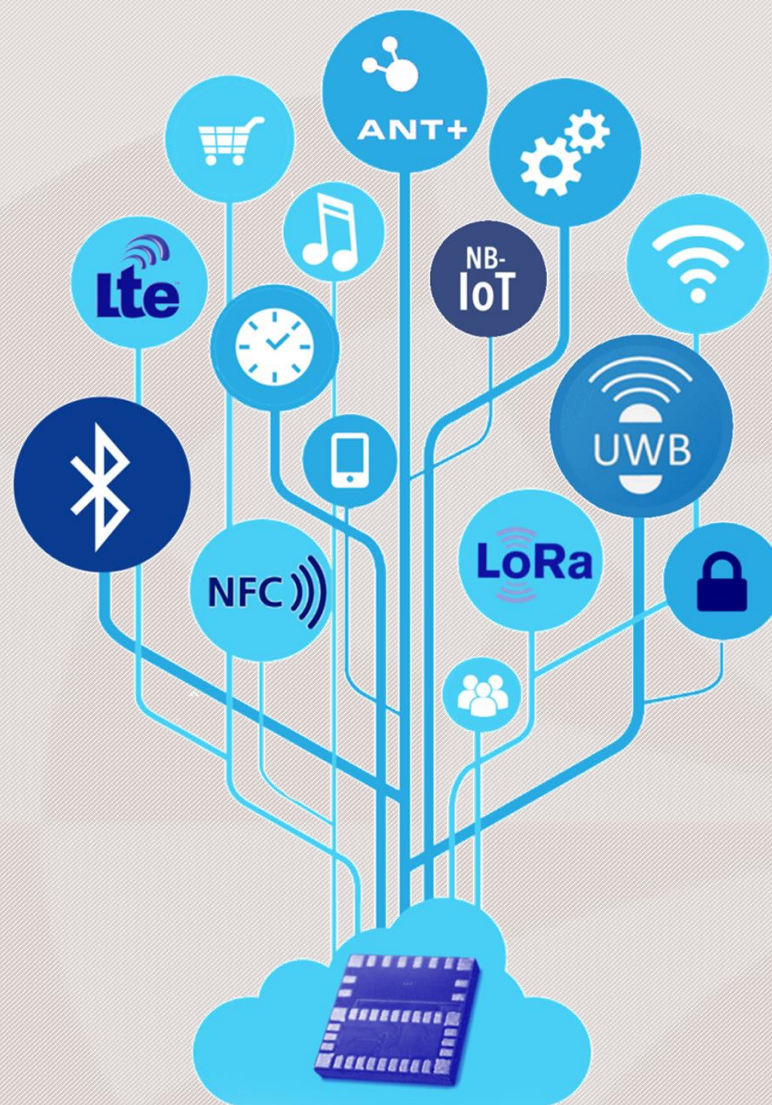
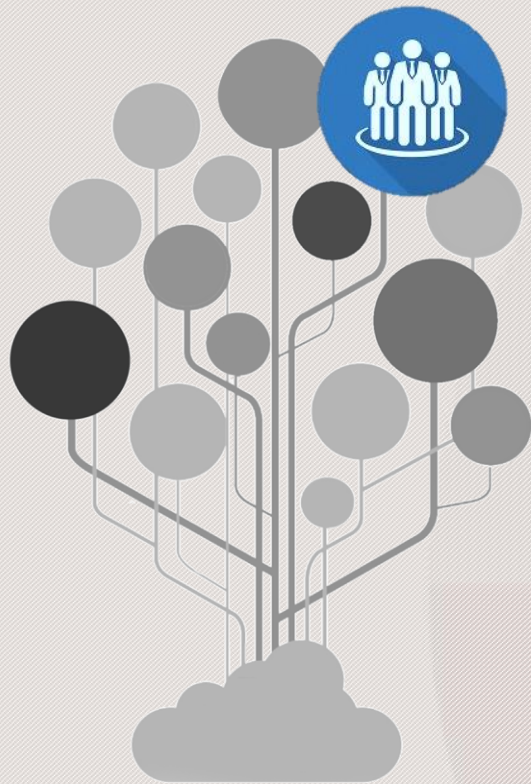


Smart Modules

General Information



- ✚ **Company Profile**
- ✚ **BLE Generalities**
- ✚ **UWB Generalities**
- ✚ **LoRa Generalities**
- ✚ **Module Pros & Cons**



Company Profile



Experts in RF System-in-Package (SiP) and Antenna-in-Package (AiP) in response to ultra miniature wireless solution demand

Established in 2005

- ✓ Founded by actual CEO and CTO
- ✓ Core team of PhD and MSc from National Semiconductor
- ✓ Electromagnetic simulation, antenna design and μ W & RF circuit theory skills
- ✓ Unique set of design techniques & industrialization expertise
- ✓ Fab-less company

READ MORE



Locations

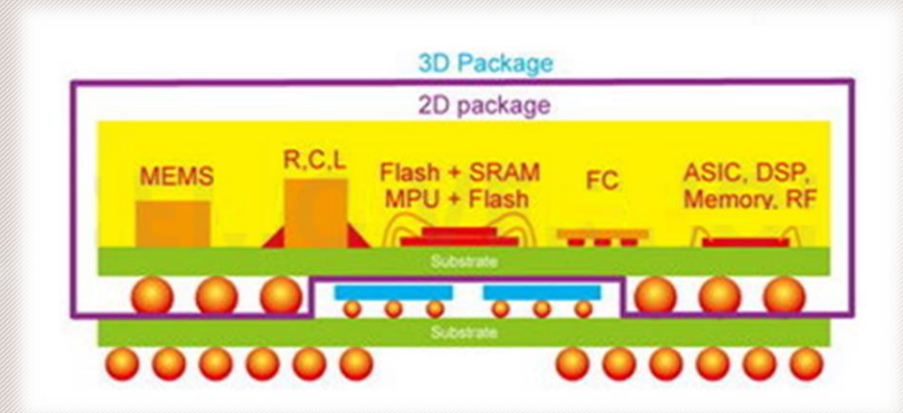
- ✓ Europe – HQ & Technical team in Sophia-Antipolis ●
- ✓ North America – Subsidiary in Denver ●
- ✓ Asia – Sales office in Tokyo ●
- ✓ Global network of distributors ●



Our Expertise

✚ SiP approach consists of integrating several different components into a single miniaturized module

- ✓ From different semiconductor and passive technologies
- ✓ Unique ability to embed functions within the package
- ✓ RF know-how
- ✓ Irrespective of the technology
 - Organic substrates (BT, FR4...)
 - Multi-layer ceramic substrates (LTCC, HTCC, Thick film...)
 - Thin film Integrated Passive Devices (IPD) on silicon or glass
- ✓ Extremely rapid and low cost development cycles



✚ Addition of ultra-miniature antennas to the RF SiP create a so called “Antenna in Package” product (AiP)

- ✓ Fundamental part of long term Insight SiP’s research program
- ✓ Combining electromagnetic simulations and circuit level optimization
- ✓ Based on a user extendable library of physical objects
- ✓ R&D work has already been implemented in products for **Bluetooth Low Energy** and Wireless High Definition Interface products

Our Mission

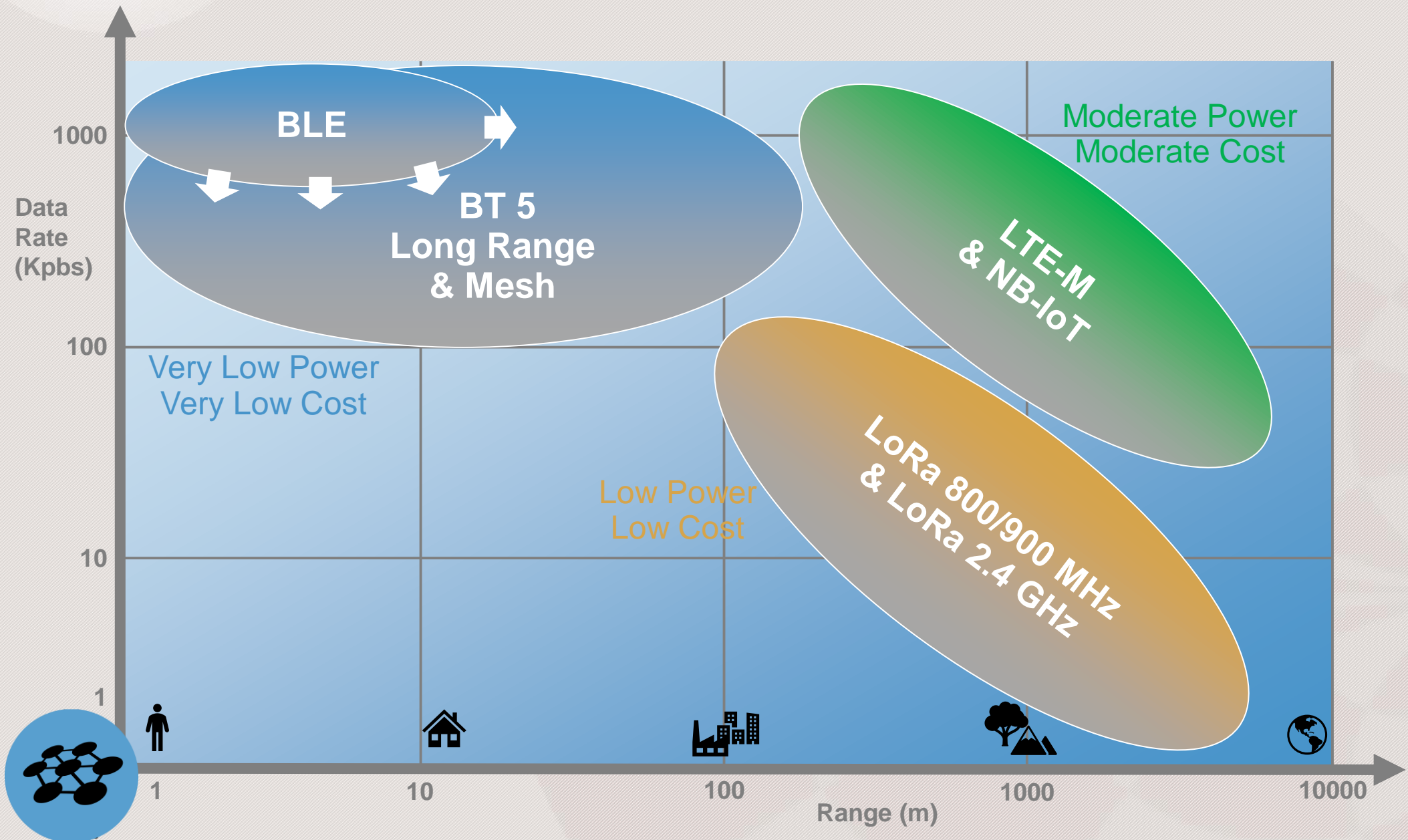


Insight SiP is the leading provider of Low Power Networking and Ranging modules for advanced IoT solutions



- ✚ Our portfolio includes a diverse set of solutions to meet different IoT use cases
- ✚ Our modules provide class leading miniaturization
- ✚ They are designed with superb radio performance

Low Power Networking



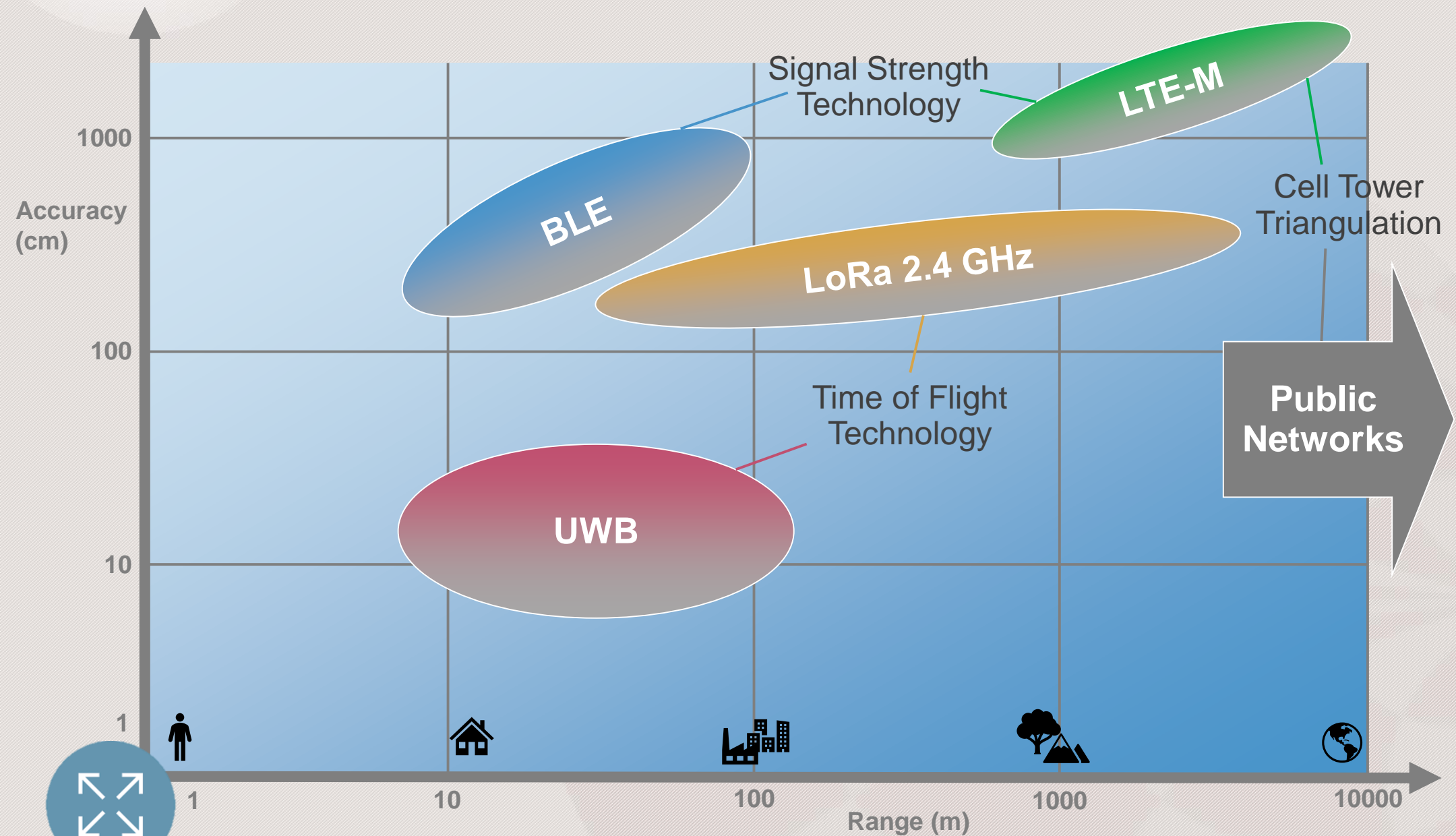


Insight SiP developments focusses on providing a full range of products for IoT communication and networking



- ✚ **Body Area Networks – BLE**
- ✚ **Home Networks – BLE, BLE Long Range, BLE Mesh**
- ✚ **Building Networks – BLE Mesh, BLE Long Range, LoRa Private**
- ✚ **Outdoor Area Networks – LoRa Private & Public**
- ✚ **Global Coverage – LoRa, LTE-M, NB-IoT**

Positioning





Another strategic focus for Insight SiP is to deploy a full range of modules and solutions for location applications



- ✚ Security Bubble – UWB
- ✚ Cheap and Cheerful Location – BLE
- ✚ Location in Building – UWB, LoRa 2.4
- ✚ Outdoor Area Networks – LoRa, LoRa 2.4
- ✚ Global Coverage – LoRa, LTE-M, NB-IoT, Cell Tower Based Location

Our Product Lines

Design Service Business Unit

- ✓ Turnkey solutions for creative packaging solutions
- ✓ Any Wireless connectivity to fit any device space
- ✓ Multiple Technologies : BT, FR4, LTCC, HTCC, Thick Film, PCB, IPD,...
- ✓ Multiple Assembly Methods: SMT, Wirebond, Flipchip, Embedded Dies...
- ✓ Optimization Size / Cost / Time to Market
- ✓ Technical Successes in 3G, ANT, BLE, Bluetooth®, GSM/W-CDMA, GPS, ISM, LTE, NFC, RFID, UMTS, UWB, WHDI™, WiFi, Wlan, Zigbee ® ...
- ✓ **Benefits to our customers: Smaller, Faster, Lower Cost**

Standard Modules Business Unit

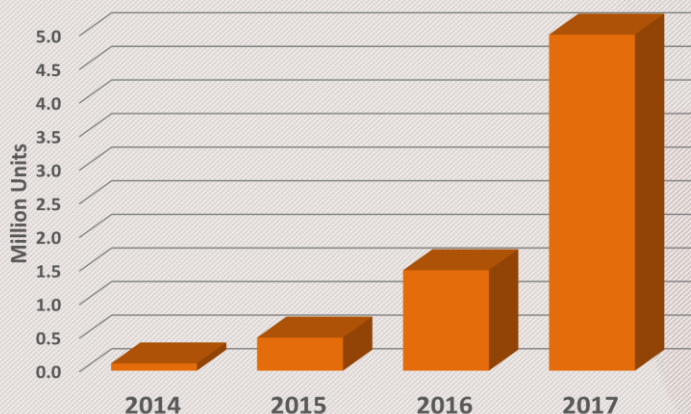
- ✓ Dedicated to wireless electronic industry
- ✓ Bluetooth Low Energy, ANT+, UWB, LoRa, LTE-M, NB-IoT
- ✓ Secured Connectivity
- ✓ Low Energy Sensors
- ✓ Beacons
- ✓ **Benefits to our customers: Ready to use modules**

Our Production

Manufacturing with multiple established partners

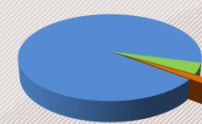
- ✓ Amkor
- ✓ ASE
- ✓ AT&S
- ✓ Barry Ind
- ✓ Kyocera
- ✓ Tong Hsing

Modules Shipment



Break by Application Volumes

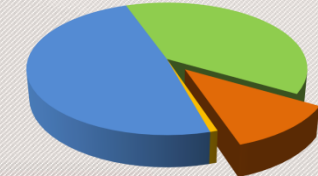
2014



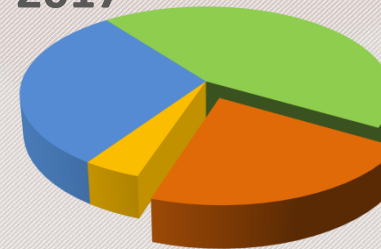
2015



2016



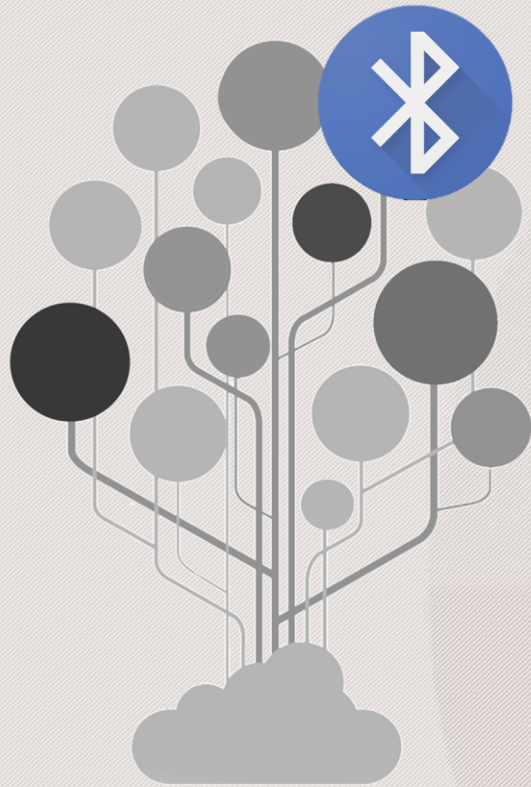
2017



- Low Energy Connectivity
 - Connectivity
 - 4G/5G Front End & Radio
 - Secure Connectivity
- (Internal and licensed production)

Quality standards in production

- ✓ ISO9000 standards and several other equivalent certifications
- ✓ OHSAS18001 – Health and Safety management
- ✓ ISO13485 – Medical requirements
- ✓ AS9100 – Aerospace requirements
- ✓ QS9000 – Automotive requirements



BLE

Generalities

+ Bluetooth SIG

- ✓ The Bluetooth Special Interest Group was formed in 1998
- ✓ This is now a community of over 30000 members

+ Bluetooth Classic

- ✓ V2.0 Bluetooth Classic released in 2004
- ✓ V3.0 Bluetooth High Speed adopted in 2009
Dedicated to audio application

+ Bluetooth Low Energy

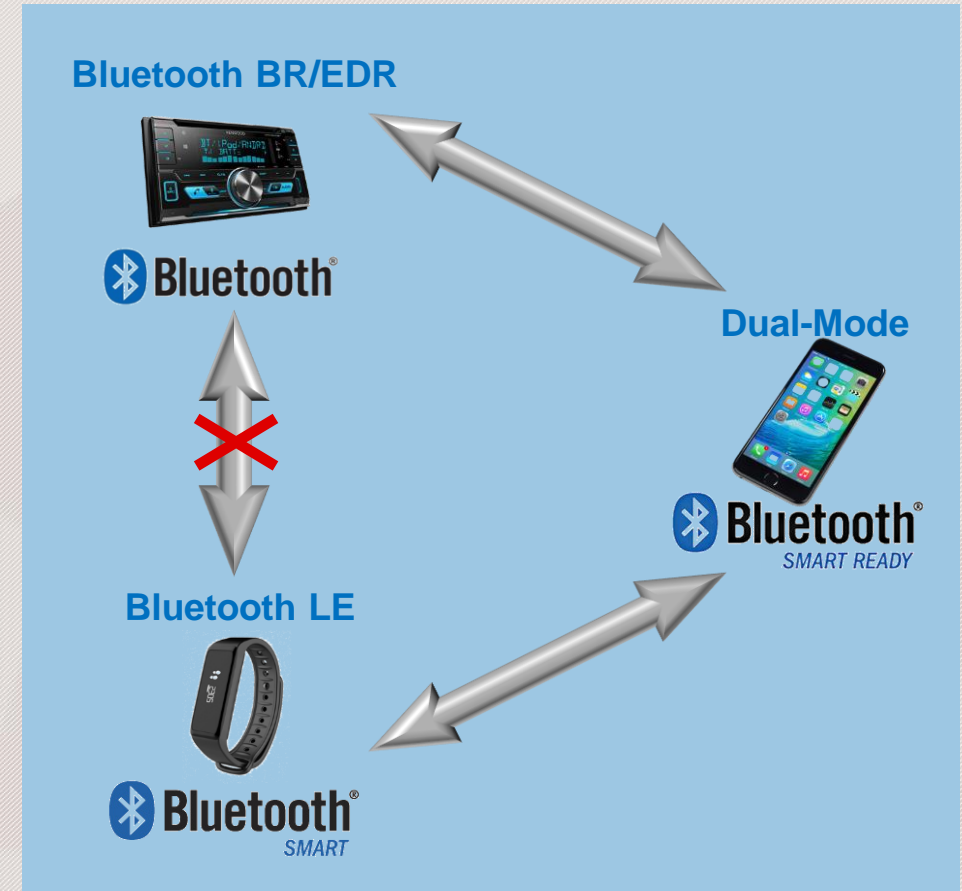
- ✓ V4.0 First Bluetooth Low Energy concept adopted in 2010
- ✓ V4.1 Multirole capabilities
Master & Slave on the same chip
- ✓ V4.2 Enable IPv6 for Bluetooth
Improve speed, security and privacy
- ✓ BT 5 Adopted end 2016
2X speed, 4X range, 8X throughput

BLE Generalities

- ✚ **Bluetooth BR/EDR**
= **Basic Rate / Enhanced Data Rate**
 - ✓ establishes a relatively short-range
 - ✓ continuous wireless connection
 - ✓ makes it ideal for use cases such as streaming audio

- ✚ **Bluetooth LE = Low Energy**
 - ✓ allows for short bursts of long-range radio connection
 - ✓ doesn't require continuous connection
 - ✓ depends on long battery life
 - ✓ makes it ideal for Internet of Things (IoT) applications

- ✚ **Dual-Mode**
 - ✓ available to support single devices such as smartphones or tablets
 - ✓ need to connect to BR/EDR devices (such as audio headsets)
 - ✓ Also need to connect to LE devices (such as wearables or retail beacons)



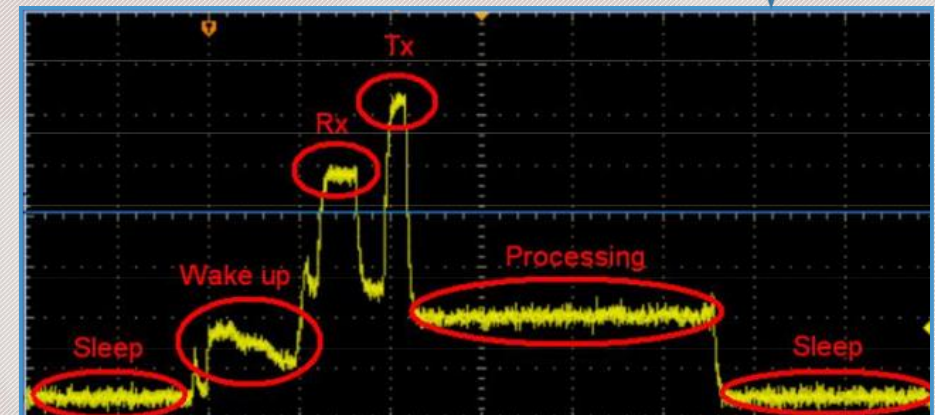
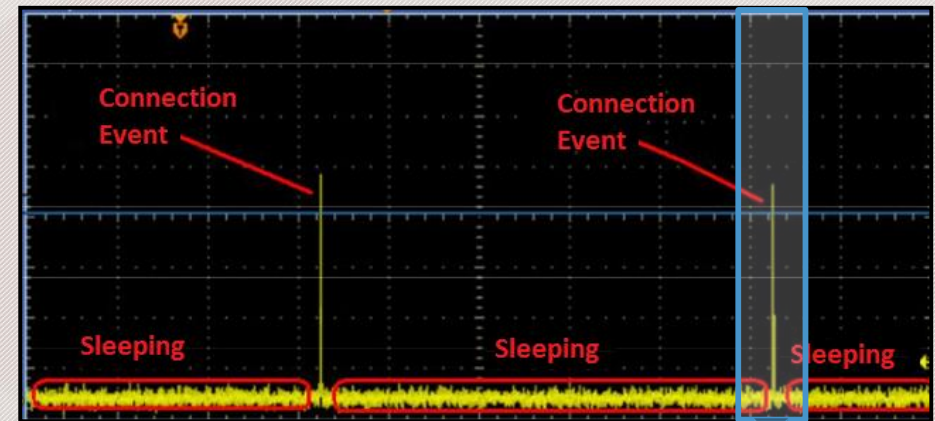
BLE Consumption

✚ Bluetooth LE is designed for Low Power Applications

- ✓ Where aim is long battery life
- ✓ Months / years off coin cell
- ✓ Occasional data exchange

✚ Principle of Bluetooth LE solution

- ✓ BLE chip saves power by being in “sleep mode” most of the time
- ✓ Power consumption is strongly related to data rate
- ✓ Bluetooth low energy is designed to enable connectivity of power-sensitive devices operating on primary cells for long periods of time ranging from months to potentially several years
- ✓ One cannot look at peak RX or TX current to assess overall power consumption since the time in low power “sleep” mode dominates overall power consumption



BLE Specifications

+ Frequency range

- ✓ In the globally unlicensed ISM 2.4 GHz band : 2400–2483.5 MHz
- ✓ Bluetooth uses a radio technology called frequency-hopping spread spectrum (FHSS)
- ✓ It usually performs 1600 hops per second
- ✓ The transmitted data are divided into packets and each packet is transmitted on one of the 79 channels (or 40 channels for Bluetooth Low Energy)

+ Modulation

- ✓ Originally, Gaussian frequency-shift keying (GFSK) modulation was the only modulation scheme available, said to be operating in basic rate (BR) mode where an instantaneous data rate of 1 Mbit/s was possible
- ✓ Since the introduction of Bluetooth 2.0, DQPSK and 8DPSK modulation may also be used between compatible devices, describe as enhanced Data Rate (EDR), each giving 2 and 3 Mbit/s respectively

+ Data rate

- ✓ Enhanced rate with V3.0
- ✓ Reduced for V4.0 to save energy

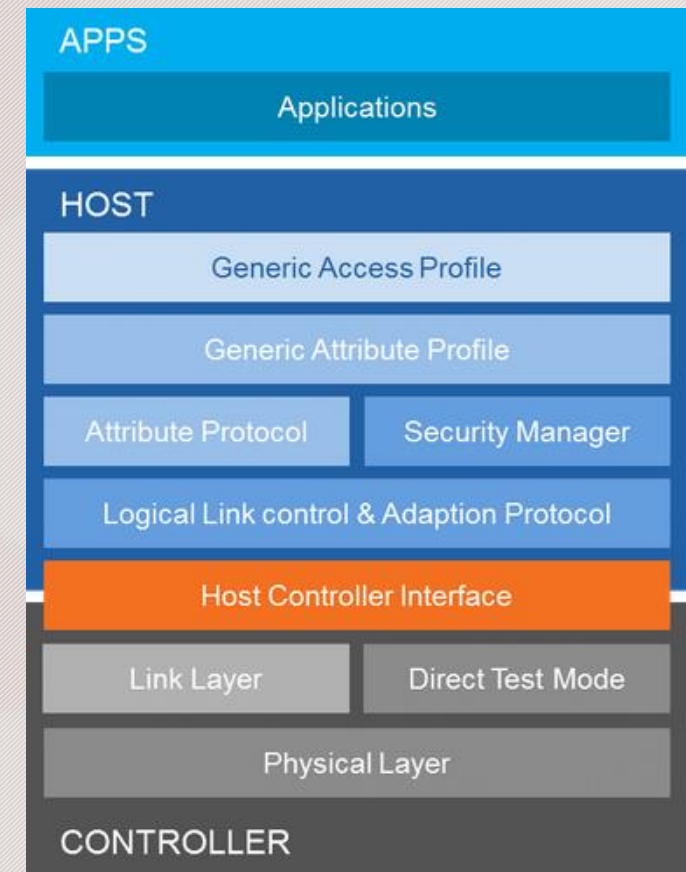
Version	Data rate
1.2	1 Mbits/s
2.0 + EDR	3 Mbits/s
3.0 + HS	24 Mbits/s
4.0	1 Mbits/s
5.0	2 Mbits/s

+ Core Architecture: Host

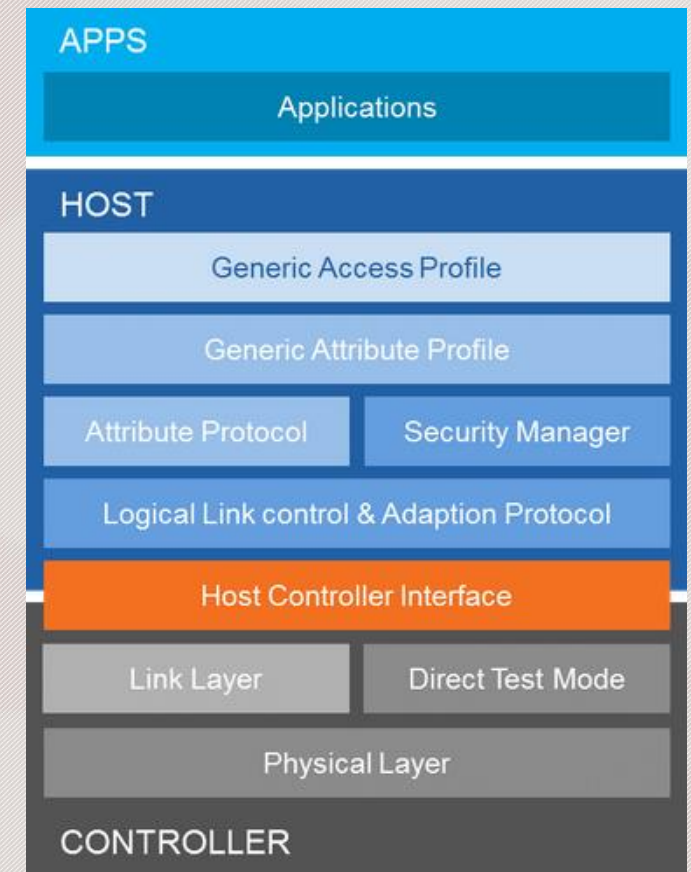
- ✓ Generic Access Profile (GAP) works in conjunction with GATT to define procedures and roles related to the discovery of Bluetooth devices
- ✓ Generic Attribute Profile (GATT) groups services and defines procedures and formats of services including discovering, reading, writing, notifying
- ✓ Attribute Protocol (ATT) defines the client/server protocol for data exchange once a connection is established
- ✓ Security Manager defines the protocol and behavior that manages pairing integrity, authentication and encryption
- ✓ Logical Link Control and Adaptation Protocol (L2CAP) transmits packets to the HCI

+ Core Architecture: Controller

- ✓ Link Layer defines packet structure/channels, discovery/connection and sends/receives data
- ✓ Direct Test Mode allows testers to instruct the PHY layer
- ✓ The Physical Layer (PHY) controls 2.4Ghz radio



- ✚ The Bluetooth stack is commonly integrating the Host
- ✚ Application Profiles & Services
 - ✓ A device must interpret certain profiles, which are definitions of possible applications and specify general behaviors that devices use to communicate with other devices
 - ✓ There are a wide range of Bluetooth profiles that describe many different types of applications or use cases for devices
- ✚ Central role (Client) & Peripheral role (Server)
 - ✓ Bluetooth is a packet-based protocol with a client-server structure. One client may communicate with several servers, all devices share the client's clock.



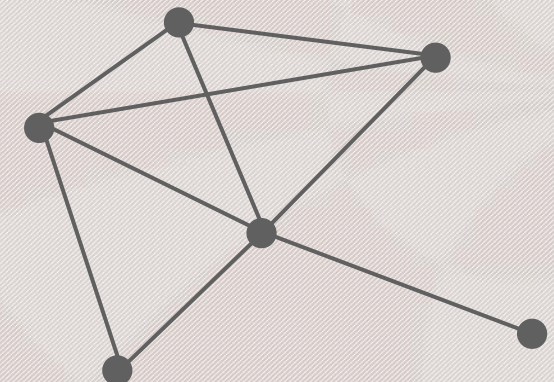
BLE Mesh

- ✚ **BLE Mesh is the latest extension of Bluetooth technology**
 - ✓ It extends the capabilities and potential uses of Bluetooth in many application
 - ✓ Particularly suited to smart building and home automation applications

- ✚ **BLE Mesh is an independent development to the enhancements introduced by the progression from Bluetooth 4.2 to Bluetooth 5**
 - ✓ It uses the same radio and physical transport as existing BLE
 - ✓ It adds a networking layer that allows multiple Bluetooth devices to work together
 - ✓ Messages from one device to another can be sent via one or more intermediate nodes
 - ✓ In other words the network or “mesh” allows two devices to communicate that are too far apart to make a direct point to point Bluetooth connection
 - ✓ In practical terms, a direct point to point Bluetooth connection is limited to around 50m (direct line of sight), or 200m for Bluetooth 5 long range.

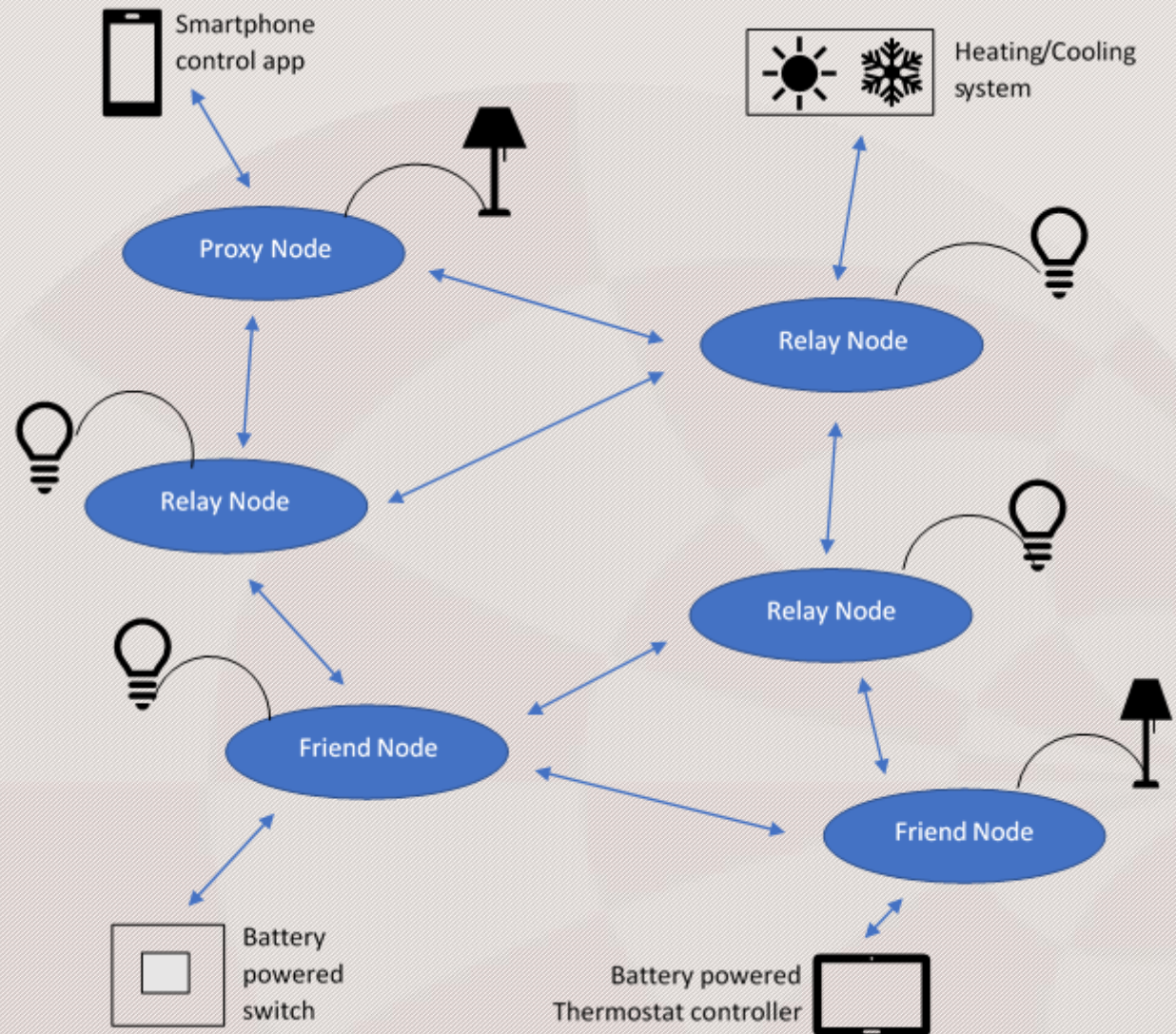
- ✚ **Ability to extend the effective communication distance**

- ✚ **Allows devices to be put into groups and message to be sent to one device or a group of device**



Relay nodes

- ✓ Receive and forward messages to other nodes
- ✓ Can also be connected to a device (light, thermostat ...)
- ✓ Act themselves on a message or generate one
- ✓ A relay node receiving a message will look at it, decode and act it (e.g. switch the light on or off), or broadcast the message onward
- ✓ Relay nodes are not “low-energy nodes”



+ Friend nodes

- ✓ Friend nodes enable to connect a low energy device to a mesh network
- ✓ The low energy device is linked to a relay node
- ✓ The friend device can operate in Low Energy mode, and the associate relay node will store a message, and send it on when the friend node is awake
- ✓ In the other direction, the friend node sends data when it wants, and the associated relay node is ready and waiting
- ✓ Friend nodes cannot act to relay messages in the mesh , they are “end point”

+ Proxy Nodes

- ✓ Smartphone or tablet don't need to be updated to run mesh
- ✓ As of today no phones run Bluetooth Mesh
- ✓ Proxy node acts as a bridge between a standard BT4+ dual mode and the mesh
- ✓ Proxy node runs both the Mesh and the standard BLE stacks, and can thus receive a message from a phone, and send it on to the mesh

BLE Pros & Cons

+ Major advantages of BLE

- ✓ Presence of BLE connectivity in nearly every phone and laptop released today
- ✓ Only need new hardware at one end
- ✓ Software for phone/laptop easily distributable via app stores
- ✓ Bluetooth protocol widely understood and used, mature

+ Various alternative technologies on the market

- ✓ Zigbee, ANT, Various proprietary sub-giga protocols
- ✓ BLE is “adapted” for low energy use-case
- ✓ Other protocols are technically better designed for certain use cases
- ✓ Other protocols may have lower power consumption for certain use case
- ✓ Some are established in certain market sectors

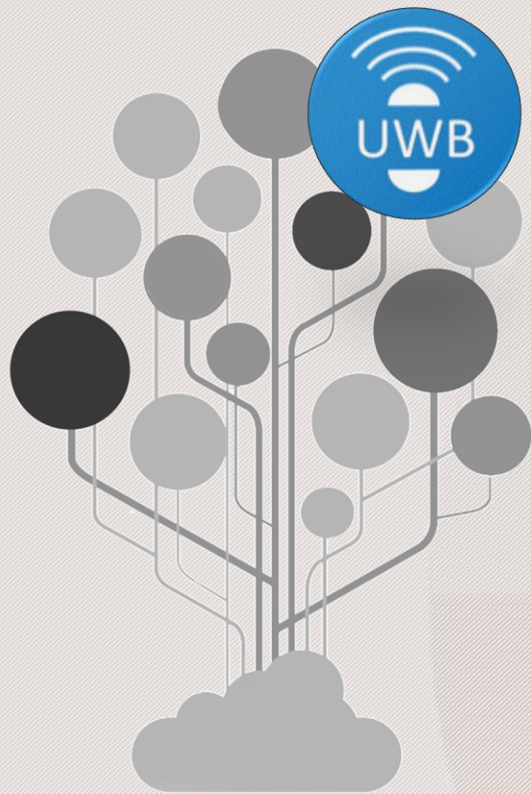
+ For the vast majority of applications where connectivity to a phone or laptop is involved, the “built in” advantage of BLE is overwhelming

BLE Main Applications

+ BLE typically used for

- ✓ Connected sensors for medical devices, healthcare, sport, fitness, industrial devices ...
- ✓ IoT applications: connected objects like bracelet, watches ...
- ✓ Wearable technology
- ✓ Phone/laptop accessories
- ✓ Home automation
- ✓ Beacons
- ✓ Localize indoors to medium accuracy
- ✓ Wireless charging
- ✓ Led lighting
- ✓ Toys

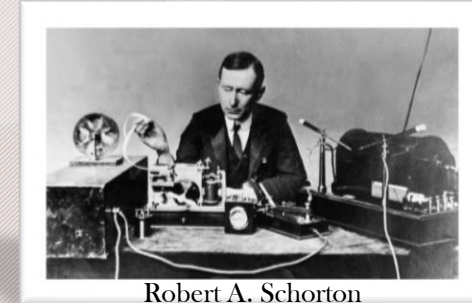




UWB **Generalities**

+ Ultra Wide Band in the age

- ✓ UWB is more than 100 Years old technology
- ✓ In the 2000's, WiMedia was intended for short-range multimedia file transfers and was promoted for personal computers, consumer electronics, mobile devices ...



Robert A. Schorton



+ UWB Impulse Radio (IR-UWB)

- ✓ Finally, UWB spectrum was opened for commercial use in 2005 by the FCC for pulse-based transmission in the 3.1 to 10.6 GHz frequency range targeting sensor data collection, precision locating and tracking applications
- ✓ UWB conforms with IEEE 802.15.4 technical standard which defines the operation of low-rate wireless personal area networks (LR-WPANs). It specifies the physical layer and media access control for LR-WPANs which focuses on low-cost, low-speed ubiquitous communication between devices

IR-UWB Specifications

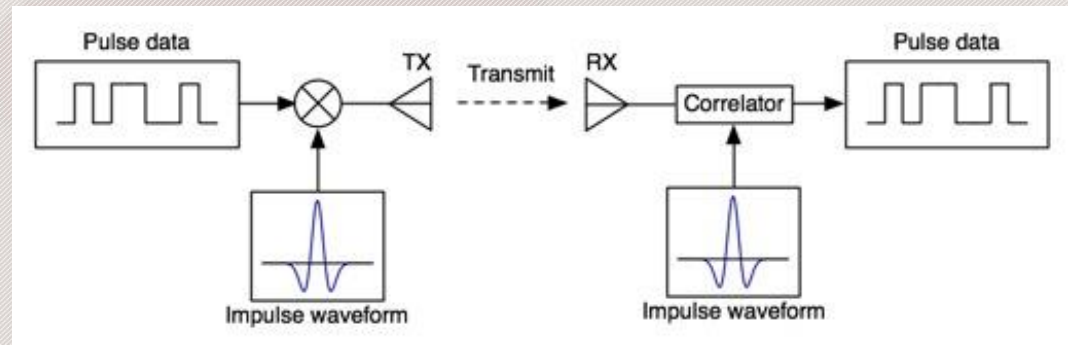
✚ Frequency range

- ✓ Insight SiP module uses UWB channel 5 center frequency 6489.6 MHz
- ✓ UWB channel bandwidth 499.2 MHz

✚ 802.15.4-2011 Standard

✚ Coded pulse train

- ✓ Binary Position Modn
- ✓ Binary Phase Shift Key
- ✓ Symbol = 2 bits 1 BPM 1 BPSK



✚ UWB consumes very little power

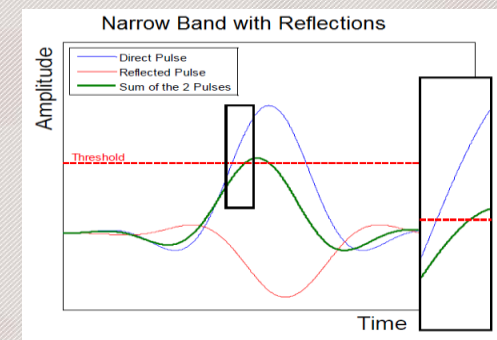
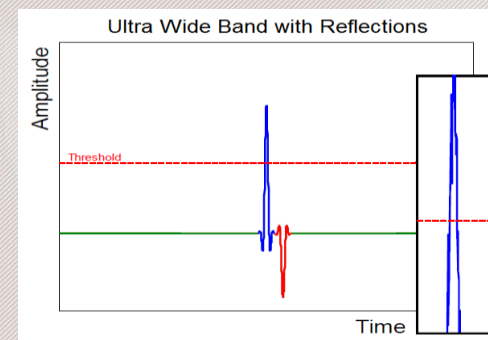
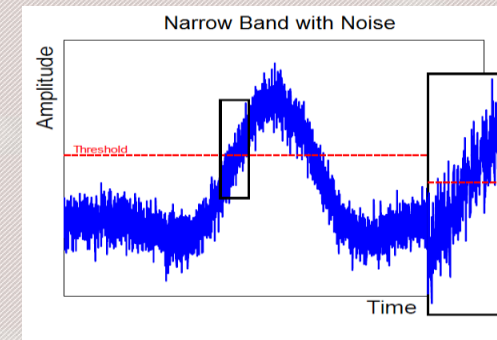
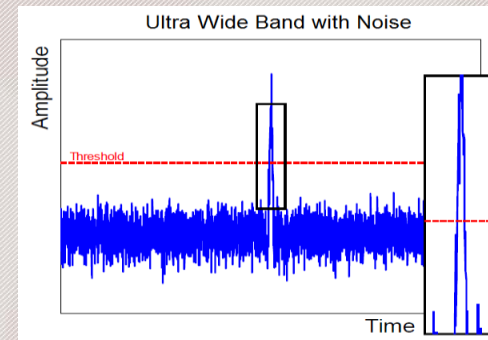
- ✓ Low regulatory limit for transmission strength
- ✓ Very short pulse train in the range of nano-seconds

✚ Built-in scalability

- ✓ Communication link can be adjusted in terms of data bandwidth, sensitivity, recurrence, etc.

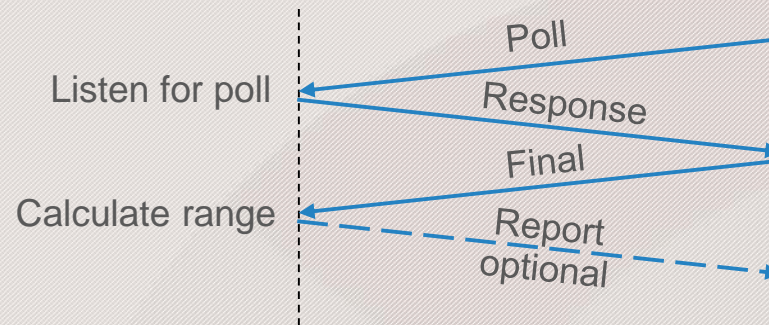
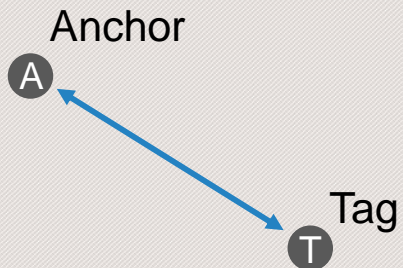
IR-UWB for Ranging

- ✚ UWB measures the travel time of the signal from the transmitter to the receiver in order to calculate a precise distance
- ✚ UWB deals with very short pulses of RF energy spread over a large bandwidth: this approach offers huge advantages compared to narrow band technologies
- ✚ **Unsensitivity to Noise & Interference of other narrow band systems**
 - ▶ RF pulse straight edges give precise determination of arrival time
- ✚ **Unsensitivity to Multi-Path Reflection Interference**
 - ▶ Short pulses avoid combination with reflected signals



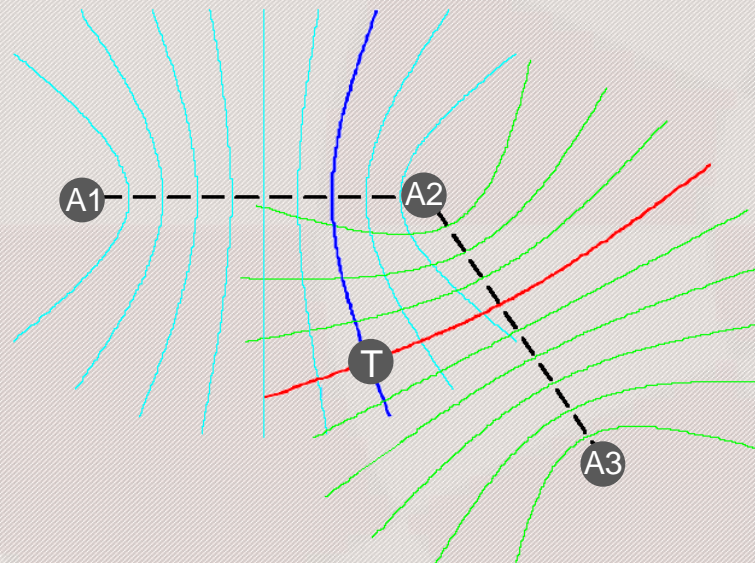
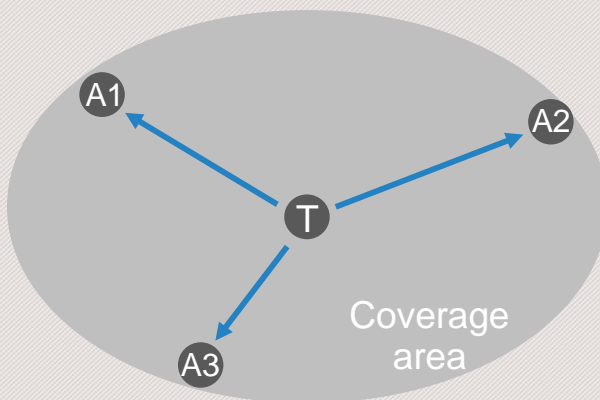
IR-UWB for Ranging

2-Way Ranging



► Simple measurement of time of flight

Time Difference of Arrival (TDOA)



► Location determined by a multi-lateration algorithm

UWB Pros & Cons

✚ **For applications where precise positioning is necessary, UWB offer the best performances over other technologies**

✚ **WiFi and BT**

- ✓ Using RSSI method
- ✓ Sensitive to Multipath, to Interference, to relative position antenna
- ✓ Precision in the 10 meters range

✚ **Narrow Band**

- ✓ Using Time of Flight method
- ✓ Sensitive to Multipath and Interference
- ✓ Precision in the meters range

✚ **IR-UWB**

- ✓ Using Time of Flight method
- ✓ Unsensitive to Multipath and Interference
- ✓ Precision in 1/10 of meters range

UWB Main Applications

Consumer

- ✓ Building Control
- ✓ Retail
- ✓ Home Robots
- ✓ Access Control



Automotive

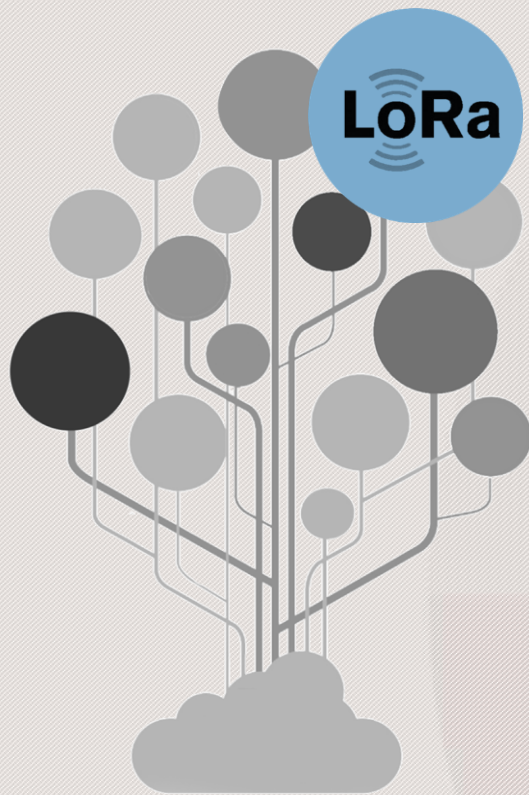
- ✓ Smart Car Entry
- ✓ Secure Bubble
- ✓ Automated Valet



Industrial

- ✓ Building Control
- ✓ Healthcare
- ✓ Agriculture
- ✓ Safety Security
- ✓ Factory Automation
- ✓ Robotics
- ✓ Mining





LoRa Generalities



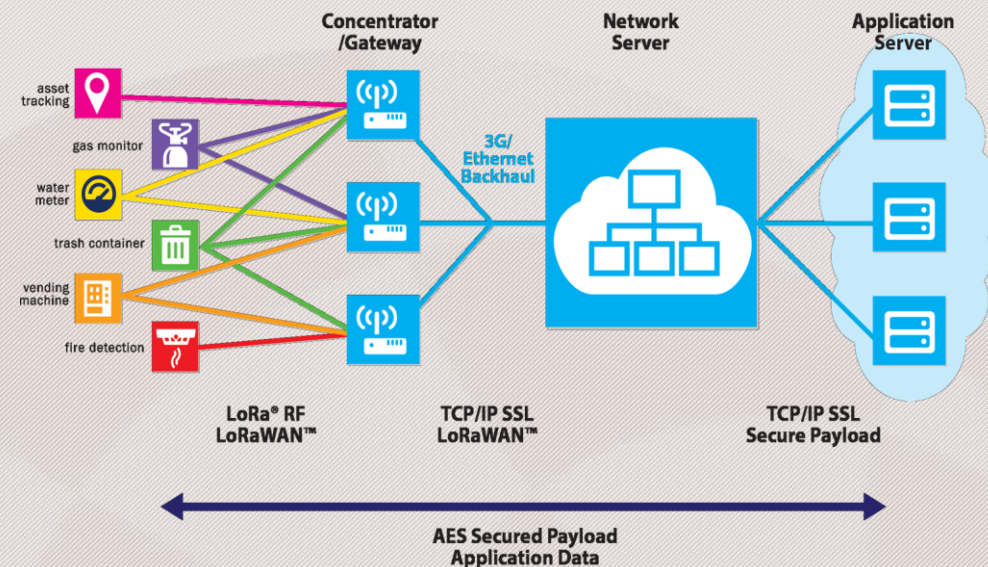
- ✚ LoRa is a Low-Power Wide Area network protocol, aimed at low data rate – low power applications (like BLE)
- ✚ Uses Adaptive Data Rate (ADR) to maximize combination of range/data/rate power
- ✚ Thus one cannot quote a max range or data rate like BLE, but the following table (Source: Orange) indicates capability (probably under ideal conditions)

Spreading factor (at 125 kHz)	Bitrate	Range (indicative value, depending on propagation conditions)	Time on Air (ms) For 10 Bytes app payload
SF7	5470 bps	2 km	56 ms
SF8	3125 bps	4 km	100 ms
SF9	1760 bps	6 km	200 ms
SF10	980 bps	8 km	370 ms
SF11	440 bps	11 km	740 ms
SF12	290 bps	14 km	1400 ms

(with coding rate 4/5 ; bandwidth 125KHz ; Packet Error Rate (PER): 1%)

LoRa Frequencies

- The following table defines the frequencies used by LoRa in key regions
- LoRa uses **unlicensed** spectrum



Region	Supported	Band [MHz]	Duty cycle	Output power
EU	Y	868	<1 %	+14 dBm
EU	Y	433	<1 %	+10 dBm
US	Y	915	<2 % (BW<250 kHz) or <4 % (BW>=250 kHz) Transmission slot < 0.4 s	+20 dBm
CN	N	779	<0.1 %	+10 dBm

LoRa Definitions I

- ✚ **LoRa Technology** refers to the special radio modulation scheme (ADR etc) used to achieve the high data rate/low power performance
- ✚ It is owned by **Semtech** (originally developed by Cycleo in France)
- ✚ Only Semtech have radio chips available today, although Semtech is licensing the technology to others
- ✚ **Semtech chip is simple radio modem**
 - ✓ Driven by 4-wire SPI
 - ✓ Controlled and monitored by Configuration and Status Registers
 - ✓ 4 IRQ lines
 - ✓ FIFO buffers for data in/out Rx/Tx
- ✚ **Different variants (for different radio bands etc), but core functionality is the same**
- ✚ **Requires external MCU**



LoRa Definitions II

- ✚ **LoRaWAN** refers to a standard Network protocol, allowing different LoRa devices to communicate with each other in a standard way
- ✚ A private point to point network could use LoRa technology, but not LoRaWAN (although it could)
- ✚ A public network would normally use LoRaWAN
- ✚ **LoRaWAN** is defined and maintained by the **LoRa Alliance** (this roughly corresponds to the BT SIG)
- ✚ **LoRa Alliance** members include chip companies, Network operators, system integrators
- ✚ **LoRaWAN** evolving – currently on 1.0.2, 1.1 coming (roaming protocol)



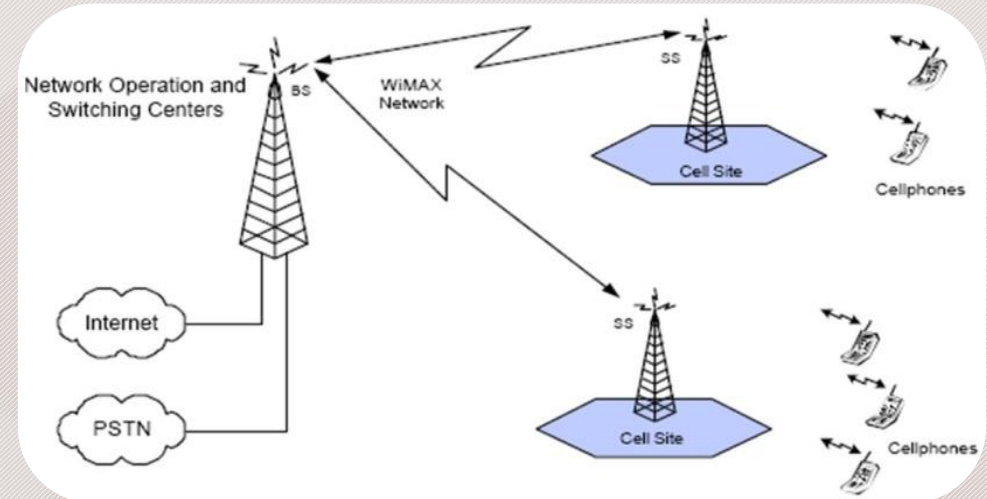
LoRa Definitions III

✚ There are two types of LoRa node – **Gateway** and **Device**

✚ Unlike BLE **Gateways** have a different hardware for the radio – thus a device module cannot be used as a **Gateway**

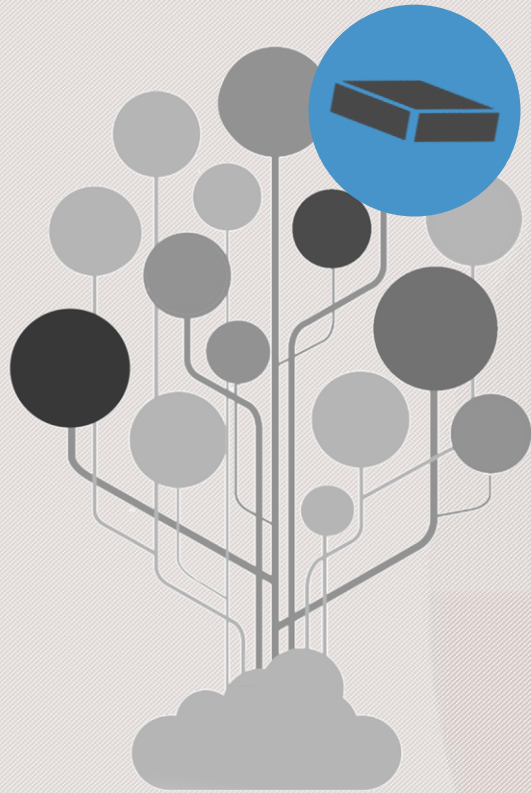
✚ **Devices** can be three classes – A, B, C

- ✓ **Class A** – Transmits only when ready
Downlink follows uplink, but there is no way for the Gateway to initiate a downlink
- ✓ **Class B** – Has a regularly scheduled downlink window
This standard is not fully defined by the LoRa Alliance
- ✓ **Class C** – Always listening



✚ **Class A** is the mode used in most battery driven nodes, as it is the lowest power mode

✚ **Class C** is generally used when power is not an issue



Module Pros & Cons

Module Disadvantages

- ✚ **Bill of Material cost is inevitably higher for a Module than for a Discrete design**
- ✚ **And that is pretty much it !**

Module Advantages

Ready to Go

- ✓ No need for RF knowledge
- ✓ Design effort for RF design is very often underestimated
- ✓ Minimum electronic skills for digital connection
- ✓ Module is pre-certified, avoiding lengthy and expensive certification process

Fast Time to Market

- ✓ Time to market reduced by 3 to 6 months

Smaller

- ✓ Small and integrated solution
- ✓ Single component replaces many, supply chain simpler

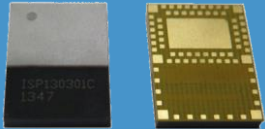

Improved performance

- ✓ Optimized antenna performance
- ✓ BLE function concentrated in one single component

Application development is focused on its added value

Module Trade Off

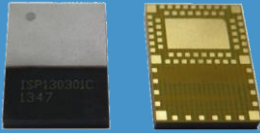

✚ Need to check overall project cost and duration between both solution

	Standard Off-shelf Modules 	Custom Designs 
RF design	Core competency of module vendor Heavy 1-time investment	Expertise required for layout, signal routing, layer stack-up, interference, shielding
Size	Optimized size	May require larger area on target PCB
Procurement	1 component	Multiple components
Complexity	Like any component to place	RF design and RF yield
Assembly	1 component ready to mount	Complex Bill Of Material (BOM)
Test	Module fully tested (behaviour, Electromagnetic, placement,...)	Need full test on end-product
Yield	100% yield ready modules	Yield losses in production Failure analysis & rework costs
Quality	Modules are fully tested and provided as known good	RF expertise and test flows to cover connectivity systems
Certification	Pre-certified / already certified	Certification from scratch

Module Trade Off

✚ Example of global cost approach for a 100 k pieces project

- ✓ Of course, this calculation depends strongly on customer know how for each specific application






	Standard Off-shelf Modules 		Custom Designs 	
RF design			Personnel cost (6 months)	50 k€
			Material, Equip., Indust.	50 k€
Certification			FCC, CE, IC, Telec	40 k€
Procurement	1 Module @ 4 € ea.	400 k€	BOM @ 2 € ea.	200 k€
Assembly			Part of total assy	several 10 k€
Test			Part of total test	several 10 k€
Yield			Maybe 95-98% & rework	several 10 k€
Total	400 k€		> 400 k€	

Module Trade Off

Volume	Standard Off-shelf Modules	Project Points
Up to 200 K pcs / year	Std Module is ideal	<ul style="list-style-type: none"> At this level, BOM savings will simply not cover development costs
200 – 500 K pcs / year	Std Module is the best solution	<ul style="list-style-type: none"> Looking only at BOM costs, custom looks good However, it is important to double check real development cost that might be under-estimated
500 K + pcs / year	Std Module is a good solution	<ul style="list-style-type: none"> Here, custom solution starts to look attractive Even so, when real dev. costs, certification etc is accounted for, it isn't clear Need to look at other factors – time to market, risk etc Can suggest customer starts with module, and can switch later if custom cost saving got proven



Insight SiP offers a wide range of Wireless Modules with strong and concentrated performances for IoT applications

-  **Offers Networking Connectivity & Positioning Modules**
 - ✓ Multi BLE platforms with additional ANT+ and NFC connectivity
 - ✓ UWB – BLE combo modules
 - ✓ Soon LoRa – BLE combo modules
-  **Offers complete development kit**
-  **Working demos including hardware, and software for iOS**
 - ✓ Sensor demo
 - ✓ Beacon demo
 - ✓ Easy starting point for customers
-  **Very high quality hardware support from true RF experts**
 - ✓ Possible RF and range simulation of customer design
-  **Capacity to offer custom design if required later**

SiP Module Concept

+ Designed by RF specialist and leading chipset manufacturer

1 Nordic Inside

✓ WLCSP wireless SoC and multiple analog and digital functions

2 Both crystals included

✓ Radio & Synchronization

✓ Reduced power consumption

3 Power supply decoupling

✓ For both DC-DC enable or disable operating mode

4 Antenna matching circuit

5 Integrated Antenna

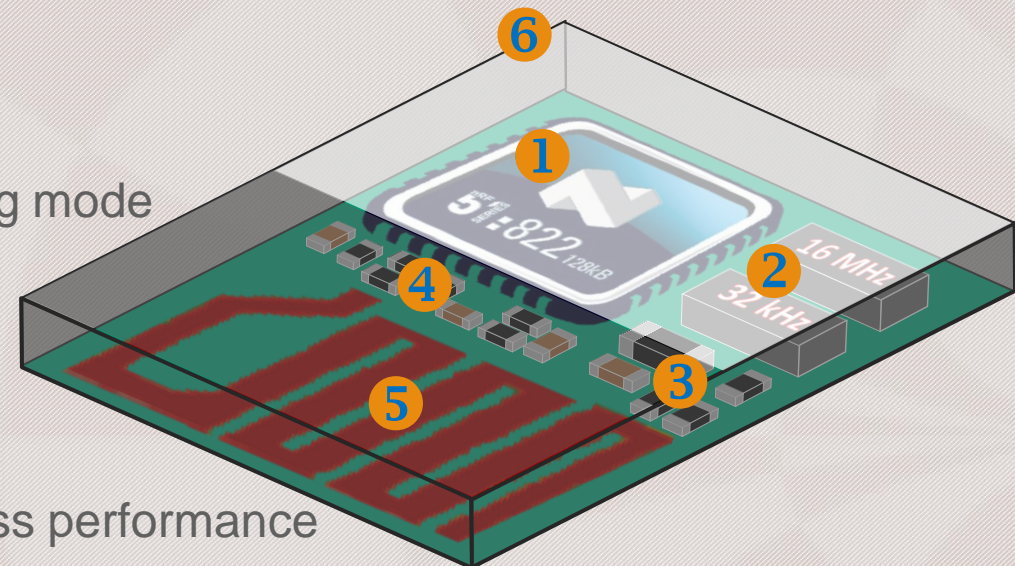
✓ Proprietary integrated antenna

✓ Offering best reproducibility and best in class performance

✓ Relatively insensitive to environment

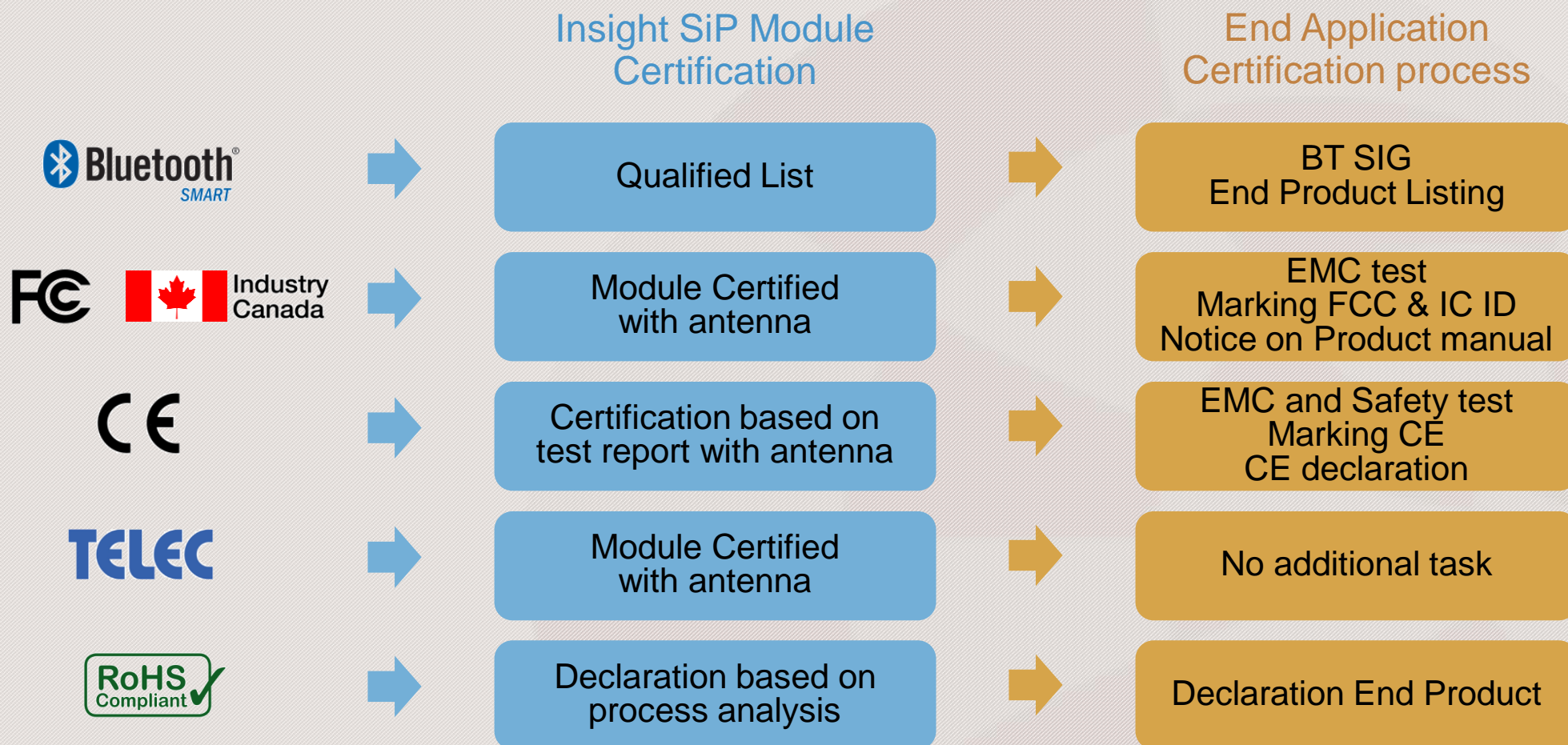
6 Integrated shielding avoiding external metallic covers

✓ Reduces height and size



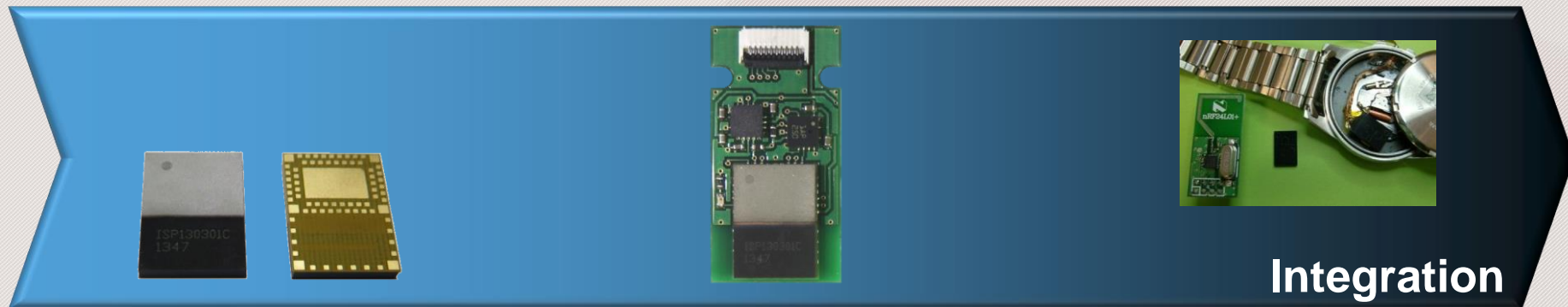
Certified Portfolio

 Modules all certified for easy final application certification



Evolutionary Offering

- ✚ Insight SiP intends to propose a **complete set of solutions** to our customers



- ✚ **Smart Modules**

- ✓ Ready to Use Module to be integrated in application circuit
- ✓ Off shelf

- ✚ **Smart Devices**

- ✓ Ready to Use Radio and Hardware circuit with integrated sensor
- ✓ Custom or Off shelf

- ✚ **Design to Production**

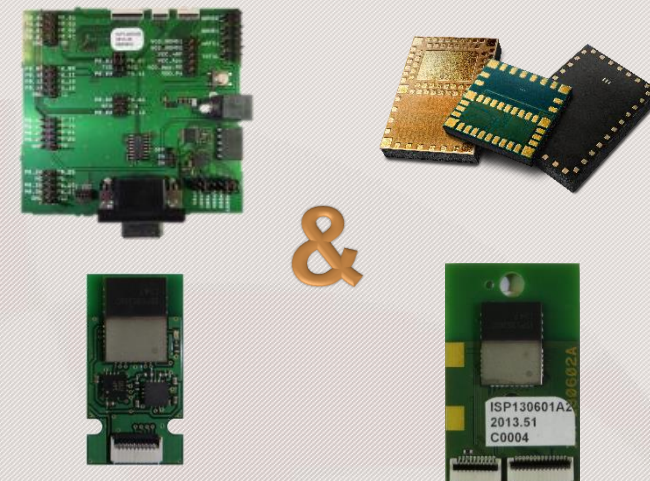
- ✓ Radio and Hardware included in a Custom Design SiP
- ✓ Specific form factor

Module Dev Boards



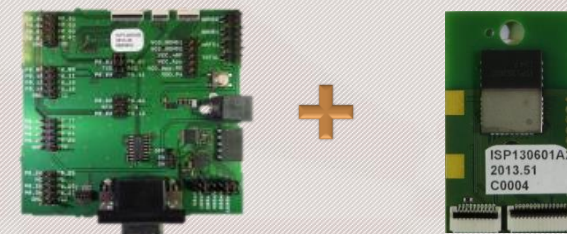
Complete Development kit

- ✓ 1 interface board with nRF51822 dongle and J-Link Cortex emulator
- ✓ 1 test board
- ✓ 1 application demo for test purpose
- ✓ 5 sample module units
- ✓ Cables
- ✓ Dev Kits are compatible in between P/N



Evaluation Board

- ✓ 1 interface board with nRF51822 dongle and J-Link Cortex emulator
- ✓ 1 test board



Test Board

- ✓ Specific test board of required P/N compatible with any Kit
- ✓ Note: ISP091201 test board is only suitable with Nordic Dev Kit

Module Manufacturing

- ✚ **Modules are manufactured in 2 plants, in Taiwan and Philippines**
 - ✓ Contingency plan in place
- ✚ **All modules fully tested before delivery**
 - ✓ IOs, Radio and Flash/RAM writing
 - ✓ Possibility to offer Pre-programming service
- ✚ **Large choice of packaging**
 - ✓ Samples are provided in thermoformed trays or cut tape
 - ⚠ ISP Modules have been tested MSL-5
It is recommended to bake the product before assembly
 - ✓ For volume production, modules are available in Jedec trays x100
 - 📎 Delivered in sealed pack, ready to use
Jedec trays are suitable for further baking
 - ✓ ISP Modules are also available in Tape & Reel x500 or x2000
 - 📎 Delivered in sealed pack
Tape & Reel ARE NOT suitable for further baking





**ANY QUESTION ?
FEEL FREE TO CONTACT US**
contact@insightsip.com

THANK YOU !

