

DecaWave's ScenSor DW1000: The World's Most Precise Indoor Location and Communication CMOS Chip



IdTechEx USA 2013

Meet DecaWave at Booth #04 // Santa Clara Convention Centre November 20 - 21st 2013

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AGENDA

DecaWave Introduction



The Product: ScenSor DW1000

Markets and Applications

DecaWave Launches Industry's Most Precise Indoor Location and Communication CMOS Chip

Latest News and PR

Some Facts: RTLS TDOA performance



DECAWAVE INTRODUCTION

Introducing DecaWave

- DecaWave is a Fabless Semiconductor Company designing and bringing to market a family of IEEE802.15.4-2011 compliant Integrated Wireless Transceivers called ScenSor based on Ultra Wideband Technology
- We make Integrated Wireless Transceivers, integrated radio transmitter and receiver on the same piece of silicon
- **Our Wireless Transceivers can also Locate things.**
We allow RTLS, WSN and IoT Systems to reach unprecedented performance levels at consumer costs.

OUR VISION

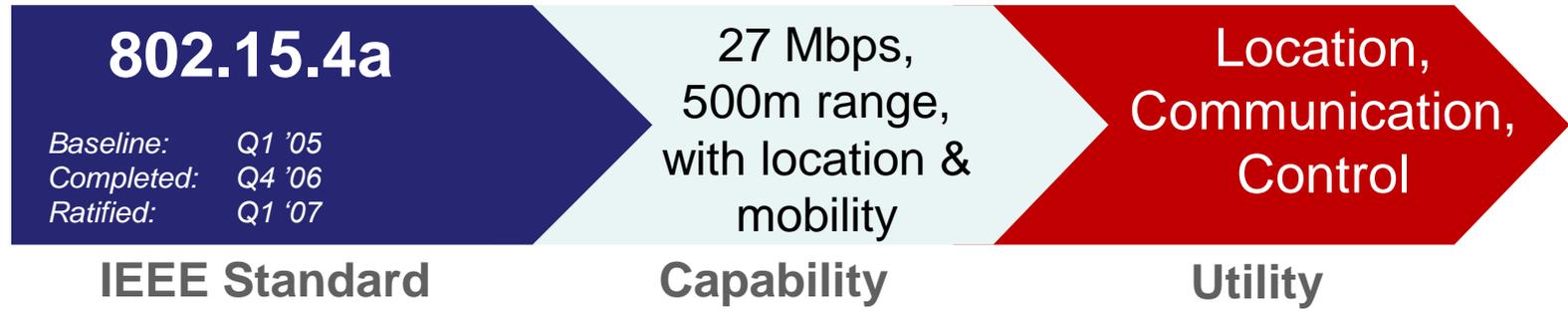
“The Internet of Things”

A World where anybody or anything can locate and communicate between any other person or thing, made possible by pervasive, extremely low power, low cost, high data rate wireless transceivers.

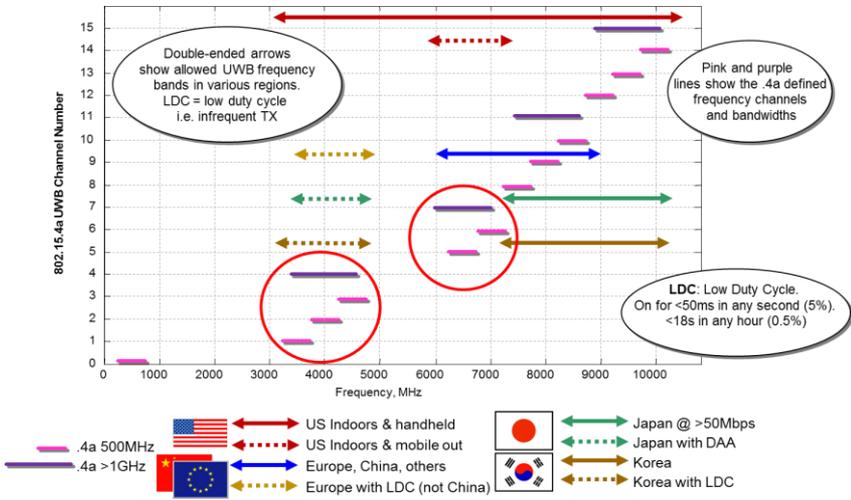


IEEE802.15.4-2011 Standard Compliant

- "An international standard for an **ultra-low complexity, ultra-low cost, ultra-low power consumption** alternate PHY for IEEE Std 802.15.4."



- Band plan facilitating Worldwide Deployment



A Strong Market Traction

Total
Quality Leads

1833

Samples ordered
From September 2013

4450 IC Samples
250 EVBs

Production Ramp-up
From November 2013

Strong Backlog



- For a first Product introduction, there is already a very strong market traction
- Very solid design-in backlog
- Increasing Worldwide demand
- Early Adopters starting production in 2013 in Healthcare and Industrial applications
- 2014 is the first full-year revenue with forecast in excess of 3M parts to be shipped

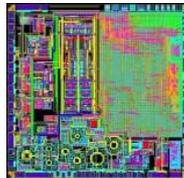
Robust Intellectual Property Protecting ScenSor

- Patents Essential to IEEE802.15.4a
 - 3 Essential patents all granted
- Implementation Patents
 - 5 Implementation patents, 2 granted and 3 filed
 - 10 Further implementation patents in progress
- Internal IP
 - Significant technical know-how in a vastly experienced team.
 - 9 years of algorithm development to get the performance we enjoy
- Patents in the USA, currently applying for EU (Germany, France, UK) and Asia (China, Korea, Japan)

Stairway to Heaven

Sensing Market:
Sold 45 kits to 17 customers
Productisation:
Proving algorithms

Customer Validation: TWR & RTLS demo to key Customers
Productisation: Proving cost profile



FPGA Prototype
March 2009

MPW1
May 2010

MPW2 July 2011

MPW3
Oct 2012

Production Ramp-up
Nov. 2013

Customer Validation: 10 customers endorse & request full production
Productisation: Full feature design

Customer Validation: 1700 leads, 30 lead customers
Productisation: Production ready design. All bands, all data rates, Approx. 300m LOS, 35m NLOS

Ready to Order





Decawave ScenSor

Unrivalled Positioning and communications For IPS, RTLS, WSN and LBS

[Read More](#)

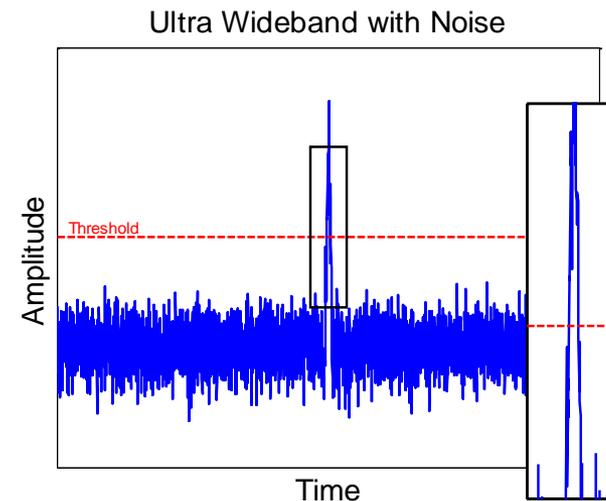
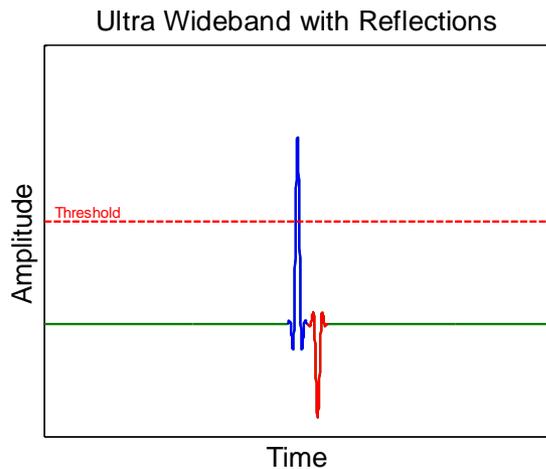
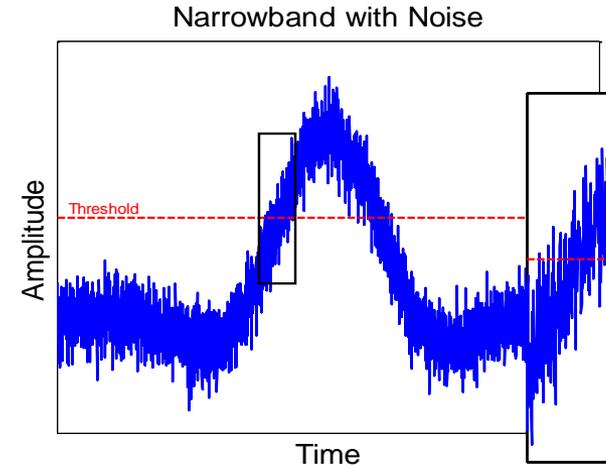
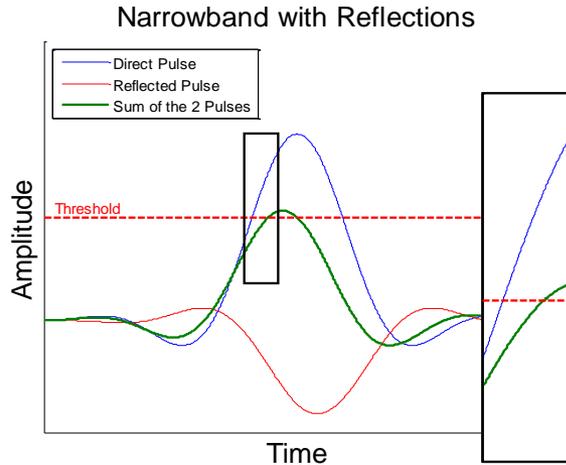
THE PRODUCT

RTLS, WSN and IoT: Problem Statement

- RTLS and location aware IoT and WSN have a fantastic market potential through a myriad of applications.
- However this is today a fragmented market as current technology limitations do not allow large scale adoption.
- The problems with the existing solutions and restrictions on mass adoption are:
 - Location precision
 - Power consumption
 - Price
 - Interference and multi-path
 - Environment dependent tailor-made systems
- **DecaWave Solves all The Above Problems**

Why Ultra-Wide Band (IR-UWB)

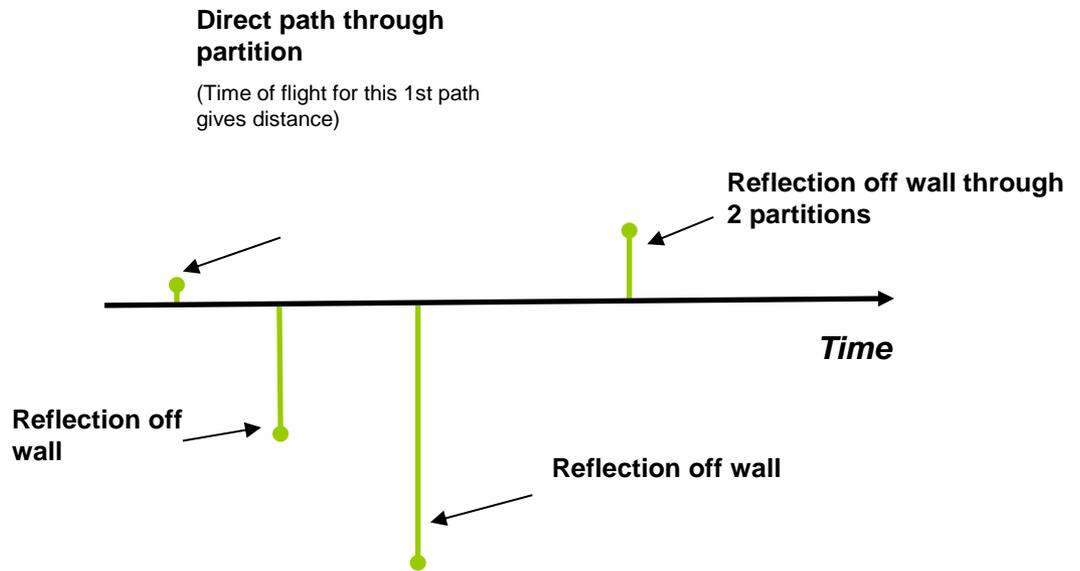
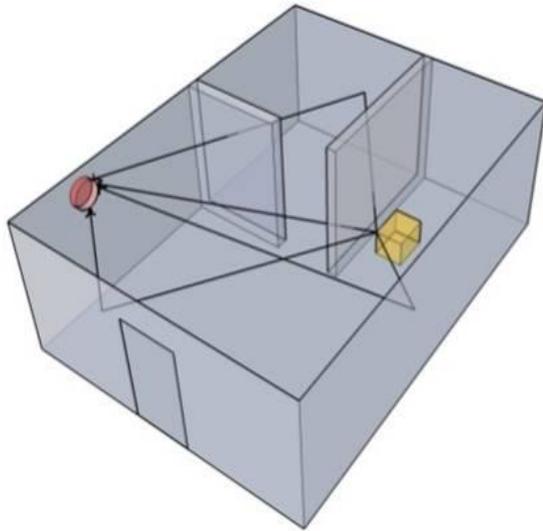
Particular method of radio transmission using narrow pulses with very attractive benefits



UWB allows very **high precision measurement of the time of flight** of the signal

Why Ultra-Wide Band (IR-UWB)

Ability to very **precisely** measure the time of flight of the radio signal from transmitter to receiver => **very accurate distance measurements (range & precision)** – orders of magnitude more precise than existing systems



ScenSor allows **Direct Path** to be identified even if it is severely attenuated relative to other indirect paths

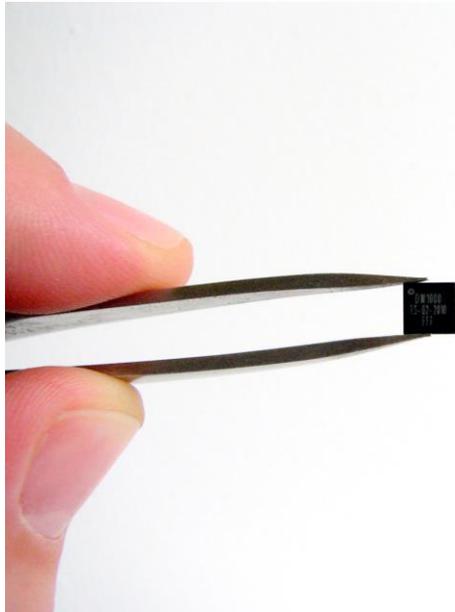
ScenSor: Standard Compliant at Best Price, Best Power, Right Now



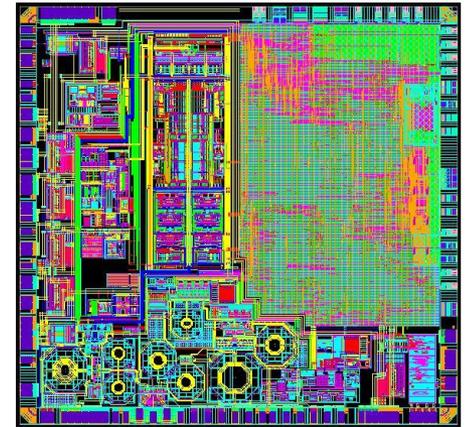
Decawave ScenSor

Unrivalled Positioning and communications For IPS, RTLS, WSN and LBS

[Read More](#)

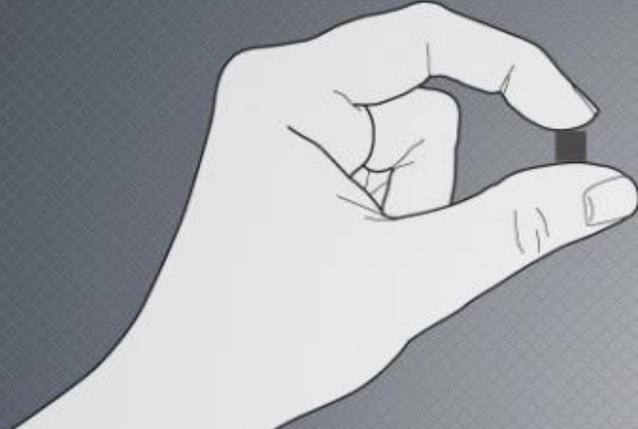


QFN 6x6mm 48L



Performance
Power
Price

Why is ScenSor better



ScenSor
Decawave's Unprecedented, Precise Indoor Location and Communication Chip

 [Order Now](#) [▶ SEE HOW IT WORKS](#)

DecaWave solves the problem of **location specific identity indoors** at **ultra low cost & ultra low power**

- Smaller Silicon Implementation hence cheaper and lower power
- Operates using up to 12 times lower energy in transmit & 7 times lower energy in receive than competing narrowband solutions
- Can locate items within 10 cm of where they are, and highly reliable
- LOS approx. 300m, NLOS 35m, allowing it to be deployed in WLAN APs
- Can identify up to 11,000 items within a 20 meter radius
- Both One way and Two way ranging capability, hence no infrastructure required
- Very high immunity to multi path fading, allowing easy installation for end user
- Avoids spectral crowding of the ISM bands, hence dovetailing with WiFi installations



MARKETS AND APPLICATIONS

The Market

Locating (RTLS)

- WE FIX THE PRECISION PROBLEM
- WE ENABLE HIGHER TAG DENSITY
- WE FIX THE POWER CONSUMPTION PROBLEM
- WE ENABLE LOW COST TAGS

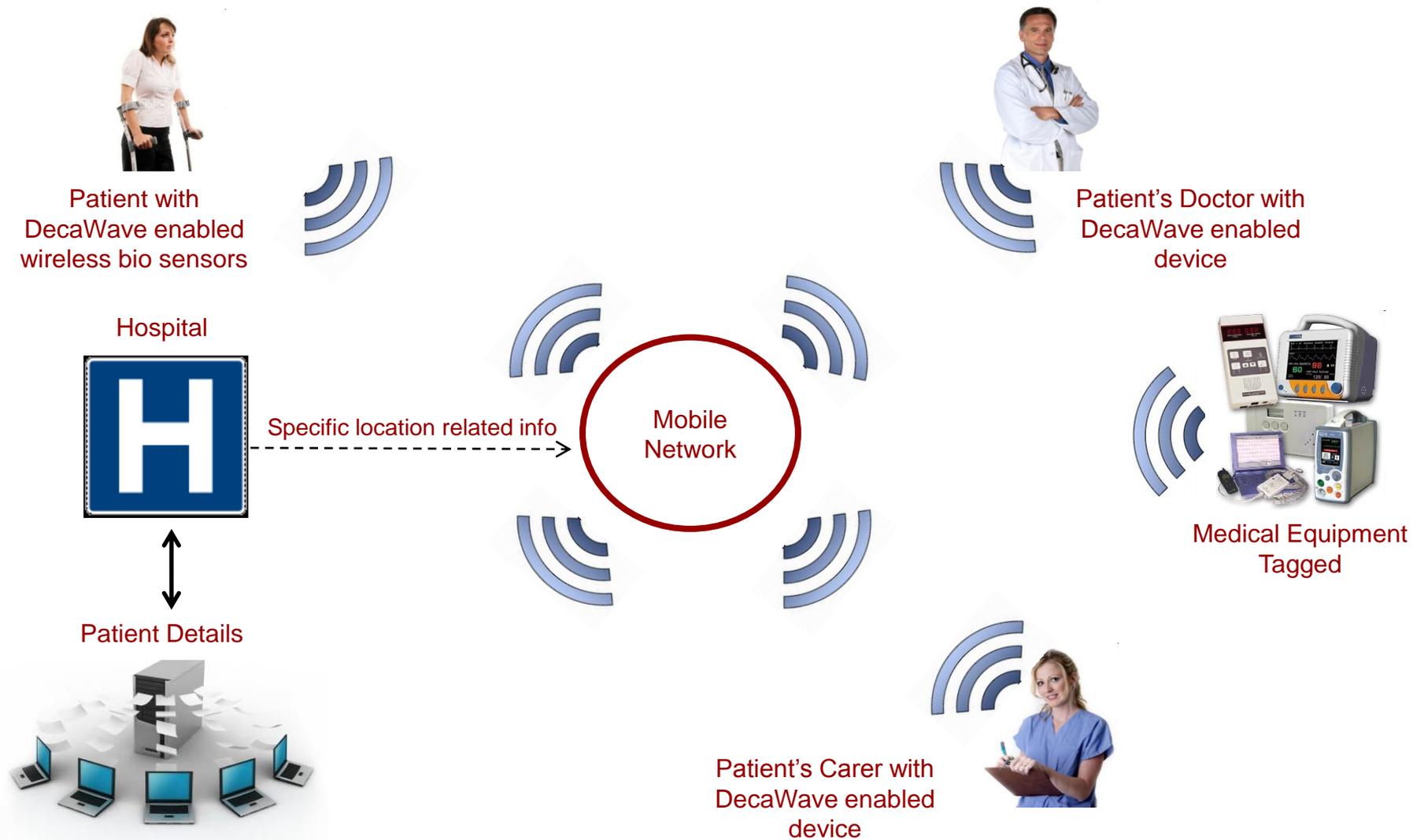
Sensing (WSN)

- WE FIX THE POWER CONSUMPTION ISSUE
- WE ENABLE HIGHER DATA RATES
- WE FIX THE MULTIPATH PROBLEM

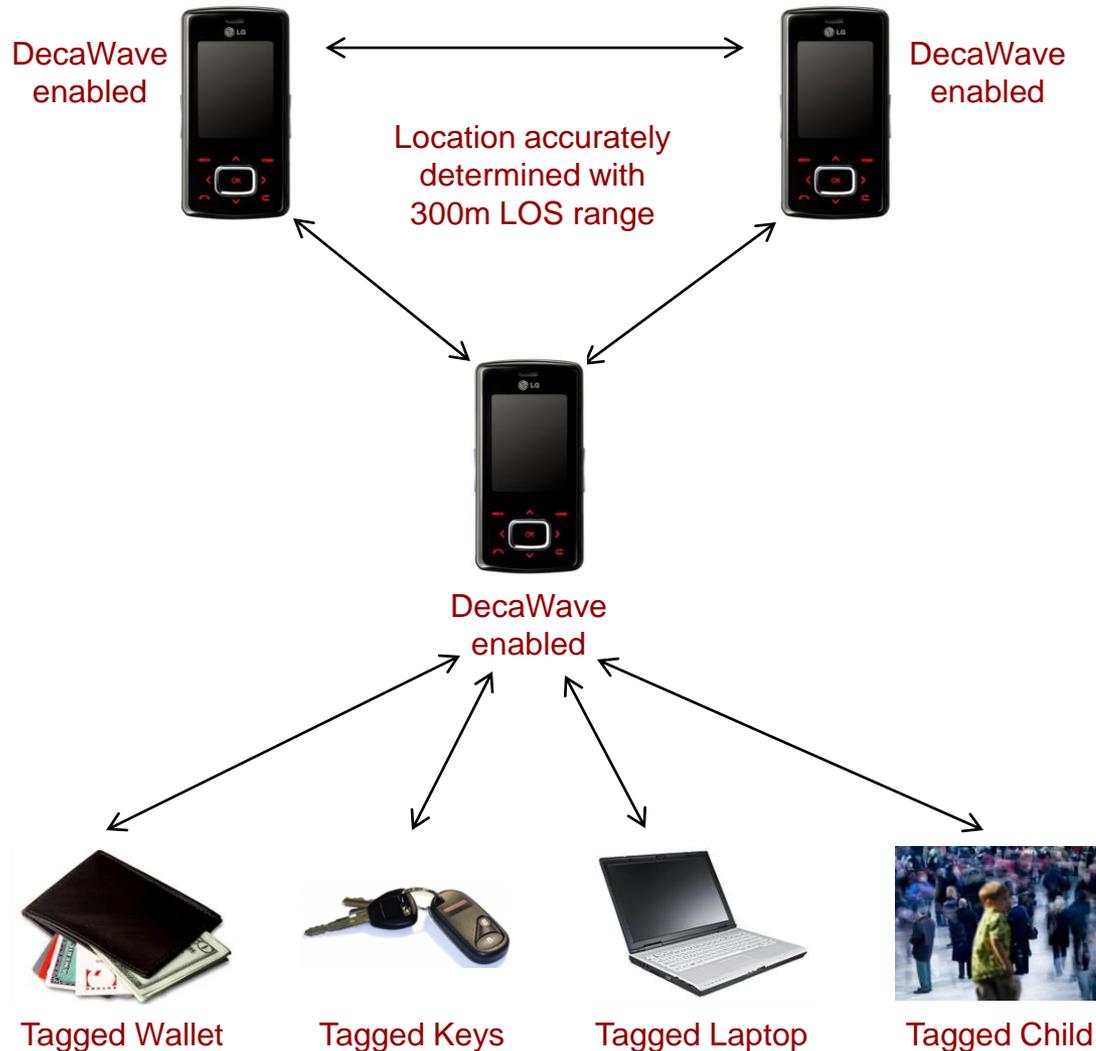
Verticals

Electronic Shelf Labelling
HealthCare
Safety / Security
Agriculture
Factory Automation
Warehouse & Logistics
Building Control
Automotive
Mobile Phone

Use Case: Healthcare

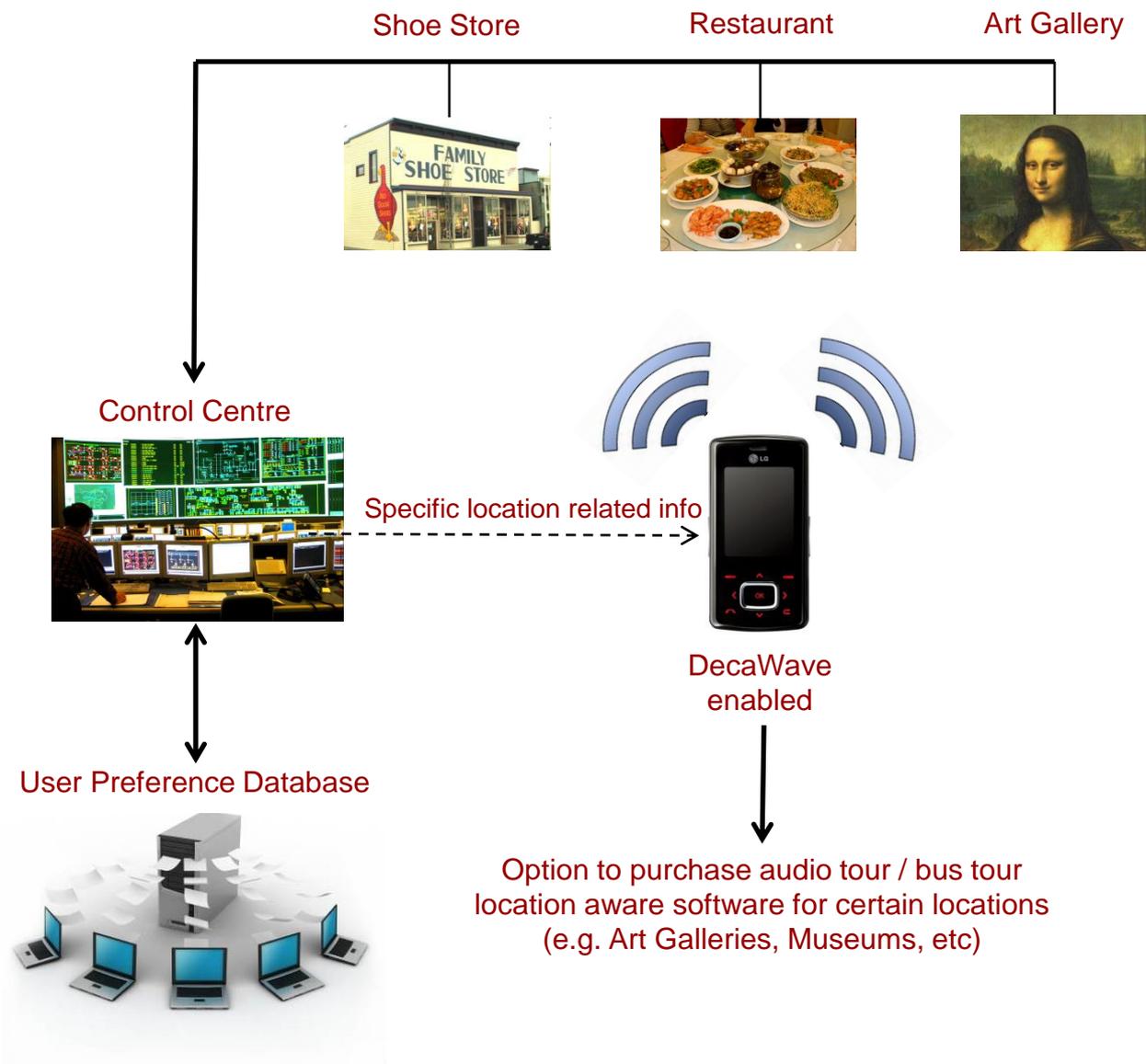


Mobile Use Case: Proximity Location



- Accurate location relative to other enabled handsets
- Can achieve this without any other 802.15.4a infrastructure
- Location of mislaid personal or secure items and people

Mobile Use Case: Service and Content



- Determine precise proximity to in-store detector nodes and use the information for location based services

DecaWave Launches Industry's Most Precise
Indoor Location and Communication
CMOS Chip

LATEST NEWS AND PR

Decawave DW1000 Launch



Irish Prime Minister Kenny at Product Launch Event



The Decawave Team

DecaWave Launches Industry's Most Precise Indoor Location and Communication CMOS Chip

Provides +/-10cm precision with ultra-low power, enabling new RTLS applications

Dublin, Ireland. - November 7, 2013 - Fabless semiconductor company [DecaWave](#) announced today its first single chip of the ScenSor wireless technology family DW1000, which makes indoor location and communications more accurate, cost-effective and power-efficient than ever before. This is the first Integrated Circuit on the market to electronically identify the specific distance to any object, person or thing with +/-10cm precision.

With multiple patents, DecaWave's ScenSor works by transmitting wireless signals to readers that use them to locate the tagged object to within 10cm. The chip is the smallest device of its class, is compliant with [IEEE 802.15.4a](#) standards (now IEEE802.15.4-2011), and uses ultra-low power - it can operate several years from a battery cell or within an energy harvesting environment. These features make the chip functionally and economically viable to deploy, both in volume and in remote locations.

ScenSor can either replace or complement the Radio Frequency Identification (RFID) and WiFi technology currently used for indoor tracking (where GPS signals are unavailable) by allowing for more specific, minute-to-minute location information for high-value goods over short range and through obstructions providing more accuracy than ever before. This brings new opportunities across multiple industries including future applications for the technology incorporated in smartphones and tablets.

"Until now, 10cm location communications across close distances was not possible and current systems with meter-level accuracy have limited reliability, signals would be lost and there was a high risk for error. Customers ask for more than average accuracy most of the time. Our new ScenSor chip changes all that, it provides unprecedented accuracy all the time" said Ciaran Connell, CEO at DecaWave. "More than 1,800 firms and institutes have expressed interest in implementing our technology for applications such as factory and building automation, agriculture, healthcare, ePOS and retail, and warehousing. We've created a foundation for all locator systems, and the systems can now be tailored to specific applications and environments."

About DecaWave

DecaWave is a pioneering fabless semiconductor company developing a family of integrated circuit products called ScenSor, compliant to the IEEE802.15.4a standard, which can electrically identify the specific location of any object, person or thing in an indoor environment at very competitive cost, ultra-low power and with a required level of precision never achieved before +/-10cm. With applications in diverse markets including factory and building automation, agriculture, healthcare, ePOS and retail, and warehousing, the company's flagship DW1000 chip has garnered interest from more than 1,800 firms, research centers and individuals. DecaWave is headquartered in Dublin Ireland, with offices in France, South Korea and Taiwan, and will open a US office early next year. www.decawave.com

TWR: Range and Location Precision Summary

Rate	DW1000 IC		
	Channel 2 (4GHz, 500MHz)	Channel 5 (6.5GHz, 500MHz)	Reported Range Variation ($\pm 3\sigma^{***}$)
Long Range Configuration, 1pm XTAL Offset, 10% PER			
110kb/s	249m*	153m*	10 cm
Default configuration, 10ppm XTAL Offset, 1% PER [Sensitivity, WSN Data]			
110kb/s	144m	89m	10 cm
850kb/s	135m	83m	10 cm
6800kb/s**	102m	63m	10cm
Default configuration, 10ppm XTAL Offset, 10% PER [RTLS]			
110kb/s	226m	136m	10 cm
850kb/s	152m	94m	10 cm
6800kb/s**	115m	71m	10 cm

* : At Channel 1 (3.5GHz), this figure is 284m for 110kb/s.

** : 6 dB gating gain applied for 128 length preamble

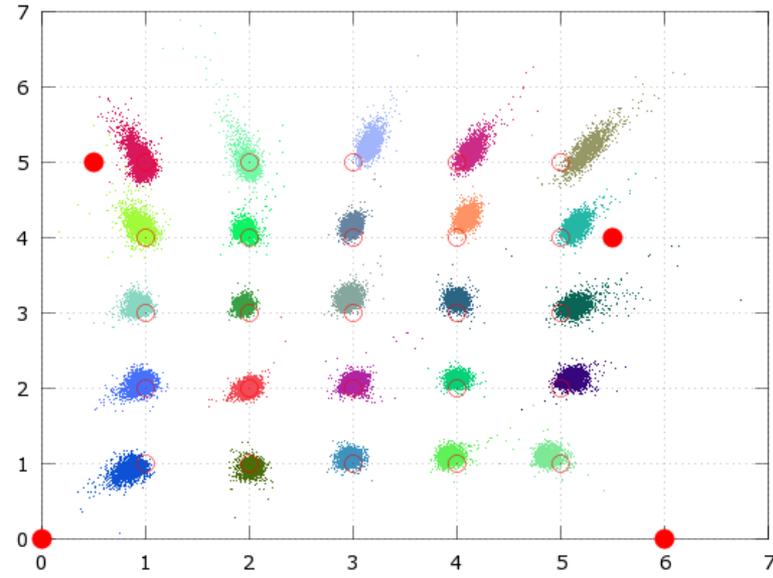
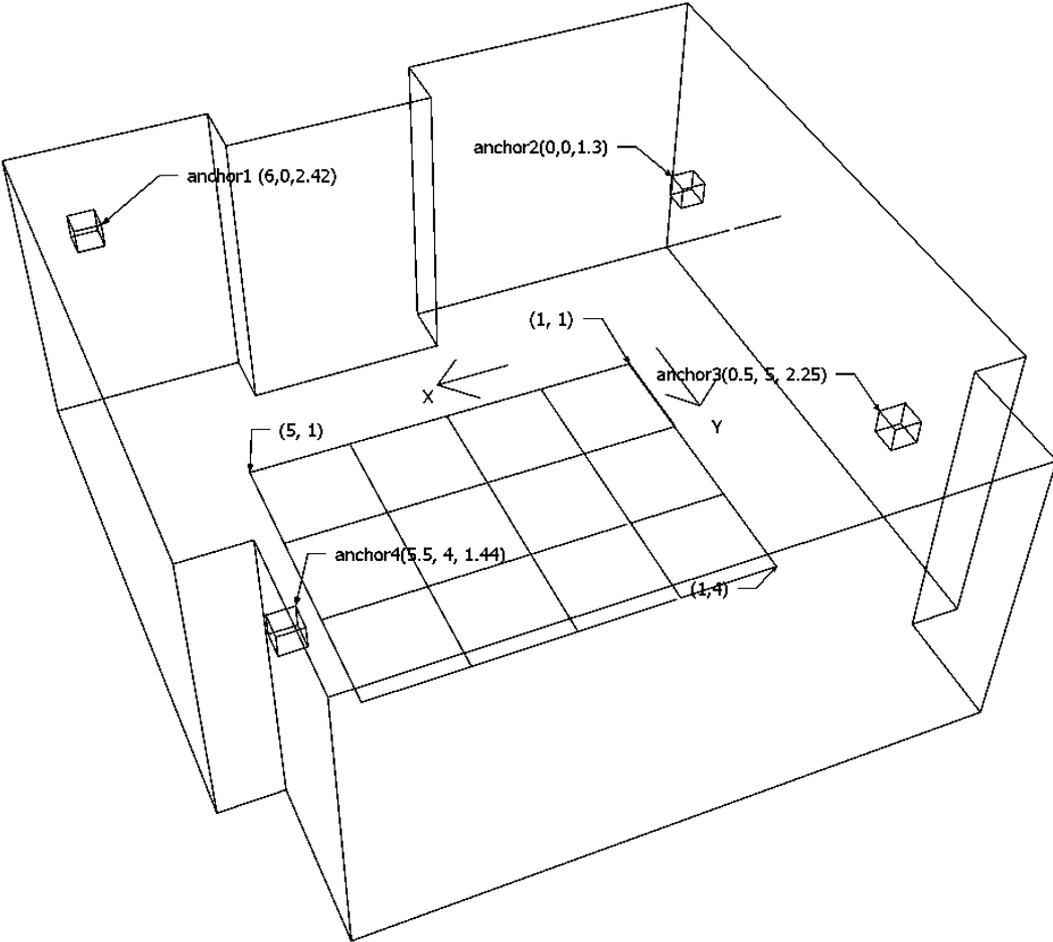
*** : Measured with 2W Ranging

TDOA RTLS: Decawave demo

- This demo is based on a TDOA scheme with 4 anchors and 1 or 2 tags
 - Each Tag blinks on a regular basis
 - The Anchors receive the Tag signal and the location engine calculates the Time Difference of Arrival and estimates the Tag location.
 - The location Engine runs on a PC
- The 4 anchors are using a wireless synchronization algorithm to eliminate the clock offset error.
 - One Master Anchor sends the reference clock to the other anchors in range



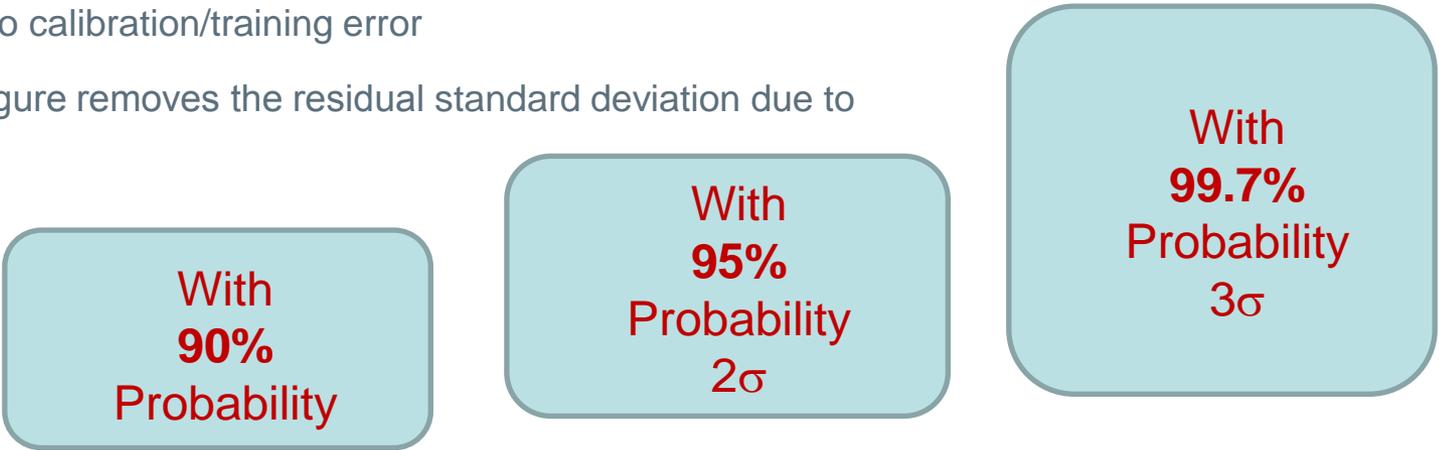
Demo Set-up



Location Error with/without Calibration/Training

The “No Calibration” figure combines the RTLS standard deviation and a residual standard deviation due to calibration/training error

The “With Calibration” figure removes the residual standard deviation due to calibration/training error



No Calibration	17 - 45cm	20 - 49cm	29 - 60cm
With Calibration	13 - 26cm	15 - 31cm	22 - 47cm

The probability of correctly locating a tag within a 20cm radius with calibration:

80 – 99.3%

THANK YOU VERY MUCH

MEET US AT BOOTH **Q04**

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LGIT and Decawave Strengthening their Partnership



Mr. Dennis WON

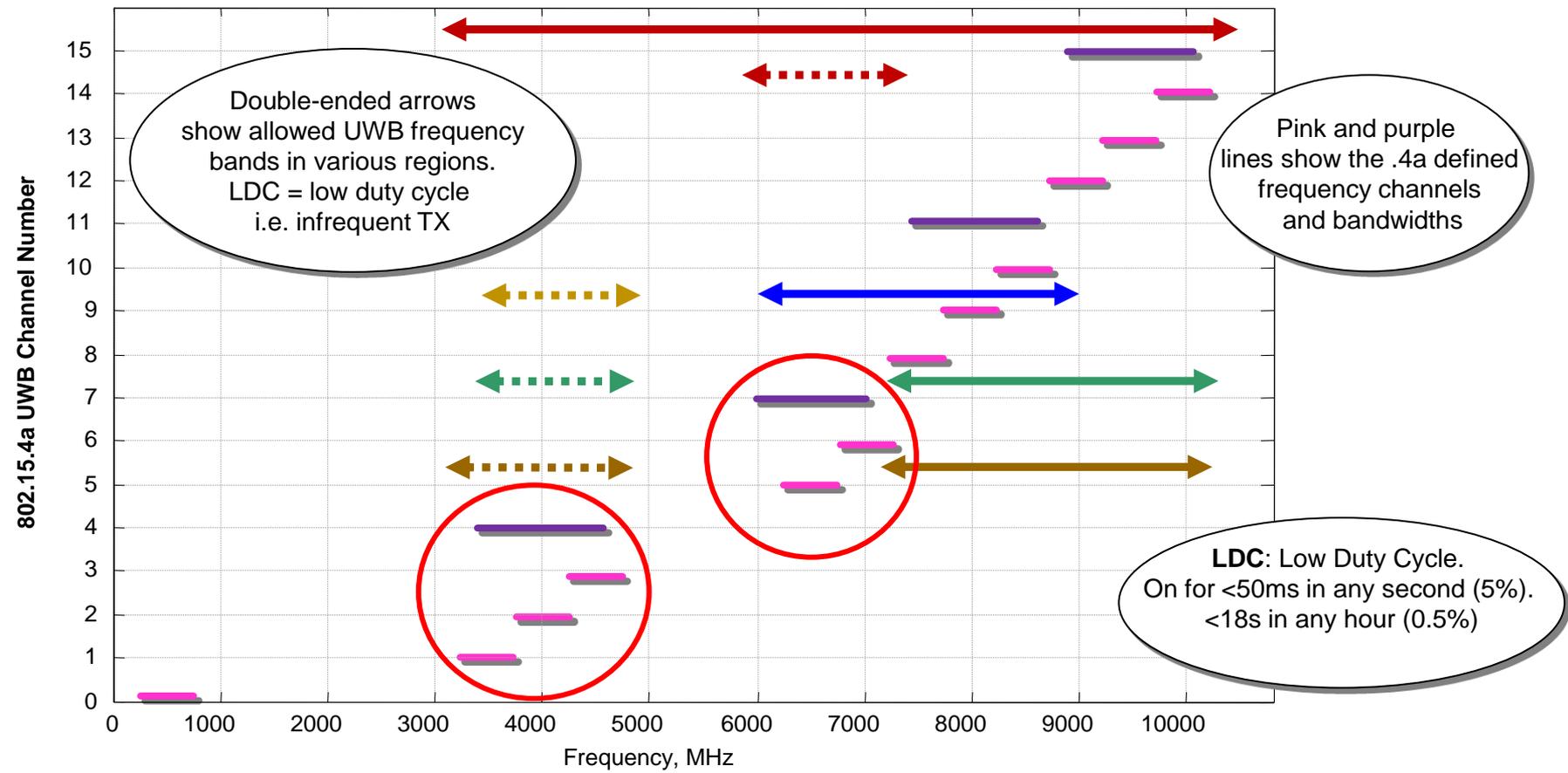


Mr. Ciaran CONNELL



Mr. Jerry PARK

Bandplan facilitating Worldwide Deployment



	.4a 500MHz			US Indoors & handheld			Japan @ >50Mbps
	.4a >1GHz			US Indoors & mobile out			Japan with DAA
				Europe, China, others			Korea
				Europe with LDC (not China)			Korea with LDC

