SMART MODULES

PRODUCT RANGE

Insight SiP
It's all in the package

👉 *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 µW & RF circuit theory skills
  - ✓ Unique set of design techniques & industrialization expertise
 - ✓ 25 people engineering and fabless company

- *Locations*
  - ✓ Europe – HQ & Technical team in Sophia-Antipolis
  - ✓ North America – Subsidiary in Denver
  - ✓ Asia – Sales office in Tokyo
  - ✓ Global network of distributors
  - ✓ Manufacturing – Taiwan and Philippines

- **SiP approach consists of integrating several different components into a single miniaturized module**
  - ✓ From different semiconductor and passive technologies
    - • Organic substrates (BT, FR4...)
    - • Multi-layer ceramic substrates (LTCC, HTCC, Thick film...)
    - • Thin film IPD on silicon or glass
  - ✓ Unique ability to embed functions within the package
  - ✓ RF know-how
 - ✓ Extremely rapid and low cost development cycles
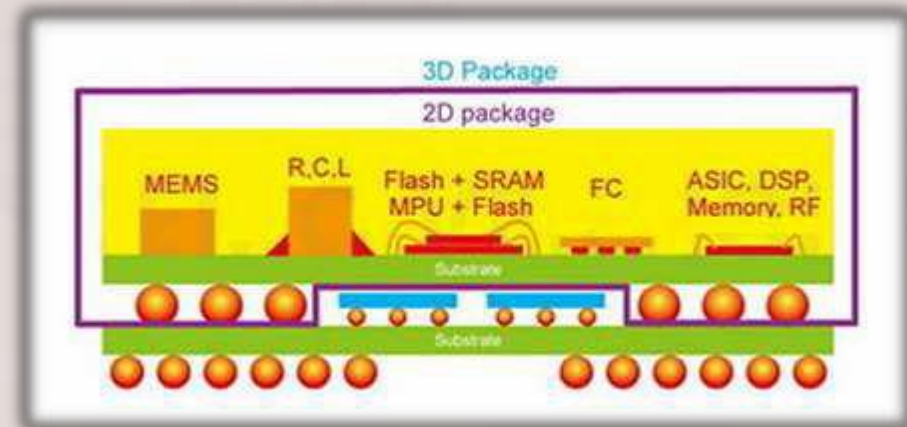
- **Insight SiP focus on AiP – Antenna in Package – products with the addition of ultra-miniature antennas in the SiP**
  - ✓ Insight SiP's long term fundamental research program
  - ✓ Combining electromagnetic simulations and circuit level optimization
  - ✓ Based on a user extendable library of physical objects
  - ✓ R&D work implemented in several Wireless Connectivity products

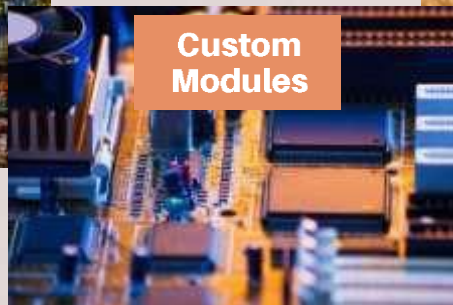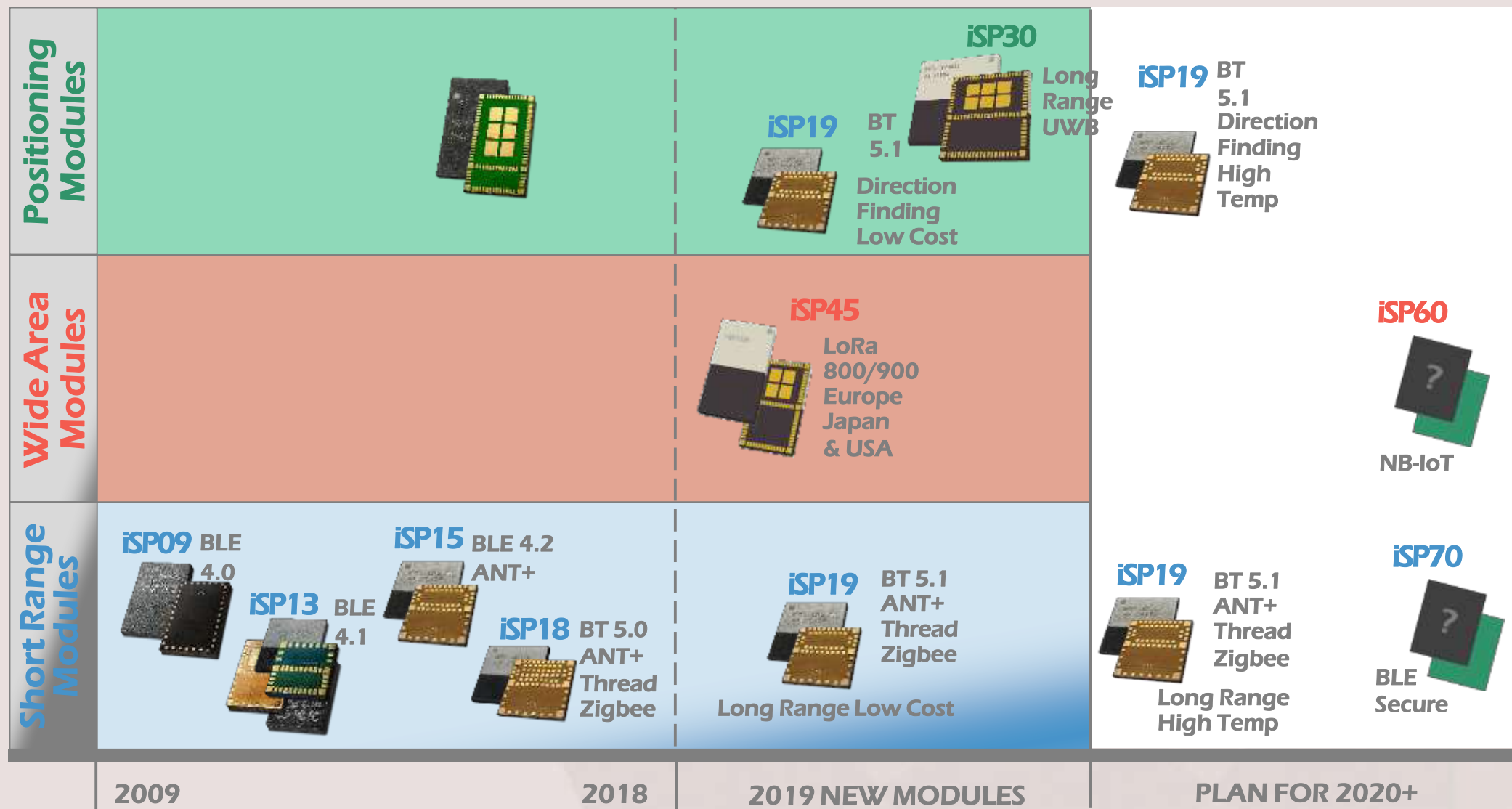## LOW POWER NETWORKING

POSITIONING
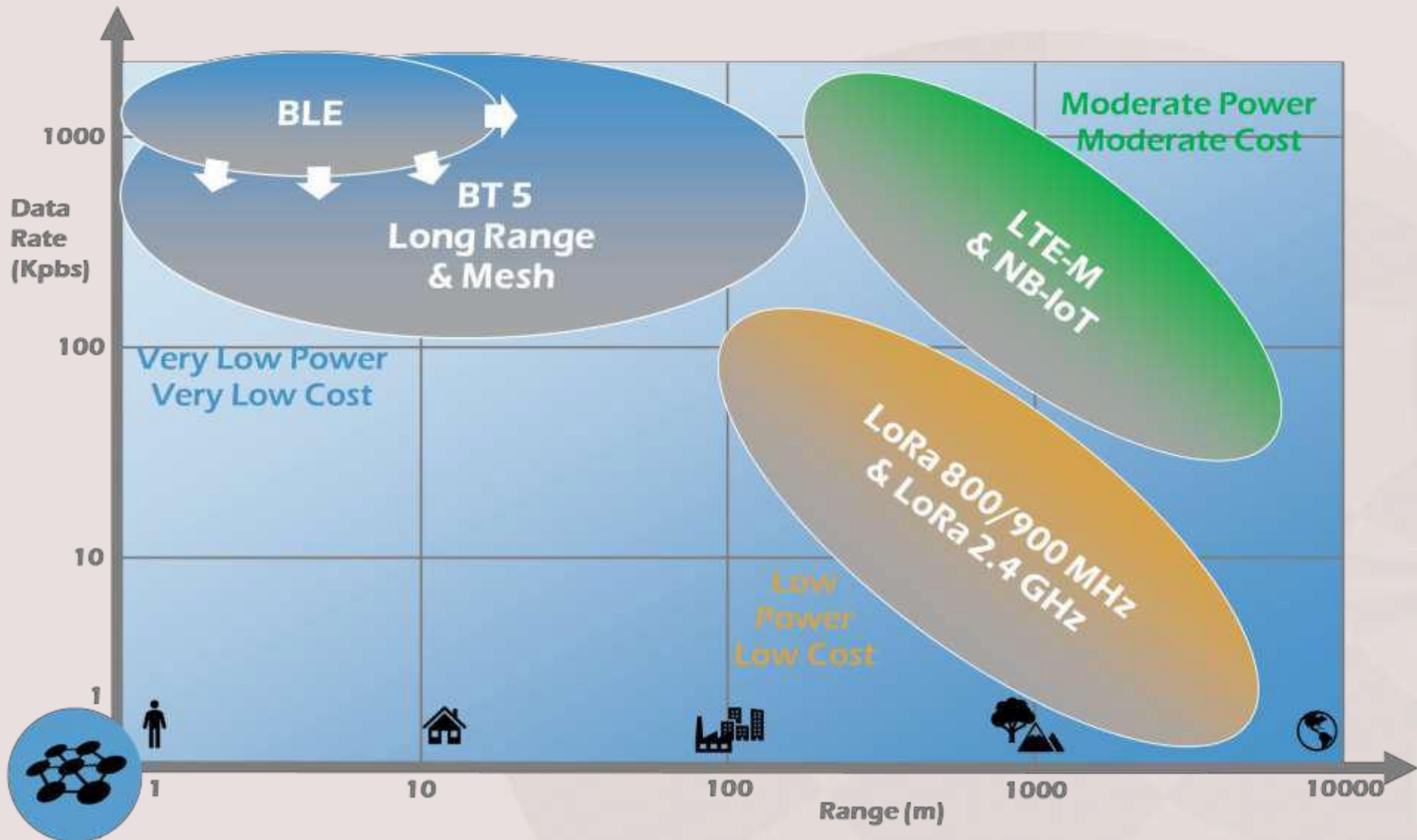
👉 **Insight SiP is the leading provider of Smart, Low Power and Built-in Antenna Connectivity Modules for advanced IoT solutions**

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

MODULE LINES

Short Range

Wide Area Network

Custom Modules

Positioning

Secure IoT

PRODUCT OFFER

Insight SiP — It's all in the package

Positioning Modules

iSP19 — BT 5.1 Direction Finding Low Cost

iSP30 — Long Range UWB

iSP19 — BT 5.1 Direction Finding High Temp

Wide Area Modules

iSP45 — LoRa 800/900 Europe Japan & USA

iSP60 — ? — NB-IoT

Short Range Modules

iSP09 — BLE 4.0

iSP13 — BLE 4.1

iSP15 — BLE 4.2 ANT+

iSP18 — BT 5.0 ANT+ Thread Zigbee

iSP19 — BT 5.1 ANT+ Thread Zigbee — Long Range Low Cost

iSP19 — BT 5.1 ANT+ Thread Zigbee — Long Range High Temp

iSP70 — ? — BLE Secure

2009 | 2018 | 2019 NEW MODULES | PLAN FOR 2020+

- ***Insight SiP offers BLE modules from V4.0 up to V5.1***
  - ✓ No Bluetooth Classic or Dual Mode available

- *Bluetooth 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

- *Bluetooth Classic*
  - ✓ establishes a relatively short-range
  - ✓ continuous wireless connection
  - ✓ makes it ideal for use cases such as streaming audio

- *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)
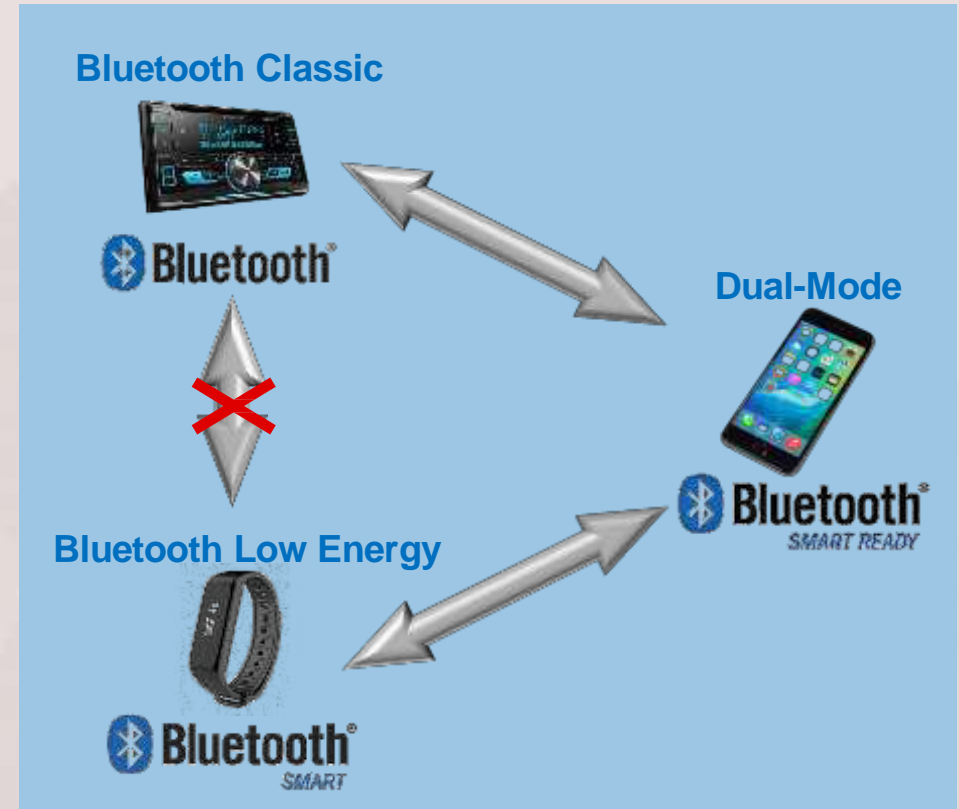
- **Bluetooth Low Energy is designed for Low Power Applications**

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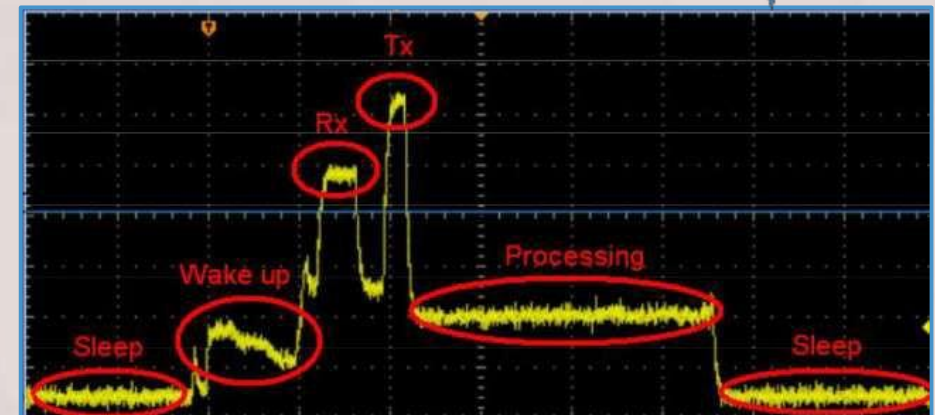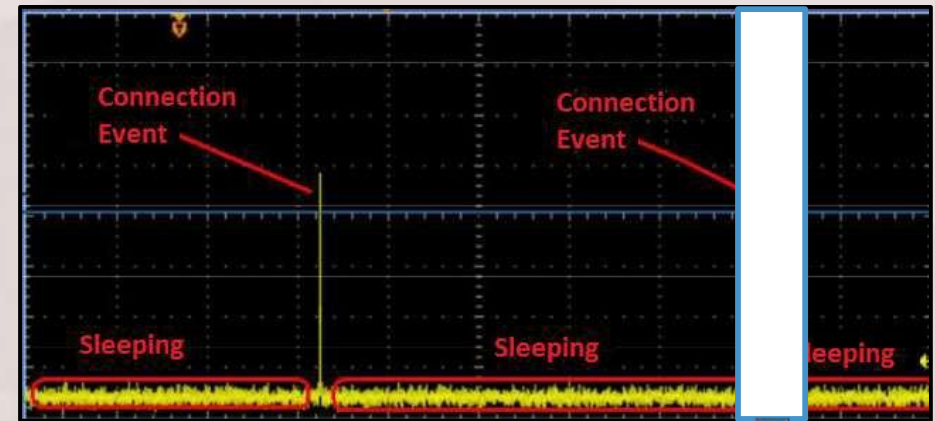
- **BLE Mesh is a recent extension of Bluetooth technology**
  - ✓ It extends the capabilities and potential uses of Bluetooth in many application
  - ✓ Particularly suited to smart building and home automation applications

- **BLE Mesh is available from V4.2 Bluetooth version**
  - ✓ 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 is 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**

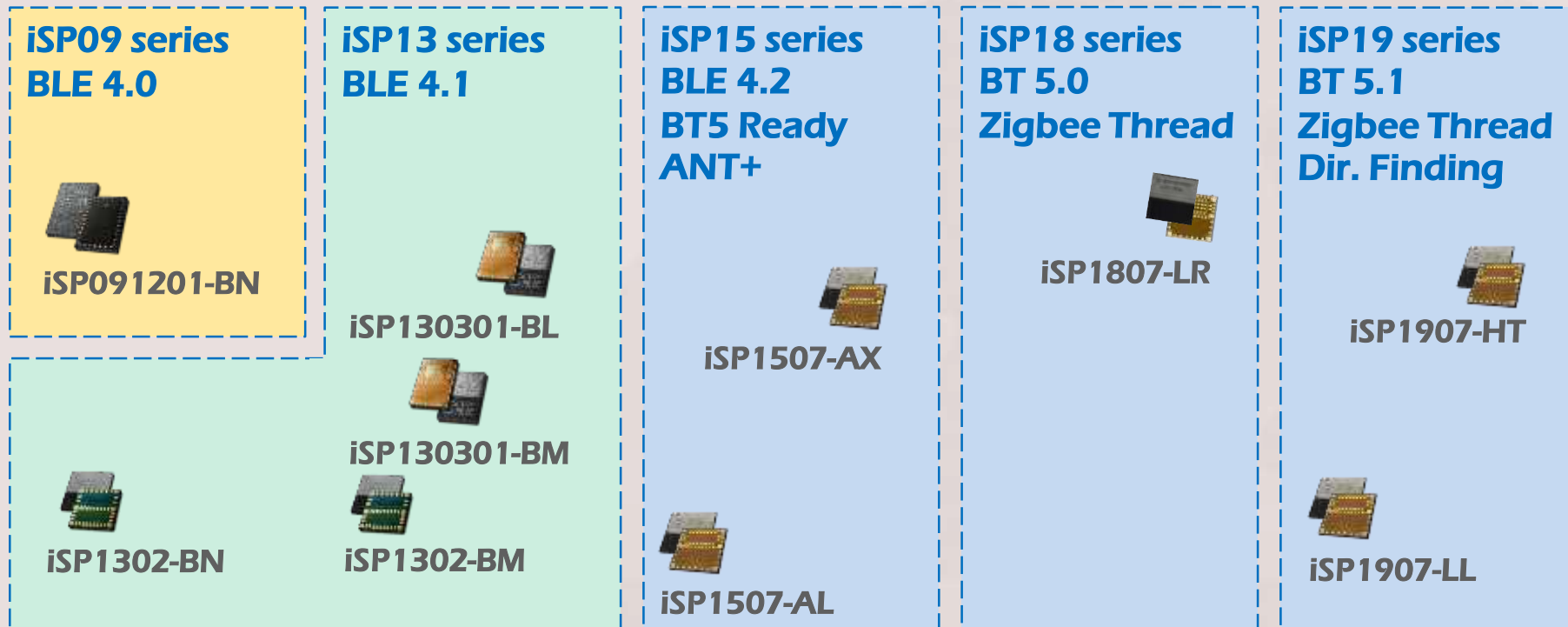- **Allows devices to be put into groups and message to be sent to one device or a group of devices**
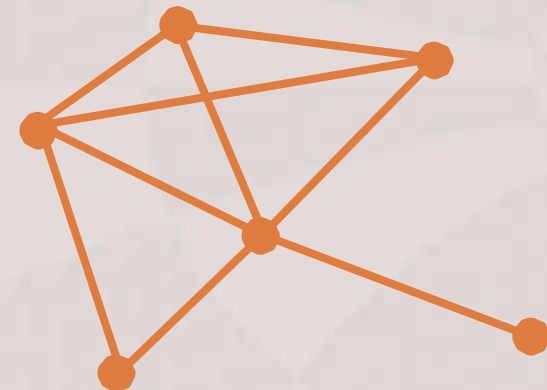
EXTENSIVE BLE PLATFORM

Insight SiP — It's all in the package

Price (vertical axis)

Large Choice of Platforms and Options with Integrated Antenna

nRF8001 inside
nRF51 inside
nRF52 inside

iSP09 series
BLE 4.0

iSP091201-BN

iSP13 series
BLE 4.1

iSP130301-BL

iSP130301-BM

iSP1302-BN

iSP1302-BM

iSP15 series
BLE 4.2
BT5 Ready
ANT+

iSP1507-AX

iSP1507-AL

iSP18 series
BT 5.0
Zigbee Thread

iSP1807-LR

iSP19 series
BT 5.1
Zigbee Thread
Dir. Finding

iSP1907-HT

iSP1907-LL

BLE Connectivity for External MCU

Integrated MCU Sensor Node

Integrated MCU Sensor Node & Mesh

Integrated MCU – Multiprotocol Long Range & Mesh

Performance (horizontal axis)

Insight SiP — It's all in the package

- **Comprehensive brand new range of BT 5.0 and BT 5.1 modules based on nRF52 family**

ISP1507-AX

All-purpose BLE solution for sensor & Mesh connectivity

MASS PRODUCTION

- ✓ Based on nRF52832
- ✓ BT 5.0 Ready
- ✓ 512 kB Flash & 64 kB RAM
- ✓ 30 IOs

Common features
Interchangeable Pin to Pin compatibility

- ✓ Form Factor 8 x 8 x 0.95 mm
- ✓ BLE, ANT+, BT Mesh
- ✓ Built-in Antenna, Cortex M4, DC/DC, Xtals, Balun
- ✓ SPI, I2C, UART, ADC interfaces

ISP1907-HT

Long Range High Temperature for Smart Home & Lighting

JAN 2020

- ✓ Based on nRF52833
- ✓ BT 5.1 Long Range & AoA
- ✓ 512 kB Flash & 128 kB RAM
- ✓ 30 IOs + USB

ISP1507-AL

Perfect for Mesh Relay nodes and price sensitive solutions

MASS PRODUCTION

- ✓ Based on nRF52810
- ✓ BT 5.0 Ready
- ✓ 192 kB Flash & 24 kB RAM
- ✓ 13 IOs

ISP1807-LR

Home and Building Networks and secure solutions

MASS PRODUCTION

- ✓ Based on nRF52840
- ✓ BT 5.0 Long Range
- ✓ 1 MB Flash & 256 kB RAM
- ✓ ARM Cryptocell
- ✓ 46 IOs + USB

ISP1907-LL

Price Sensitive Home and Building Networks

SAMPLES & KITS

- ✓ Based on nRF52811
- ✓ BT 5.1 Long Range & AoA
- ✓ 192 kB Flash & 24 kB RAM
- ✓ 13 IOs

LOW COST BT5 READY

iSP1507-AL

Perfect for Mesh Relay Node and Price Sensitive Solutions Ultra Low Consumption

Key Features

✓ **Based on nRF52810**
✓ **BT 5 Ready BLE transceiver**
✓ **Ultra Small LGA 8 x 8 x 1 mm**
✓ **32-bit ARM Cortex – M4 CPU**
✓ **192K Flash & 24 K SRAM**
✓ **Suitable for ANT+ Protocol**
✓ **Complete set of 13 IOs included**
✓ **Radio 32 MHz & Synchro 32 kHz Xtals**
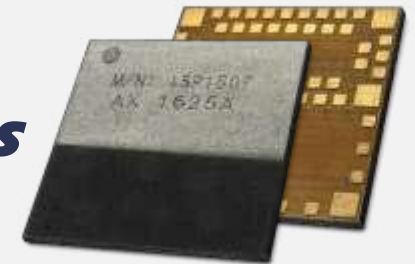✓ **Decoupling and DCDC circuit on board**
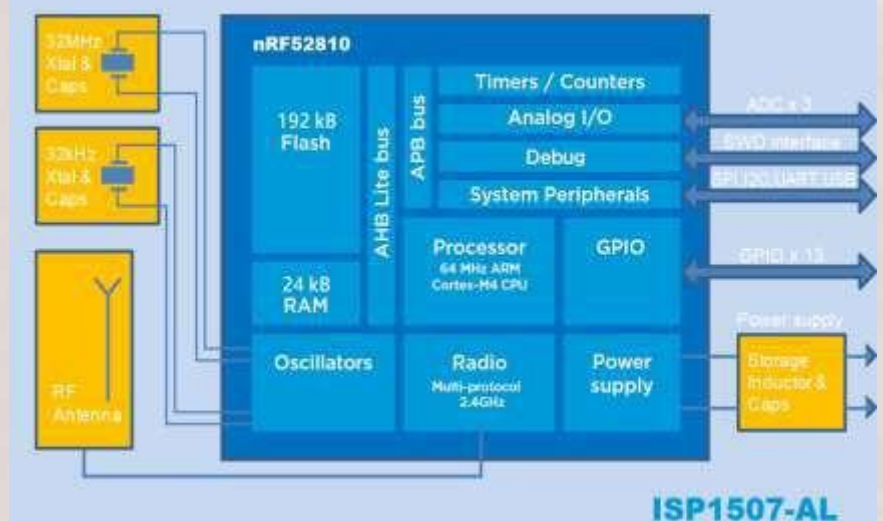
Applications

✓ **Any type of Body Area applications**
✓ **Industrial Sensors**
✓ **Home network applications**

Market Introduction

✓ **Samples, kits available**
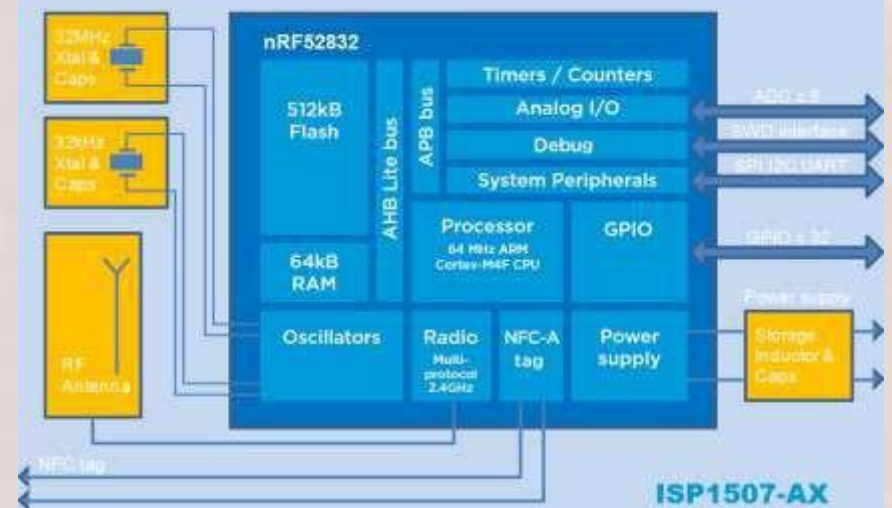✓ **Full Mass production**
✓ **Fully Certified**

Insight SiP — It's all in the package

iSP1507-AX

High Performance Module for BLE / ANT+ / NFC Applications Ultra Low Consumption

Key Features

NORDIC
nRF 52 series

Bluetooth SMART

RoHS Compliant ✓

TELEC

FC

Industry Canada

CE

- ✓ Ultra Small LGA 8 x 8 x 1 mm
- ✓ BT 5 Ready nRF52832 BLE transceiver
- ✓ 32-bit ARM Cortex – M4 CPU
- ✓ 512 K Flash & 64 K SRAM
- ✓ NFC-A Tag for OOB pairing
- ✓ Suitable for ANT+ Protocol
- ✓ Complete IO set included
- ✓ Radio 32 MHz & Synchro 32 kHz Xtals
- ✓ Decoupling and DCDC circuit on board

Applications

- ✓ Connected sensors
- ✓ IoT applications
- ✓ Wearable technology
- ✓ Home automation
- ✓ Beacons

Market Introduction

- ✓ Samples, kits available
- ✓ Full Mass production
- ✓ Fully Certified

**Insight SiP** — It's all in the package

iSP1807-LR

Long Range BT5 Module for BLE, ANT+, NFC Applications Ultra Low Consumption

Key Features

- ✓ Ultra Small LGA 8 x 8 x 1 mm
- ✓ BT 5.0 nRF52840 BLE transceiver
- ✓ Long Range +8 dBm Tx power
- ✓ 32-bit ARM Cortex – M4F CPU
- ✓ 1MB Flash & 256 K SRAM
- ✓ ARM CryptoCell, NFC pairing
- ✓ USB interface
- ✓ Suitable for ANT+, Zigbee, Thread
- ✓ Complete 46 IOs set included
- ✓ Radio 32 MHz & Synchro 32 kHz Xtals
- ✓ Decoupling and DCDC circuit on board

NORDIC nRF52

Bluetooth SMART

RoHS Compliant ✓

TELEC

FC

Industry Canada

CE

ISP1807-LR
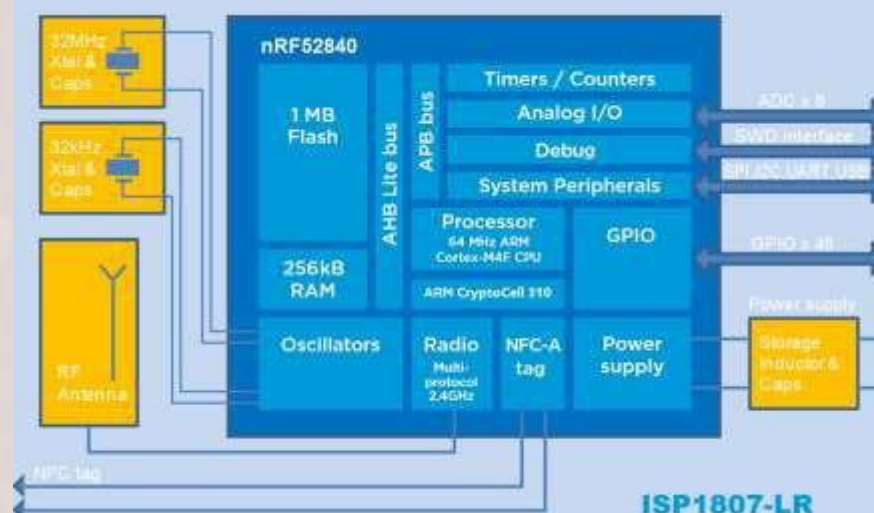
Applications

- ✓ Wearables
- ✓ Fitness, Health
- ✓ Smart Home
- ✓ Industrial sensors
- ✓ Remote controls
- ✓ Gaming controller

Market Introduction

- ✓ Samples & Kits available
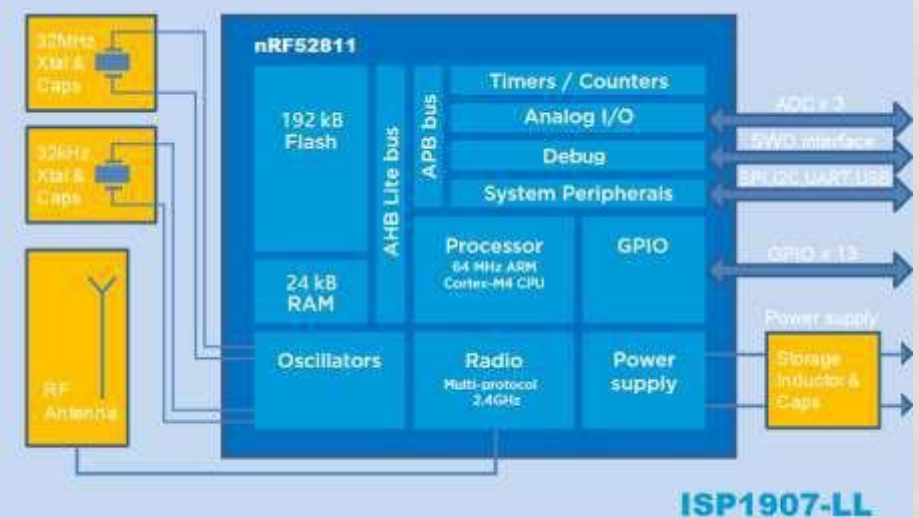- ✓ Full Mass production
- ✓ BT SIG, CE, TELEC, KCC CERTIFIED

Insight SiP
It's all in the package

iSP1907-LL

Long Range & AoA BT 5.1 Module for Price Sensitive Applications

M/N: ISP1907 LL 1825A

Key Features

NORDIC nRF52

✓ Ultra Small LGA 8 x 8 x 1 mm
✓ BT 5.1 nRF52811 BLE transceiver
✓ Long Range +4 dBm Tx power
✓ 32-bit ARM Cortex – M4 CPU
✓ 192 KB Flash & 24 K SRAM
✓ Suitable for ANT+ Protocol
✓ Complete set of 13 IOs included
✓ Radio 32 MHz & Synchro 32 kHz Xtals
✓ Decoupling and DCDC circuit on board

Bluetooth SMART
RoHS Compliant ✓
TELEC
FC
Industry Canada
CE

nRF52811

- 32MHz Xtal & Caps
- 32kHz Xtal & Caps
- 192 kB Flash
- 24 kB RAM
- Oscillators
- RF Antenna
- AHB Lite bus
- APB bus
- Timers / Counters
- Analog I/O
- Debug
- System Peripherals
- Processor 64 MHz ARM Cortex-M4 CPU
- GPIO
- Radio Multi-protocol 2.4GHz
- Power supply
- ADC x 3
- SWD interface
- SPI,I2C,UART,USB
- GPIO x 13
- Power supply
- Storage Inductor & Caps

ISP1907-LL

Applications

✓ Body Area
✓ Industrial Sensors
✓ Home network
✓ Logistics and warehousing
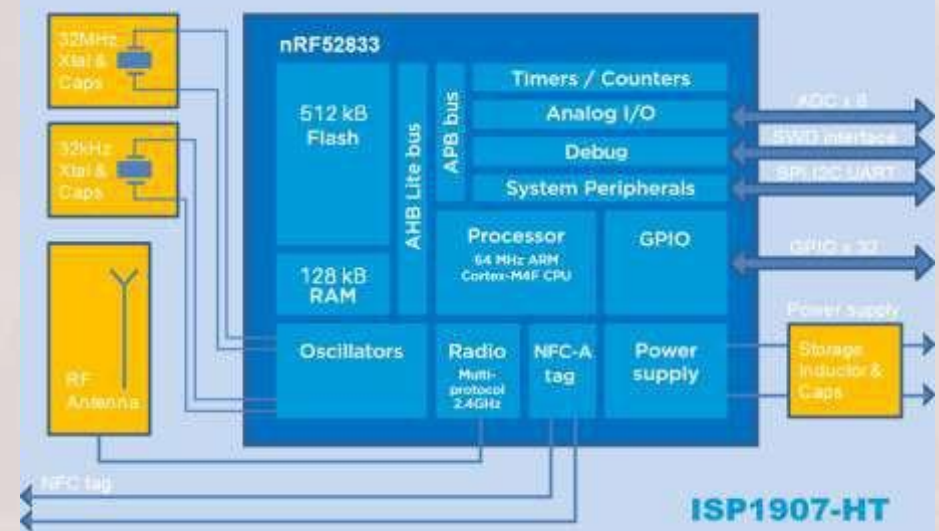✓ Value asset security

Market Introduction

✓ Samples & Kits available
✓ First Production batch in progress
✓ Certification pending

iSP1907-HT

Long Range & AoA BT 5.1 Module For High Temperature And Mesh Applications

Key Features

- ✓ Ultra Small LGA 8 x 8 x 1 mm
- ✓ BT 5.1 nRF52833 BLE transceiver
- ✓ Long Range +8 dBm Tx power
- ✓ 32-bit ARM Cortex – M4F CPU
- ✓ 512 KB Flash & 128 K SRAM
- ✓ USB interface
- ✓ Suitable for ANT+, Zigbee, Thread
- ✓ 30 IOs included
- ✓ Radio 32 MHz & Synchro 32 kHz Xtals
- ✓ Decoupling and DCDC circuit on board
- ✓ Extended temperature range -40/+105°C

Applications

- ✓ Lighting Applications
- ✓ Industrial
- ✓ Smart Home
- ✓ Logistics and warehousing
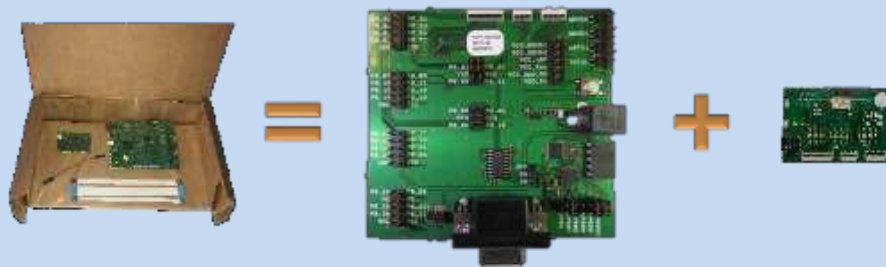- ✓ Value asset security

Market Introduction

- ✓ Samples & Kits schedule Q1-2020 to be confirmed when the chip is available

iSP15 series
iSP18 series
iSP19 series
Evaluation Board & Test Board

Evaluation Baord

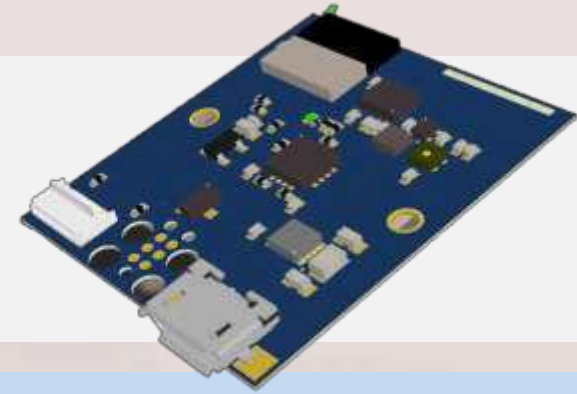- ✓ 1 interface board with J-Link Cortex emulator
- ✓ 1 test board

Test Board

- ✓ Specific test board of required P/N compatible with any Kit
- ✓ Test Boards integrate a "Connector Debug In" port compatible with Nordic Dev kits
- ✓ All IOs "Test Point" on board

iSP1880

BLE Miniature Multi Sensor Based on iSP1807

Key Features

- ✓ BT5 nRF52840 transceiver
- ✓ Long Range +8 dBm Tx power
- ✓ 32-bit ARM Cortex – M4F CPU
- ✓ 1MB Flash & 256 K SRAM
- ✓ ARM CryptoCell
- ✓ USB interface
- ✓ Single 2.1 to 5.5 V supply
- ✓ Decoupling and DCDC circuit on board
- ✓ Ultra Low Power Consumption on CR2032 Coin cell battery
- ✓ Overall Size 26 x 32 mm
- ✓ Temperature -25 to 75 °C
- ✓ Fully integrated RF matching and Antenna
- ✓ Radio 32 MHz & Synchro 32 kHz Xtals

- ✓ Accelero /Gyro / Magneto Sensor
- ✓ Temperature/Barometer
- ✓ Humidity Sensor
- ✓ Programmable controlled mini LED
- ✓ Sensor Demo available on iTunes and Google Play

Sensor Demo

Insight SiP — It's all in the package

- **Select the RF and Protocol requirements**

  ✓ **Does the application needs other protocol than pure BLE ?**
    What about ANT, Zigbee, Thread ?
  ✓ **Is BLE Mesh needed ?**
  ✓ **Should the radio be Long Range ?**
  ✓ **Any need for Direction Finding ? Tag ? Anchor ? Both ?**

Module Type	iSP1507-AL	iSP1507-AX	iSP1807-LR	iSP1907-LL	iSP1907-HT
Multi Protocol		OK ANT+	BEST ANT, Thread Zigbee		BEST ANT, Thread Zigbee
NFC Pairing		OK	OK		OK
Mesh needed		BEST	BEST		BEST
Long Range needed			BEST	BEST	BEST
Direction Finding				TAG only	TAG & Anchors

- **Select the adapted CPU performance**

  - ✓ Does the application needs an embedded MCU or use an external host ?
  - ✓ Does it need many calculation with floating point capability ?
  - ✓ What is the requirement in term of memory ?
  - ✓ Any additional security required ?

Module Type	iSP1507-AL	iSP1507-AX	iSP1807-LR	iSP1907-LL	iSP1907-HT
External Host Micro	BEST			BEST	
Embedded floating point computing		YES	YES		YES
Embedded memory requirement	LIGHT 192 / 24 kB	MEDIUM 512 / 64 kB	LARGE 1 MB / 256 kB	LIGHT 192 / 24 kB	MEDIUM 512 / 128 kB
Embedded Cryptocell security			YES		

▪ **Select the module interfaces**

   ✓ **How may IOs are required ?**
   ✓ **Any Analog port ?**
   ✓ **Any USB interface ?**

Module Type	iSP1507-AL	iSP1507-AX	iSP1807-LR	iSP1907-LL	iSP1907-HT
Ios including I2C, SPI, UART, PWM, etc.	LIGHT 13	MEDIUM 30	LARGE 46	LIGHT 13	MEDIUM 30
ADCs	LIGHT 3	LARGE 8	LARGE 8	LIGHT 3	LARGE 8
USB			YES		YES

👉 **Insight SiP offers LoRa Low Power solution platform for Longer Range Networking applications**

- **Insight SiP is LoRa Alliance member since 2018**

- **LoRa section based on Semtech transceiver**
  - ✓ Europe: based on Semtech SX1261, 867-869 MHz and +14dBm
  - ✓ US: based on Semtech SX1262, 902-928 MHz and +20dBm
  - ✓ Japan: based on Semtech SX1261, 920-925 MHz and +14dBm

- **BLE section based on Nordic nRF52 chipset**
  - ✓ Providing over the air configuration of LoRa through smartphone or tablet
  - ✓ Also offering low energy rough location indication

- **Dual antenna integration**
  - ✓ New and unique concept developed by Insight SiP with 2 embedded antennas in package

- **Certifications**
 - ✓ BT SIG, CE, FCC, IC, TELEC based on versions

Insight SiP — It's all in the package

- ## *LoRa is a Low-Power Wide Area Network (LPWAN) standard*

  - ✓ **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%)

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

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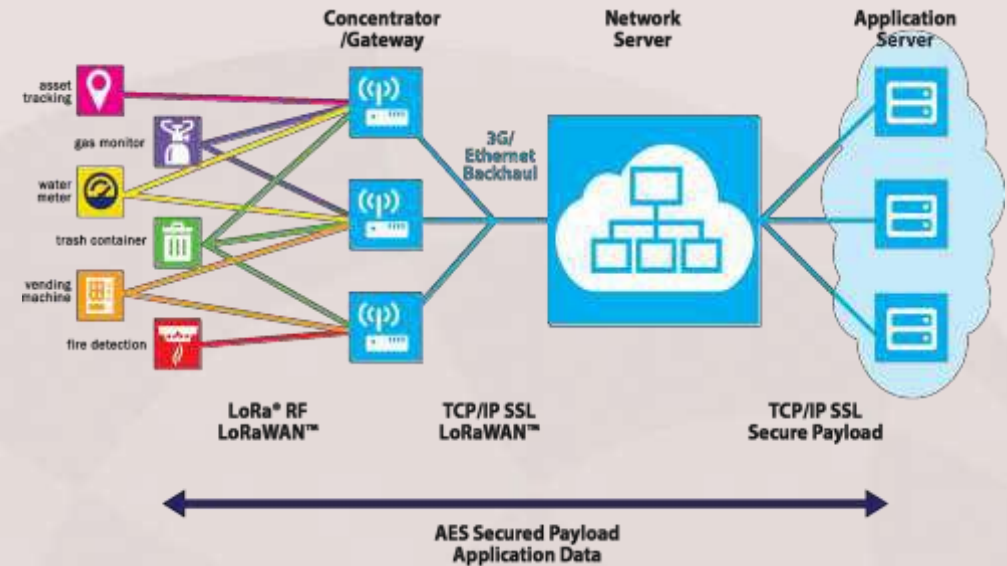
Region	Supported	Band [MHz]	Duty cycle	Output power
EU	Y	868	<1 %	+14 dBm
EU	Y	433	<1 %	+10 dBm
US	Y	915	<2 % (BW<250 kHz) or <4 % (BW>=250 kHz) Transmission slot < 0.4 s	+20 dBm
CN	N	779	<0.1 %	+10 dBm

- **_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 used 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™ Alliance
Wide Area Networks for IoT

- **Insight SiP module is focused on Class A devices, this is the mode used in most battery driven nodes, as it is the lowest power mode**

- **There are two types of LoRa node: Gateway and Device**

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

- **Devices can be three classes**

  - ✓ **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
  - ✓ **Class C** – Is always listening

Insight SiP — It's all in the package
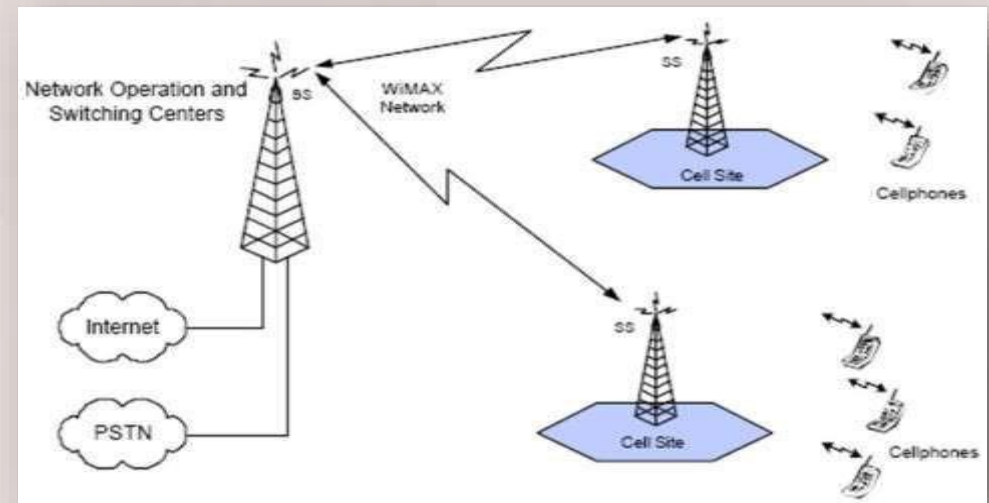
iSP4520-EU
iSP4520-US
iSP4520-JP

Combo LoRa / BLE module With Integrated Antenna EU, US and Japanese Bands

Key Features

- ✓ LoRa Alliance
- ✓ BT 5 Ready
- ✓ NFC-A Tag for OOB pairing
- ✓ Fully integrated LoRa & BLE Dual Matching and Antenna
- ✓ Integrated Xtals LoRa 32 MHz, BLE 32 MHz & 32.768 kHz
- ✓ LoRa based SX126x
- ✓ BLE based nRF52
- ✓ Supply 2.8V-3.6V
- ✓ Temp. -40 to +85 °C
- ✓ Size 9.8 x 17.2 x 1.7 mm

- ✓ Externally Controlled or using embedded 32-bit ARM M4 CPU
- ✓ 512 kB Flash
- ✓ 64 kB RAM
- ✓ DC/DC converters
- ✓ Analog, Digital peripherals
- ✓ SPI interface

SEMTECH SX1261   NORDIC nRF52

LoRa Alliance   CE

Bluetooth SMART   RoHS Compliant

ISP4520 BLE - LoRa
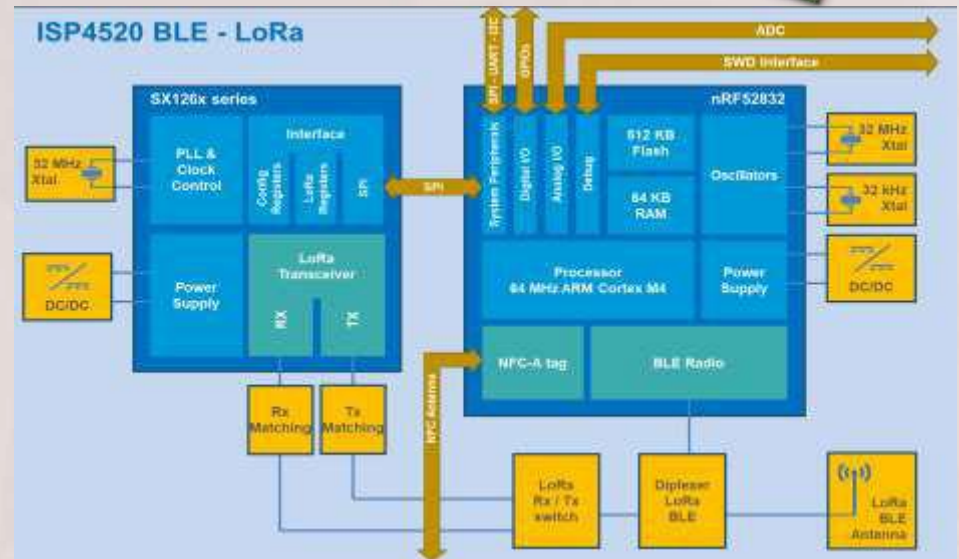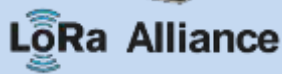
Typical Application

- ✓ Smart Cities / Smart Retail
- ✓ Industrial Internet
- ✓ Big Data / Data science
- ✓ Energy Engagement / Smart grids

Specification	iSP4520-xx	
	LoRa Section	**BLE Section**
Radio	EU = 867-869 MHz US = 902-928 MHz JP = 920-925 MHz + Balun + Antenna	2.4 GHz + Balun + Antenna
NFC	-	Type 2 NFC-A Tag
Supply Voltage	2.8 / 3.6 V + DCDC	1.8 / 3.6 V + DCDC
Peak current Tx	30 mA	5.3 mA @ 0 dBm
Peak current Rx	12 mA	5.4 mA
Deep sleep Current	0.1 µA	0.3 µA
Tx Power	EU & JP = +13 dBm US = +20 dBm	-20 to +4 dBm
Rx sensitivity	-132 dBm	-96 dBm
Range	10 km	70 m
CPU	-	32-bit ARM Cortex M4F
Memory	-	512 kB flash / 64 kB RAM
Crystal	32 MHz	32 MHz and 32 kHz
Interfaces	SPI	GPIO, SPI, I2C, UART, ADC
Size	9.8 x 17.2 x 1.7 mm	

Supported Stacks

✓ **S132 BT 5.0 compliant stack concurrent central, observer, peripheral, and broadcaster with up to 20 connections**

✓ **LoRa stack ported from STM32 platform to nRF52 one**

Market Introduction

✓ **Samples & Kits available for all versions EU, US and JP**

✓ **First production batch on going**

✓ **Certifications: LoRaWAN, BT SIG and local certification based on different version, targeted Q1-2020**

Insight SiP — It's all in the package

iSP4520

**Complete Kit
Test Board / Mote
Test Board / Gateway**

Development Kit

✓ Offers the perfect solution to start with ISP4520, including ...

✓ 1 x Interface Board with integrated J-Link Emulator
✓ 1 x Tx Test Board / Mote
✓ 1 x Rx Test Board / Gateway
✓ Example firmware codes for both Mote & Gateway demonstrating temperature sensor application
✓ Including LoRaWAN stack ported on nRF52 platform

Tx Test Board / Mote

✓ Consists of a module mounted on a PCB
✓ Includes a connection to the Insight SiP generic Interface Board
✓ Offers test points for all IOs and can be used in conjunction with a Nordic Development kit.

Rx Test Board / Gateway

✓ Consists of a PCB integrating an ISP4520 module and a USB plug for connection to a PC port com
✓ Enables to communicate with a Mote in a point to point connectivity mode through LoRa standards.

Insight SiP
It's all in the package

iSP4580

LoRa & BLE
Multi Sensor Demo
Based on iSP4520-EU

Key Features

- ✓ LoRa Alliance based on SX1261
- ✓ BT 5 Ready based onnRF52
- ✓ Fully integrated LoRa & BLE Dual Matching and Antenna
- ✓ Integrated Xtals LoRa 32 MHz, BLE 32 MHz & 32.768 kHz
- ✓ Supply 2.8V-3.6V
- ✓ Temp. -40 to +85 °C
- ✓ Coin cell battery CR2032
- ✓ Accelero / Gyro / Magneto Sensor
- ✓ Temperature / Barometer
- ✓ Light Sensor
- ✓ Humidity Sensor
- ✓ Sensor Transmission with LoRa

BLE Setup

LoRa Sensor Transmission

Cloud Data Transfer

👉 **Insight SiP is developing NB-IoT & BLE combo solution with Built-in Antennas**

- **This small LGA module, 16 x 18 x 1.5 mm, is based on the nRF91 and nRF52 series devices**

- **Dual processor**
  - ✓ Cortex M33 Application processor with 1MB Flash and 256 kB RAM
  - ✓ Together with a Cortex M4 processor dedicated to Bluetooth activities

- **BLE connectivity allows for easy configuration and firmware updates**

- **Incorporates 2 antennas, one for NB-IoT operation in either Band 3 or Band 20 and a second one for BLE**

Insight SiP — It's all in the package

iSP 60 series

Dual NB-IoT and BLE chips
Built-In antennas
Timeline - end 2020
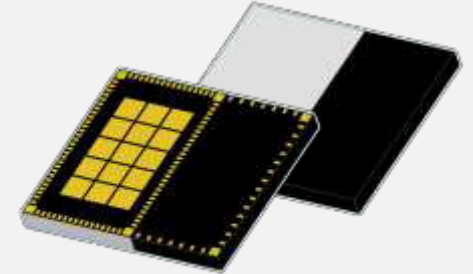
Key Features

- ✓ Ultra Low Power Consumption
- ✓ Single 3.3 to 5.5 V supply
- ✓ Small size 16 x 18 x 1.5 mm
- ✓ NBIoT Functions based on nRF91 series
- ✓ Ultra Low Power IoT Modem
- ✓ 64MHz ARM Cortex M33 CPU
- ✓ 1MB Flash 256 kB RAM
- ✓ 20 GPIOs
- ✓ BLE Functions based on nRF52 series
- ✓ Single Mode BLE V5.0 Compliant
- ✓ 2.4GHz low energy RF Transceiver
- ✓ 32bit ARM Cortex M4 CPU
- ✓ 512 kB Flash
- ✓ 64 kB SRAM
- ✓ 20 GPIOs including 5 ADC inputs & 1 reference
- ✓ Integrated Antennas
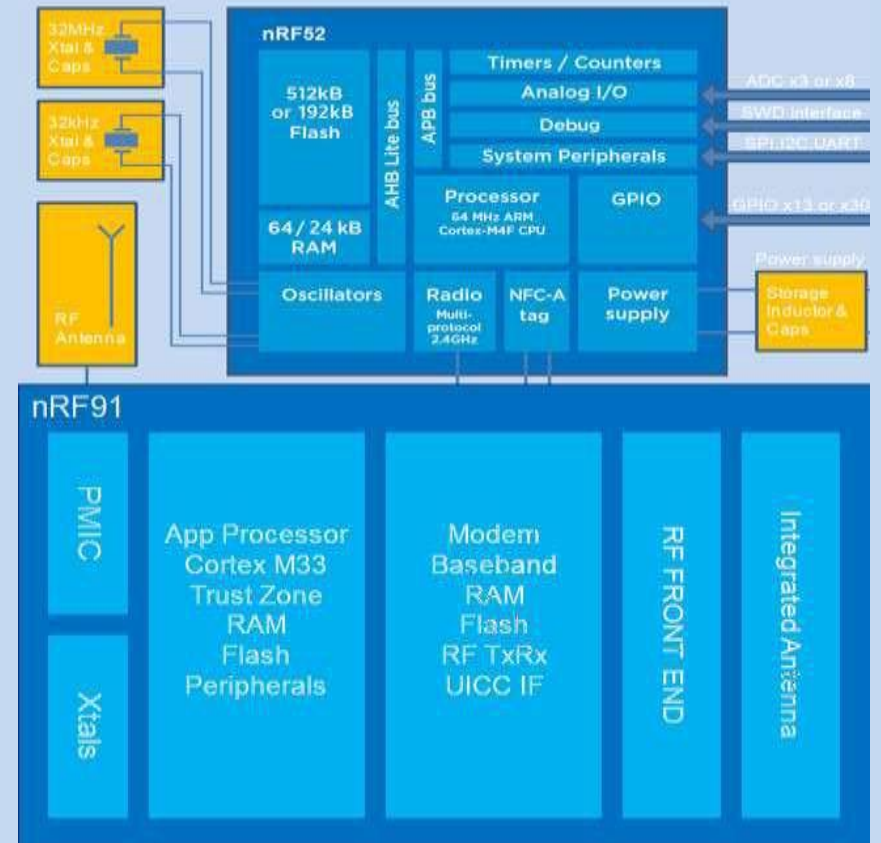
- *Direction Finding is the main new feature of Bluetooth 5.1*
  - ✓ Former BT location systems was based on RSSI only, with poor precision
  - ✓ It will offer enhance location services for Real Time Location Systems (RTLS)

- *Bluetooth direction finding is using AoA or AoD to detect tag location*
  - ✓ Angle of Arrival (AoA) and Angle of Departure (AoD) makes use of the angular phase-shifts that occur between antennas as they receive or transmit RF signals
  - ✓ This full system is made of anchor units positioned in line of sight manner
  - ✓ Antenna arrays at both side of the communication link are providing phase shift data, determining AoA or AoD
  - ✓ Position of tagged items are calculated by triangulation from different anchors

- *Allows for use of very simple and low cost tags to determine their location*

- *Perfectly suited for asset tracking in warehouses and buildings or ID location of people and staff*
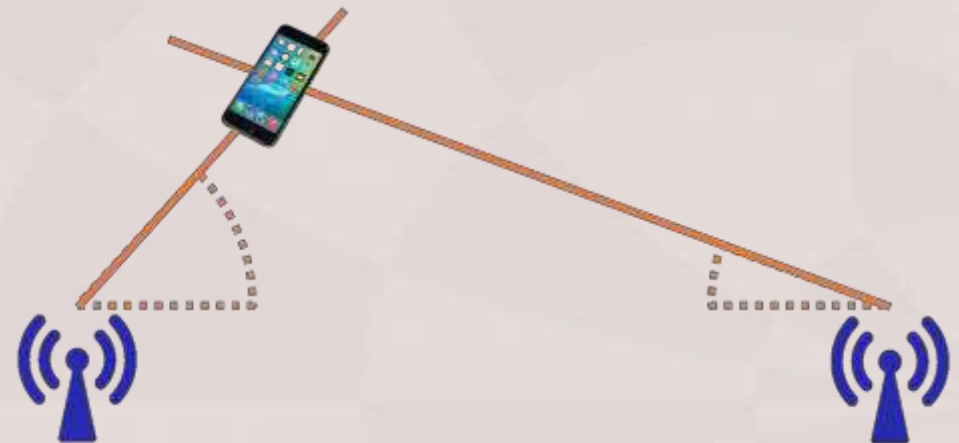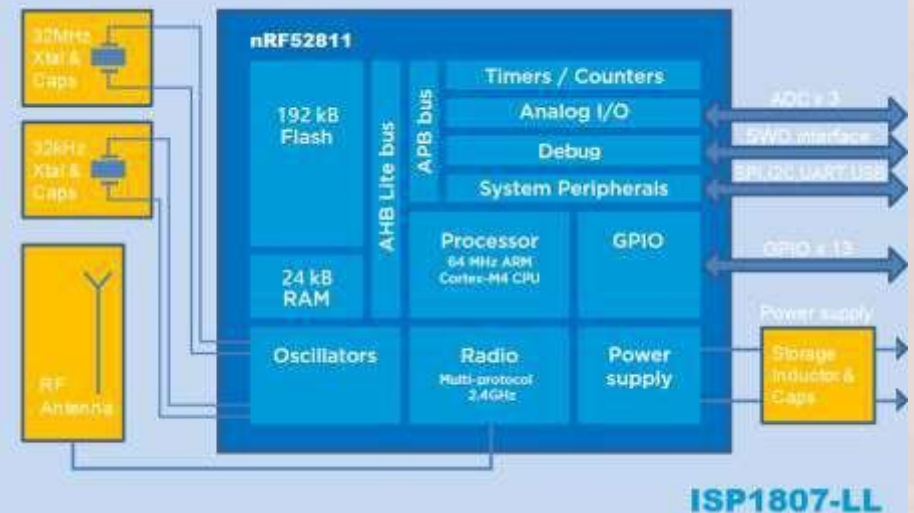
iSP1907-LL

AoA BT 5.1
Price Sensitive Applications
Best Suited for Tags

Key Features

✓ **Ultra Small LGA 8 x 8 x 1 mm**
✓ **BT 5.1 nRF52811 BLE transceiver**
✓ **Long Range +4 dBm Tx power**
✓ **32-bit ARM Cortex – M4 CPU**
✓ **192 MB Flash & 24 K SRAM**
✓ **Suitable for ANT+ Protocol**
✓ **Complete set of 13 IOs included**
✓ **Radio 32 MHz & Synchro 32 kHz Xtals**
✓ **Decoupling and DCDC circuit on board**

NORDIC — nRF52
Bluetooth SMART
RoHS Compliant
TELEC
FC
Industry Canada
CE

ISP1807-LL

Applications

✓ **Body Area**
✓ **Industrial Sensors**
✓ **Home network**

✓ **Logistics and warehousing**
✓ **Value asset security**

Market Introduction

✓ **Samples & Kits available**
✓ **First Production batch in progress**
✓ **Certification pending**

Insight SiP — It's all in the package

iSP1907-HT

AoA BT 5.1
Complete Extended Solution
For Tags and Anchors

Key Features

- ✓ Ultra Small LGA 8 x 8 x 1 mm
- ✓ BT 5.1 nRF52833 BLE transceiver
- ✓ Long Range +8 dBm Tx power
- ✓ 32-bit ARM Cortex – M4F CPU
- ✓ 512 MB Flash & 128 K SRAM
- ✓ USB interface
- ✓ Suitable for ANT+, Zigbee, Thread
- ✓ 30 IOs included
- ✓ Radio 32 MHz & Synchro 32 kHz Xtals
- ✓ Decoupling and DCDC circuit on board
- ✓ Extended temperature range -40/+105°C

NORDIC — nRF 52

Bluetooth SMART

RoHS Compliant ✓

TELEC

FC

Industry Canada

CE

ISP1807-HT block diagram — nRF52833:
32MHz Xtal & Caps, 32kHz Xtal & Caps, RF Antenna, 512 kB Flash, 128 kB RAM, AHB Lite bus, APB bus, Oscillators, Radio Multi-protocol 2.4GHz, NFC-A tag, Power supply, Processor 64 MHz ARM Cortex-M4F CPU, GPIO, Timers / Counters, Analog I/O, Debug, System Peripherals, Storage Inductor & Caps, NFC tag
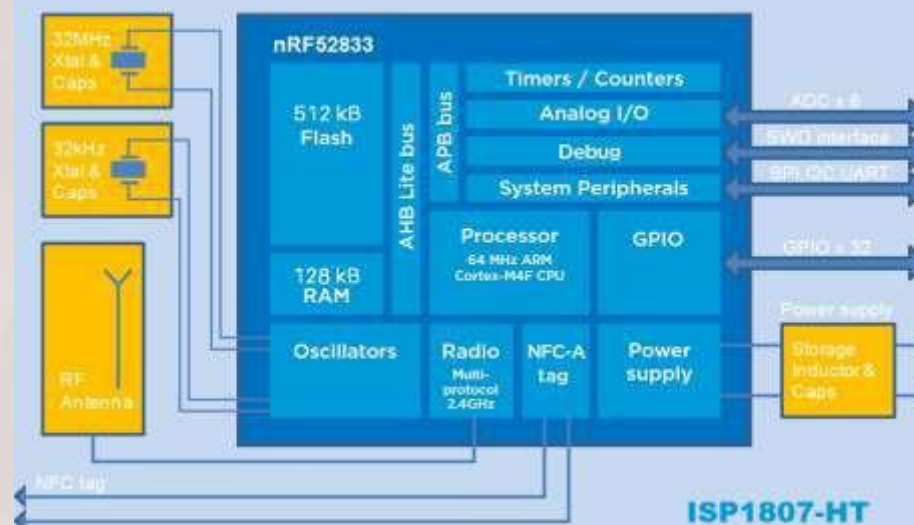
Applications

- ✓ Lighting Applications
- ✓ Industrial
- ✓ Smart Home
- ✓ Logistics and warehousing
- ✓ Value asset security

Market Introduction

- ✓ Samples & Kits schedule Jan 2020 to be confirmed when the chip is available

# UWB EXPERTISE

Insight SiP
It's all in the package

👉 *Insight SiP is also offering new range of innovative IoT Location System based on UWB technology*

- *Dual antenna integration*
  - ✓ New and unique concept developed by Insight SiP with 2 embedded antennas

- *Ultra precise Location Systems powered by Decawave DW1000*
  - ✓ Insight SiP decided to improve ISP1510, still using Decawave DW1000, but offering a 50 meters optimal range and an embedded intelligent power supply to operate on coin cell battery
  - ✓ New chipset generation are in progress with much lower power consumption, better sensitivity and longer range

- *BLE section based on Nordic nRF52 chipset*
  - ✓ Providing friendly configuration of UWB through smartphone or tablet
  - ✓ Also offering low energy rough location indication

Robert A. Schorton

- **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 ...**
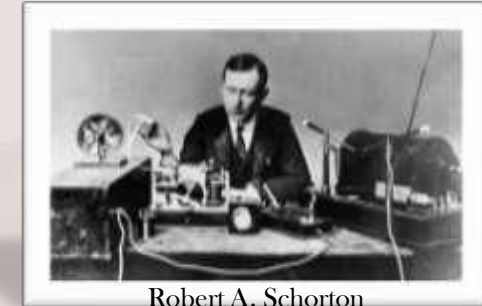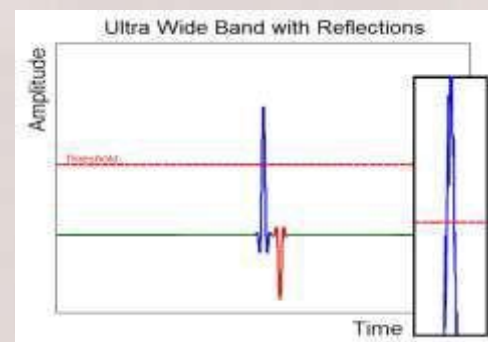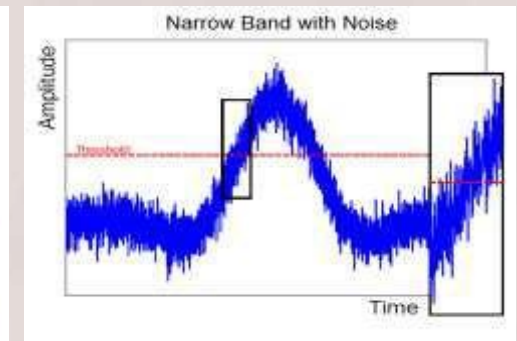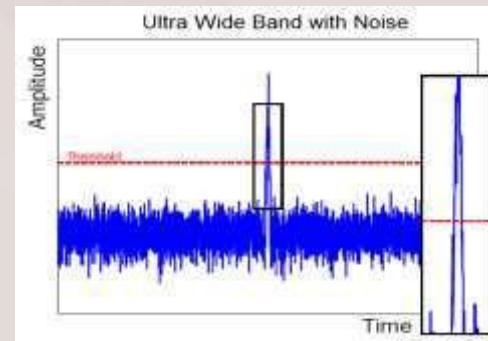
- **UWB Impulse Radio (IR-UWB)**

  ✓ **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**

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

  - ✓ **WiFi and Bluetooth using RSSI method, sensitive to Multipath, to Interference, to relative position antenna: offers precision in the 10 meters range**
  - ✓ **UWB using Time of Flight method, unsensitive to Multipath and Interference offers precision in 10 cm range**

- **Unsensitivity to Noise & Interference of other systems**

  - ▶ **RF pulse straight edges give precise determination of arrival time**

- **Unsensitivity to Multi-Path Reflection Interference**

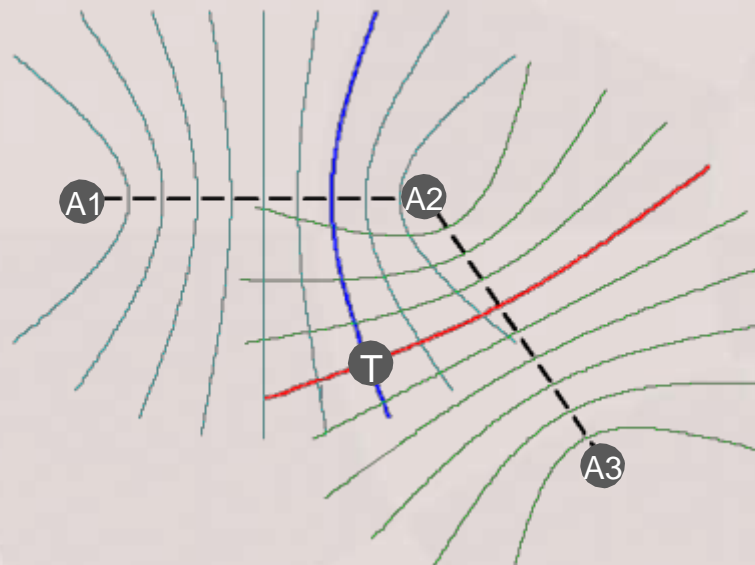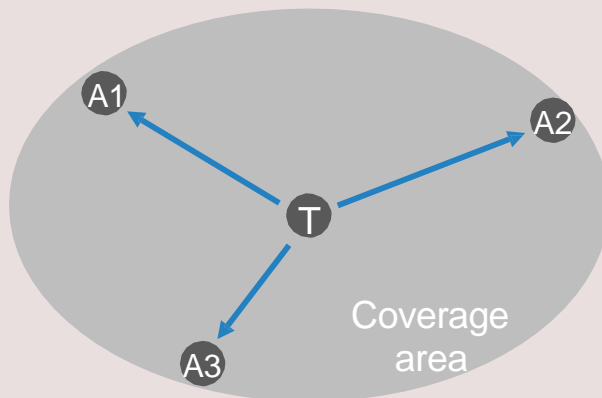 - ▶ **Short pulses avoid combination with reflected signals**

2-Way Ranging

Anchor

A

Tag

T

Listen for poll

Poll

Response

Final

Calculate range

Report optional
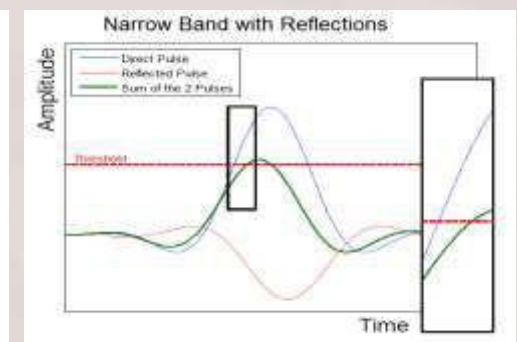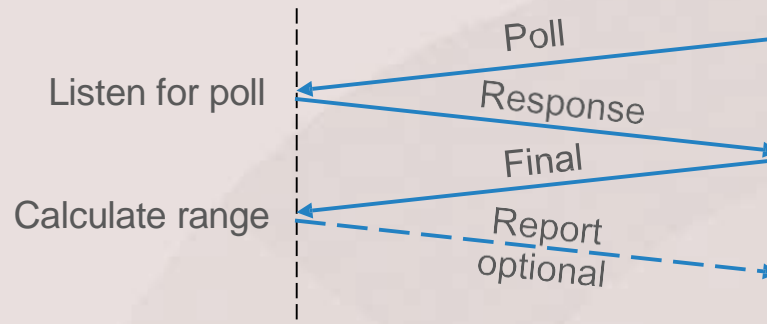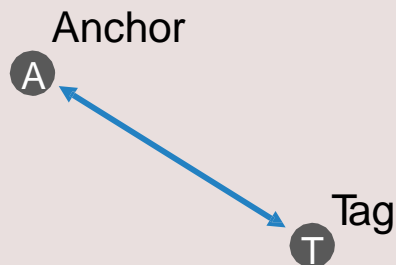
▶ **Simple measurement of time of flight**
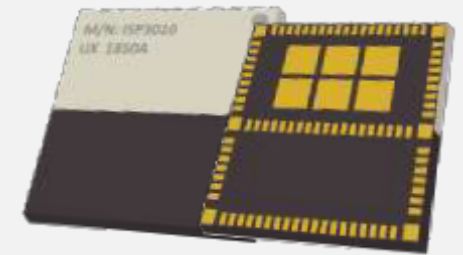
Time Difference of Arrival (TDOA)

A1

A2

T

A3

Coverage area

A1

A2

T

A3

▶ **Location determined by a multi-lateration algorithm**

▶ **Need to have all Anchors perfectly synchonized**
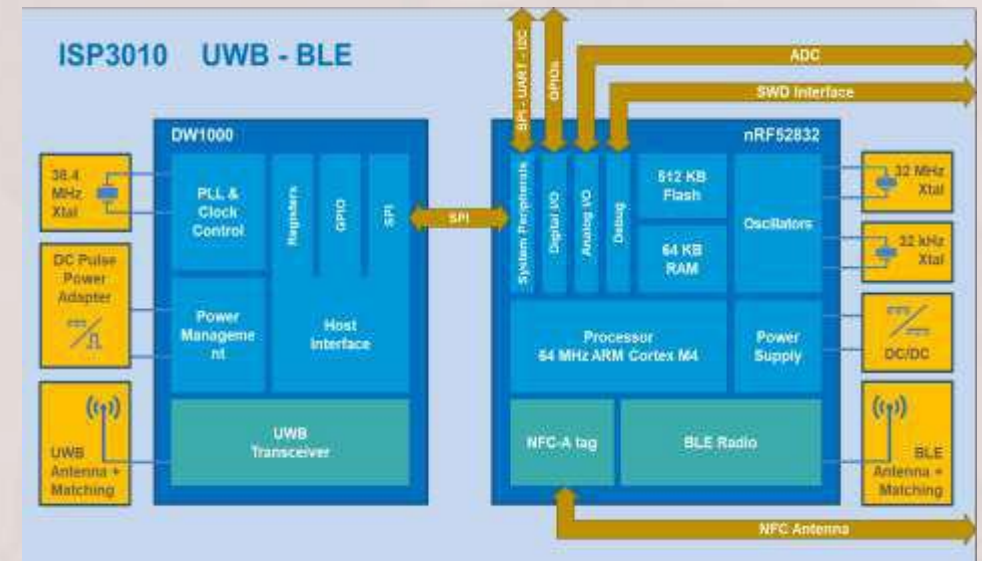
Insight SiP — It's all in the package

iSP3010-UX

High Performance Combo UWB / BLE module With Integrated Antennas

Key Features

- ✓ IEEE802.15.4-2011
- ✓ BLE V4.2
- ✓ NFC-A Tag for pairing
- ✓ Resolution < 10 cm
- ✓ Fully integrated UWB & BLE Antennas
- ✓ Integrated Xtals UWB 38.4 MHz, BLE 32 MHz & 32.768 kHz
- ✓ UWB based DW1000
- ✓ BLE based nRF52
- ✓ Compact Size 14.0x14.0x1.5 mm
- ✓ Temp. -40 to +85 °C
- ✓ Supply 2.8V-3.6V

- ✓ Externally Controlled or using embedded 32-bit ARM M4 CPU
- ✓ 512 kB Flash
- ✓ 64 kB RAM
- ✓ DC/DC converters
- ✓ Analog, Digital peripherals
- ✓ SPI interface

decaWave — Bluetooth SMART — ScenSor DW1000 — nRF 52 SERIES — RoHS Compliant — NORDIC SEMICONDUCTOR — CE FC

Typical Application

- ✓ Precision Real Time Location Systems (RTLS)
- ✓ Security bubble
- ✓ Access control
- ✓ Indoor positioning

COMBO UWB & BLE

Specification	iSP3010-UX	
	UWB Section	**BLE Section**
Radio	6.5 GHz (Channel 5) + Balun + Antenna	2.4 GHz + Balun + Antenna
NFC	-	Type 2 NFC-A Tag
Supply Voltage	2.8 / 3.6 V + DCDC	1.8 / 3.6 V + DCDC
Peak current Tx	140 mA	5.3 mA @ 0 dBm
Peak current Rx	180 mA	5.4 mA
Deep sleep Current	1 µA	0.3 µA
Tx Power	-39 dBm / MHz	-20 to +4 dBm
Rx sensitivity	-93 dBm	-96 dBm
Range	50 m	70 m
Spatial Resolution	10 cm	20 m
CPU	-	32-bit ARM Cortex M4F
Memory	-	512 kB flash / 64 kB RAM
Crystal	38.4 MHz	32 MHz and 32 kHz
Interfaces	SPI	GPIO, SPI, I2C, UART, ADC
Size	14 x 14 x 1.5 mm	

Supported BLE Stacks

✓ **S132 BT 5.0 compliant stack:** concurrent central, observer, peripheral, and broadcaster with up to 20 connections

✓ **nRF5 SDK for Mesh**

Market Introduction

✓ Kits and samples available

✓ Mass production: tbd

✓ Certifications: tbd

Insight SiP
It's all in the package

iSP3010

Complete Kit
Test Board
Anchor & Tag

Development Kit

✓ Offers the perfect solution to start with ISP3010, including ...

✓ 1x Interface Board with integrated J-Link Emulator
✓ 1x Test Board connected to the Interface Board for testing purpose
✓ 1x Anchor Board
✓ 1x Tag Board
✓ 1x NFC antenna
✓ A ranging demonstration including the embedded firmware and the Android App

Test Board

✓ Consists of a module mounted on a PCB
✓ Includes a connection to the Insight SiP generic Interface Board
✓ Offers test points for all IOs and can be used in conjunction with a Nordic Development kit.

Anchor & Tag Boards

✓ Anchor Board consists of a PCB integrating an ISP3010 module and a USB plug for connection to a PC port com

✓ Tag Board consists of a small PCB integrating an ISP3010 module powered by a coin cell.

![Insight SiP - It's all in the package]

iSP3010-AN
iSP3010-TG

UWB & BLE
Multi Sensor Demo
Based on iSP3010-UX
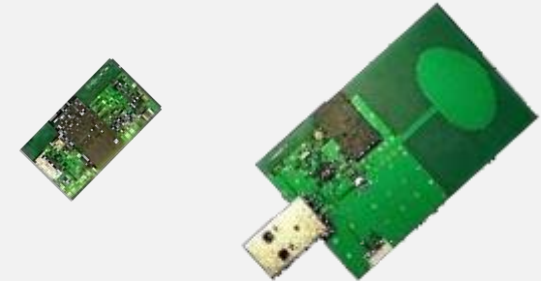
Key Features

- ✓ **Range calculation between anchor and tag using UWB and results are sent via BLE**
- ✓ **Anchor board iSP3010-UX-AN**
- ✓ **Tag board iSP3010-UX-TG**
- ✓ **Embedded firmware with Android App**
- ✓ **UWB based on DW1000**
- ✓ **BT 5 Ready based on nRF52**
- ✓ **Fully integrated UWB & BLE Dual Matching and Antenna**
- ✓ **Supply 2.8V-3.6V**
- ✓ **Temp. -40 to +85 °C**
- ✓ **Coin cell battery CR2032**

BLE Setup and Data Transfer

UWB Distance Measurement
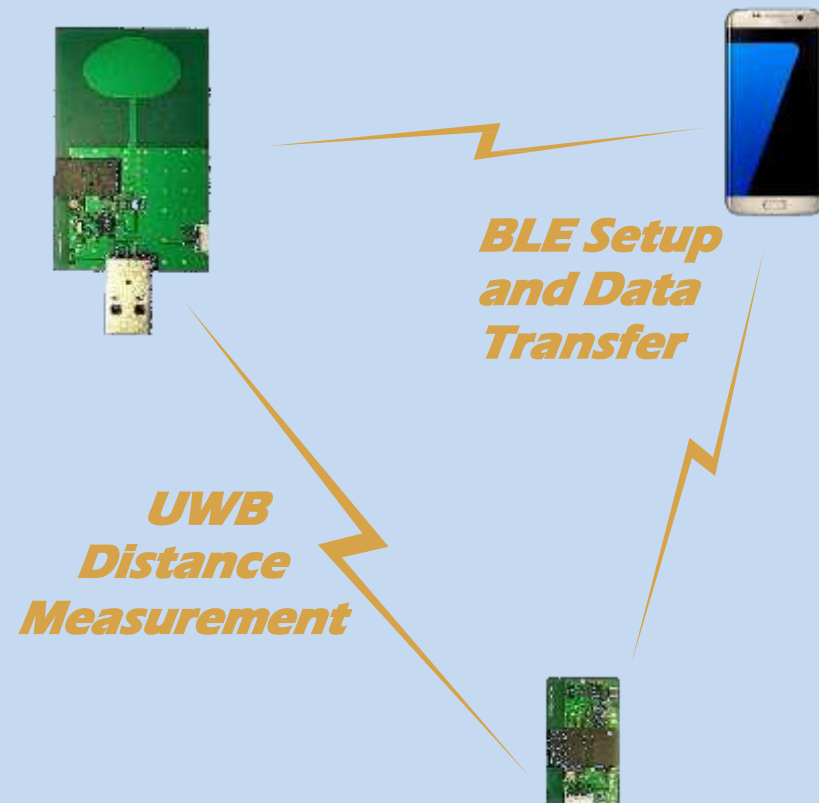
👉 **Insight SiP is developing a BLE with Secure Element solution and integrated antenna**

- **This ultra-small LGA module, 8 x 8 x 1 mm combines a state of the art BLE 5.0 device together with a Secure Element**

- **This combination allows for complete end to end data encryption with secure keys that are held within the highly protected secure element**
  - ✓ The private key remains locked in the safe space and is used to code and decode data that passes through the secure element

- **Dual processor**
  - ✓ Cortex Mxx Application processor
  - ✓ Together with a Cortex Mxx processor dedicated to Bluetooth activities

- **Incorporates the antenna for BLE**

Insight SiP
It's all in the package

iSP70 series

BLE & Secure Element
Built-In antenna
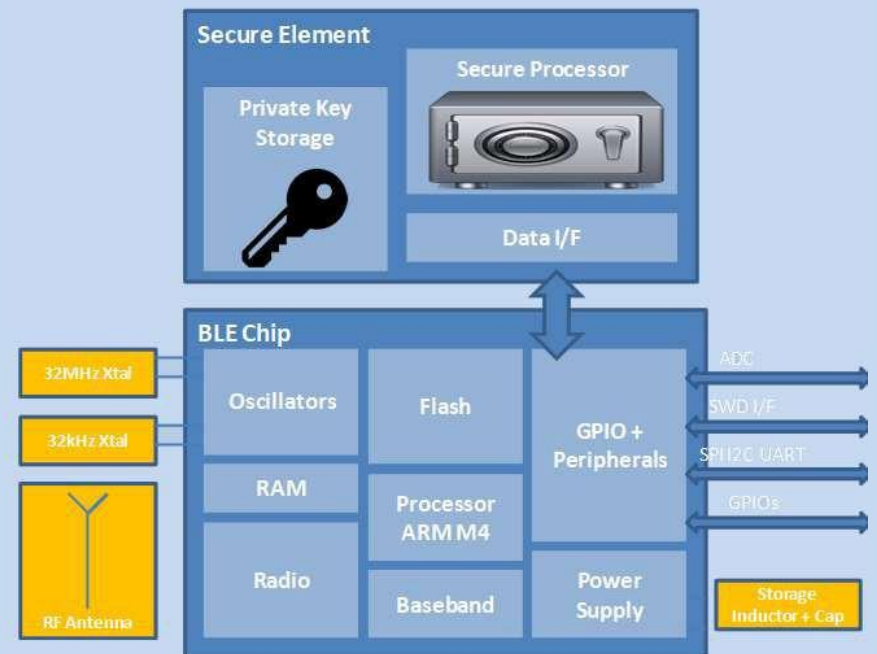### Timeline - end 2020

Key Features

- ✓ Ultra Low Power Consumption
- ✓ Single 1.8 to 3.6 V supply
- ✓ Small size 8 x 8 x 1 mm
- ✓ Single Mode BLE V5.0 Compliant
- ✓ 2.4GHz low energy RF Transceiver
- ✓ 32bit ARM CPU
- ✓ 512 kB or more Flash
- ✓ 64 SRAM or more SRAM
- ✓ Large set of GPIOs
- ✓ Integrated Antenna
- ✓ Secure Element
- ✓ Storage of Private Keys
- ✓ Storage of Code/encode Apps

Typical Applications

- ✓ Applications requiring added security
- ✓ Connected sensors for medical, healthcare, sport, fitness, industrial ...
- ✓ IoT applications, connected objects, wearable technology

ISP70 series - BLE Secure

Secure Element
- Private Key Storage
- Secure Processor
- Data I/F

BLE Chip
- 32MHz Xtal
- 32kHz Xtal
- RF Antenna
- Oscillators
- RAM
- Radio
- Flash
- Processor ARM M4
- Baseband
- GPIO + Peripherals
- Power Supply
- Storage Inductor + Cap
- ADC
- SWD I/F
- SPI I2C UART
- GPIOs

👉 **Streamline the success of your IoT application with Insight SiP services & solutions based on your needs**

- **DESIGN TO PRODUCTION fills up our Standard Module and Device offering when looking for Customized Design Service & Consultancy**

  - ✓ **From the pre-feasibility study to the Product launch, we are there to help you with a full-service solution**

  - ✓ **Insight SiP serves the IoT market with turn-key design services and creative packaging solutions to customers who need complex or highly integrated systems to meet wireless and portable devices space requirements**

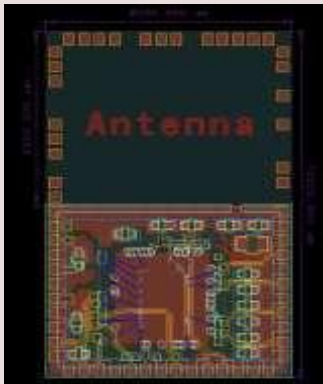 - ✓ **Benefits to our customers: Smaller, Faster, Lower Cost**

Any Electronic Specification in smallest form factor
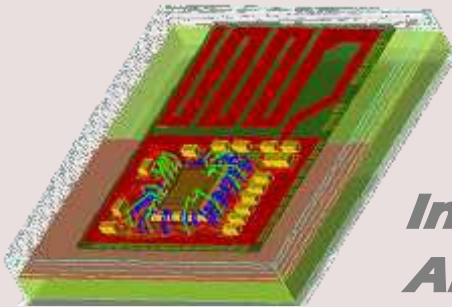
Integrated Antenna Technology Antenna in Package (AiP)
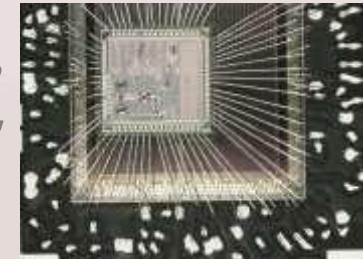
Multiple dies, crystals, MEMS, passives – different assembly techniques, substrates...

Eliminate "trial and error" by in-depth RF and Thermal Simulation

Focus on building on existing IP "Custom Products" - Greatest Value Add