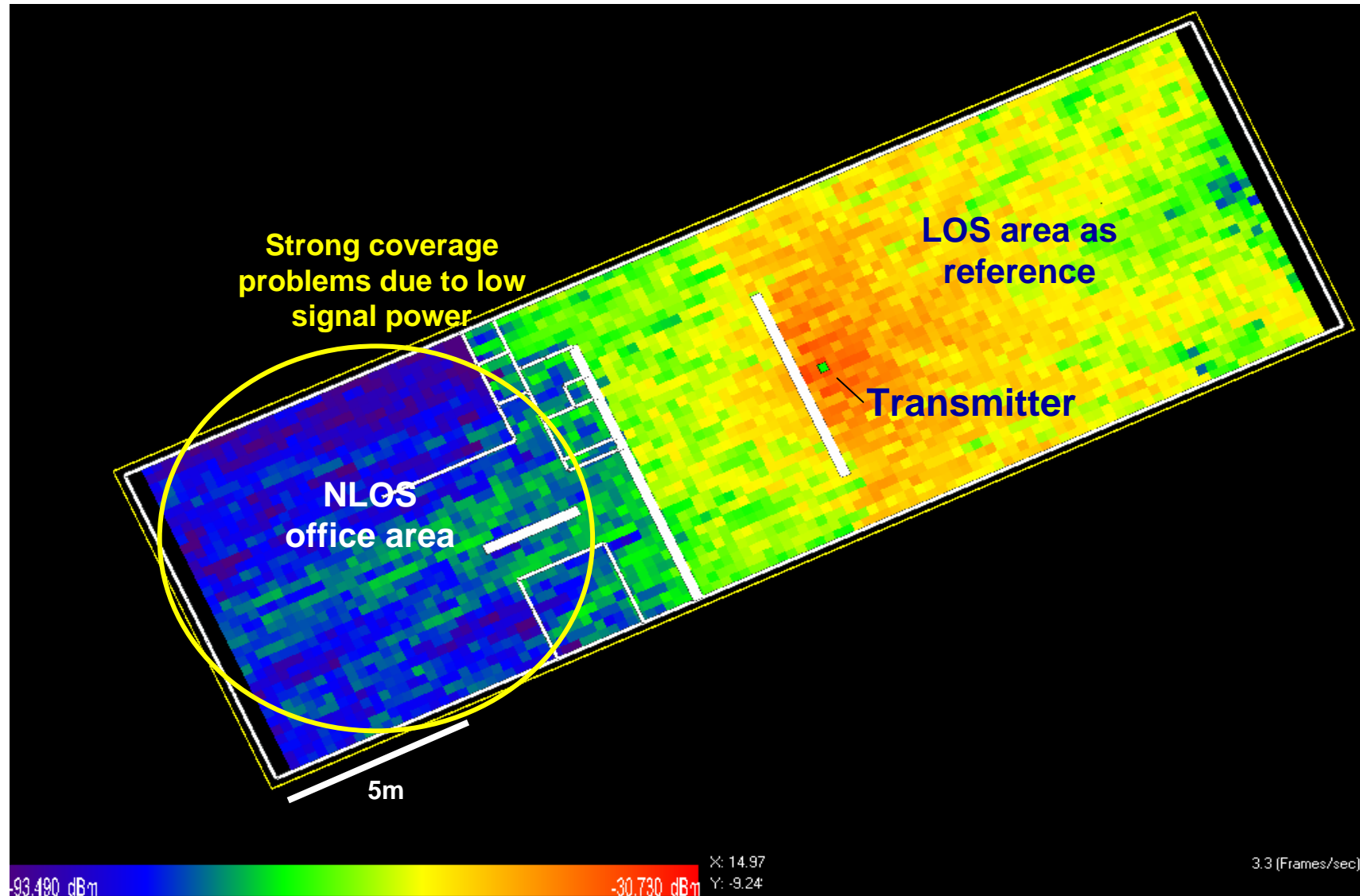
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IEEE 802.15.4b Performance Facts

- **2.4 GHz based solutions will cause performance problems due to interference with WLAN and Bluetooth. [1]**

- **Sub 1 GHz band is highly attractive due to less inference probability and better physical range. [1]**

- **Existing Sub 1GHz solutions limited to 20/40 kbps EU/US data rate (old IEEE 802.15.4).**
  - Limited number of nodes due to 1% duty cycle limitation by ETSI.
  - Not usable i.e. for Building Automation [2]

- **ZigBee offers 250 kbps in 2.4 GHz.**

- **IEEE 802.15.4b base for 250 kbps even in Sub 1 GHz (EU and US) with low cost and lower power consumption.**
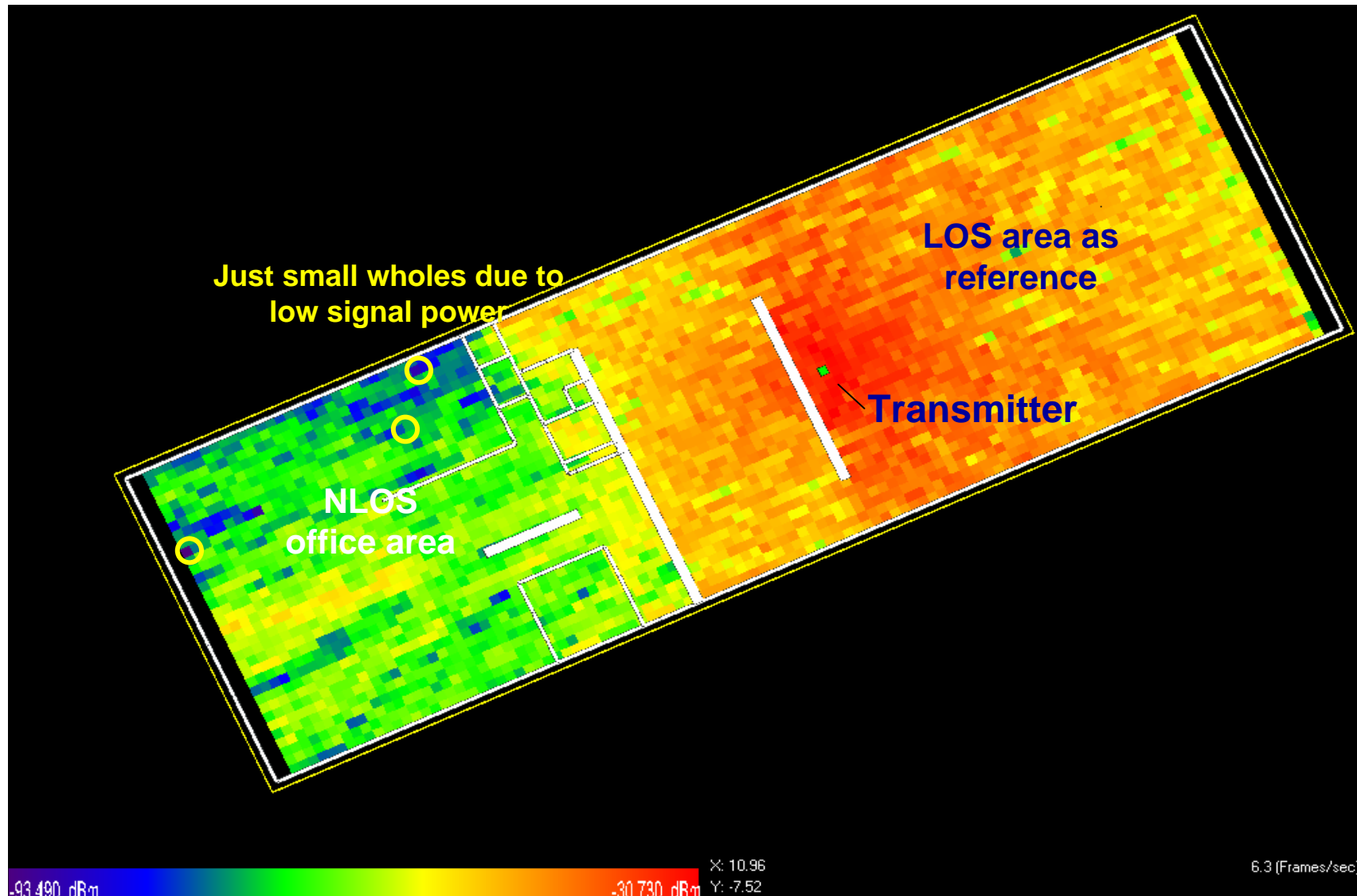
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1) Søren Hansen, Danfoss A/S, Nordborg, DK, Experience with Mesh Network Stacks in residential applications, Z-Wave Alliance- Z-Wave vs. ZigBee - CTC - 14 June 2005.
2) Dipl.-Ing. Kurt Speelmanns, Bundesamt für Bauwesen und Raumordnung, VDI Fortschritt-Berichte VDI, Wireless Technologies, 8. Kongress Sept. 2006, page 219.

DWA WIRELESS GMBH

Strong coverage problems due to low signal power

LOS area as reference

NLOS office area

Transmitter

5m

-93.490 dBm   -30.730 dBm   X: 14.97 Y: -9.24   3.3 (Frames/sec)

Building Automation & Security Application

GMS: Building Management System

DECT / WLAN ISM Gateway

GMS

Driver

IP | DECT / WLAN

IP Netz

DECT / WLAN | ISM

RS232
Gateway
ZIF

Interface

i.e.
wired temperature
sensors

ISM **Module**

ISM

ISM

ISM

ISM

i.e.
Mobile Fire Detector

DWA WIRELESS GMBH

DWA
Product Portfolio

Chip & Module Products	**Module design**	ZigBee or IPv4/6 Module	ZigBee or IPV4/6 Module Turbo	Video Module	1 Gbps Module	**Application sales**
	Chip design (system on chip)	15.4b CMOS Chip	15.4b CMOS Chip Turbo	Video CMOS Chip	1 Gbps CMOS Chip	**Chip sales**
Core & Implementation IP	**Implementation (IP)**	Customized Design	Customized Design	Customized Design	Customized Design	**IP & Design Support**
	Core (IP)	Standard 15.4b TRX-core	Standard 15.4b+ TRX-core	PSSS Video TRX-core	PSSS 1 Gbps TRX-core	**License sales**
	Intellectual Property (IP)	PSSS Version "A/B"	PSSS Version "B+"	PSSS "C"	PSSS "D"	**Patents**

PSSS: Parallel Sequence Spread Spectrum

Product Roadmap IEEE 802.15.4b

Eval Boards & Modules

Q4/06

Q4/07

Module „15.4b"

FPGA Module „B"
Eval Board

IEEE 802.15.4b Device

Q3/07

SoC/Chip 15.4b

IEEE 802.15.4b Reference Design

Q4/05

50 – 70 k gates

PSSS 802.15.4b Reference Design

PSSS IP

IP for High Data stream

IP for Voice/Video (oIP)

IP for Data

2005   2006   2007
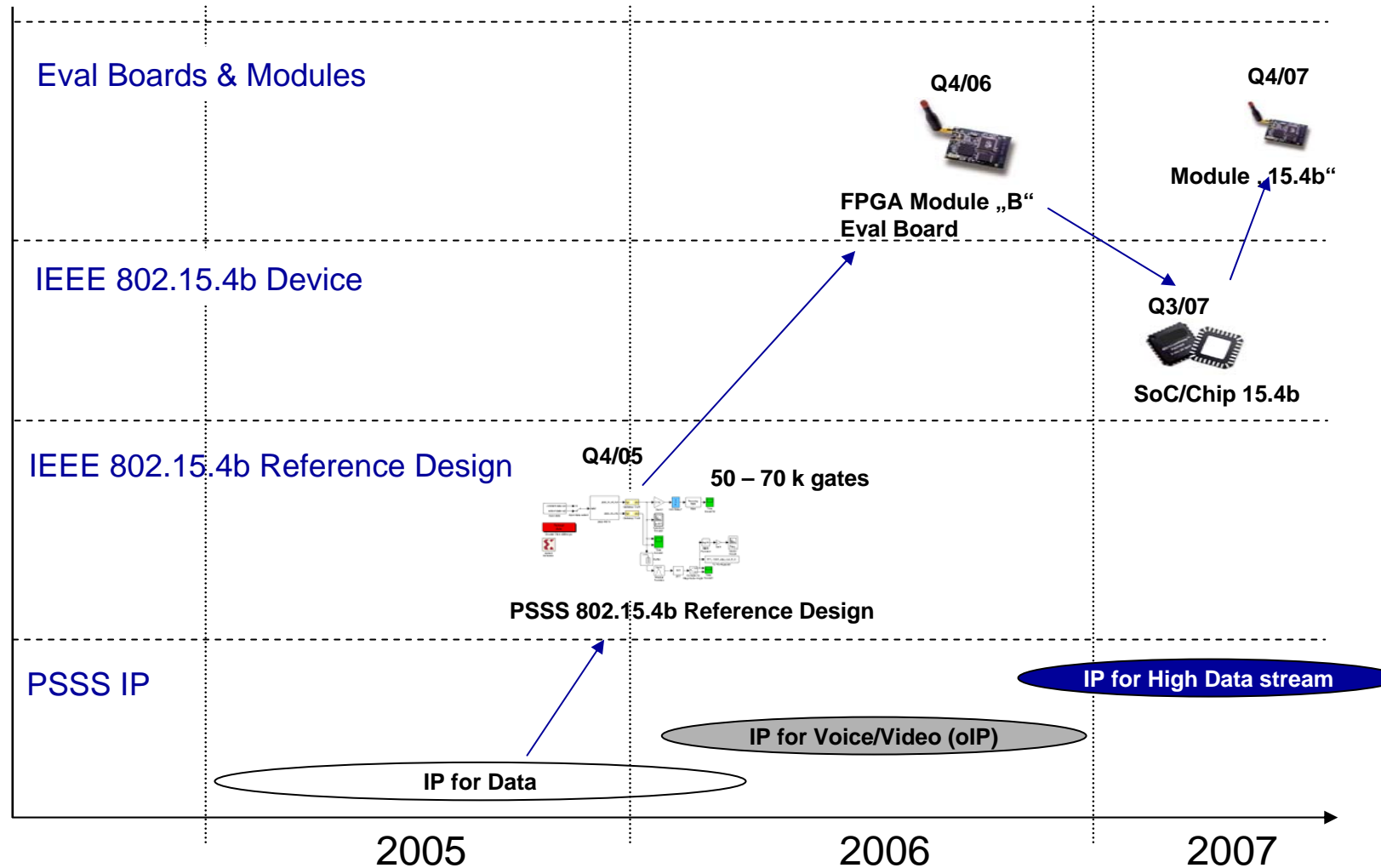
PSSS: Parallel Sequence Spread Spectrum

Further Questions?

- **Thank You**

- **Contact:**
  - www.dw-a.com.
  - info@dw-a.com.