- **Global Roadmap**
- **Short Range Modules**
- **Wide Area Network Modules**
- **Positioning Modules**
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
  - 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
Insight SiP is the leading provider of Low Power Networking and Positioning 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
**MISSION**

**LOW POWER NETWORKING**

- **BLE**
  - Data Rate (Kbps): 1000
  - Range (m): 1000
  - Very Low Power
  - Very Low Cost

- **BT 5 Long Range & Mesh**
  - Data Rate (Kbps): 100
  - Range (m): 1000
  - Low Power
  - Low Cost

- **LTE-M & NB-IoT**
  - Data Rate (Kbps): 10
  - Range (m): 10000
  - Moderate Power
  - Moderate Cost

- **LoRa 800/900 MHz & LoRa 2.4 GHz**
  - Data Rate (Kbps): 1
  - Range (m): 10000
  - Low Power
  - Low Cost
MISSION

Positioning

Accuracy (cm)

BLE

Signal Strength Technology

LoRa 2.4 GHz

Time of Flight Technology

UWB

LTE-M

Cell Tower Triangulation

Public Networks

Range (m)

1

10

100

1000

1000

Mailto: contact@insightsip.com
Web: www.insightsip.com
**TECHNOLOGY BENEFITS**

- **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
**TECHNOLOGY BENEFITS**

- **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 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 customer’s added value**
Technology Benefits

- Designed by RF specialist with leading chipset manufacturer
- Offers fully embedded connectivity solutions

1. **SoC 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
• Modules are manufactured in 2 plants, in Taiwan and Philippines
  ✓ Production level greater than 1M modules

• 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

• All modules fully tested before delivery
  ✓ IOs, Radio and Flash/RAM writing
  ✓ Possibility to offer Pre-programming service
MARKET SEGMENTS

Mobile Computing

Cellular Connectivity

Smart Secure

Healthcare and Wellness

IoT and M2M

Mobility

Industry 4.0

Defence

Avionics and Space
SHORT RANGE MODULES

Body Area Networks
► BLE, ANT+
   ► iSP13 series
   ► iSP15 series

Home Networks
► BLE, BT 5.0
   ► iSP15 series
   ► iSP18 series

Building Networks
► BLE, BT 5.0, Thread, Zigbee
   ► iSP18 series
**OFFER & ROADMAP**

- **WIDE AREA NETWORK MODULES**
  - **Building Networks**
    - LoRa
    - iSP45 series
  - **Outdoor Area Networks**
    - LoRa, NB-IoT
    - iSP45 series
    - iSP60 series
  - **Global Coverage**
    - LoRa, NB-IoT
    - iSP45 series
    - iSP60 series
**Offer & Roadmap**

- **Positioning Modules**
  - Security Bubble
    - BT5.1, UWB
    - iSP19 series
    - iSP30 series
  - Find Me, Beacon
    - BLE, BT 5.1
    - iSP15 series
    - iSP18 series
    - iSP19 series
  - Location in Building
    - BT 5.1, UWB
    - iSP19 series
    - iSP30 series
  - Outdoor Area Networks
    - UWB
    - iSP30 series
- **GLOBAL ROADMAP**
- **SHORT RANGE MODULES**
- **WIDE AREA NETWORK MODULES**
- **POSITIONING MODULES**
Insight SiP offers Built-in Antenna BLE Modules with Concentrated Performances for IoT Applications

- **Tiny module size**
  - ✓ SIP package = smallest solution on the market for antenna integrated module

- **Proven available high performance**
  - ✓ Outstanding antenna performance verified by major companies
  - ✓ Hardware support for standard application: Sensor demo, Beacon Demo
  - ✓ Very high quality hardware support from true RF experts: possible RF and range simulation of customer design

- **Based on Nordic Semiconductor chipset**
  - ✓ Established player in BLE for many years
  - ✓ Proven and well supported protocol stack, with huge firmware library

- **Fully certified**
  - ✓ BT SIG, CE, FCC, IC, TELEC
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 (BLE)
✓ 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
✓ V5.0 Adopted end 2016: 2X speed, 4X range, 8X throughput
✓ V5.1 Last generation enabling Direction Finding

✓ In parallel, Bluetooth Mesh was introduced as new connectivity capabilities, independent of BLE versions
- **Bluetooth Classic**
  - ✓ establishes a relatively short-range
  - ✓ continuous wireless connection
  - ✓ makes it ideal for use cases such as streaming audio

- **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

- **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)

- **Insight SiP offers BLE modules from V4.0 up to V5.1**
  - ✓ No Bluetooth Classic or Dual Mode available
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
## Large Choice of Platforms and Options with Integrated Antenna

<table>
<thead>
<tr>
<th>Price</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BLE Connectivity</td>
</tr>
<tr>
<td>External MCU</td>
<td>Sensor Node &amp; Mesh</td>
</tr>
</tbody>
</table>

### iSP09 series
- BLE 4.0
  - iSP091201-BN
- BLE + Integrated MCU
  - iSP091201-BN

### iSP13 series
- BLE 4.1
  - iSP130301-BM
- BLE + Integrated MCU
  - iSP130301-BM

### iSP15 series
- BLE 4.2
  - iSP1507-AX
- BT 5.0 Ready ANT+
  - iSP1507-AL

### iSP18 series
- BT 5.0
  - iSP1807-LR
- Zigbee Thread
  - iSP1807-LR

### iSP19 series
- BT 5.1
  - iSP1907-HT
- Zigbee Thread Dir. Finding
  - iSP1907-LT

---

**nRF8001 inside**

**nRF51 inside**

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

<table>
<thead>
<tr>
<th>Module</th>
<th>Features</th>
</tr>
</thead>
</table>
| **ISP1507-AX** | All-purpose BLE solution for sensor & Mesh connectivity  
Based on nRF52832  
BT 5.0 Ready  
512 kB Flash & 64 kB RAM  
30 IOs |
| **ISP1507-AL** | Perfect for Mesh Relay nodes and price sensitive solutions  
Based on nRF52810  
BT 5.0 Ready  
192 kB Flash & 24 kB RAM  
13 IOs |
| **ISP1807-LR** | Home and Building Networks and secure solutions  
Based on nRF52840  
BT 5.0 Long Range  
1 MB Flash & 256 kB RAM  
ARM Cryptocell  
46 IOs + USB |
| **ISP1907-HT** | All-purpose Long Range for Smart Home & Lighting  
BT 5.1 Long Range & AoA  
More Flash, RAM and IOs than ISP1907-LL |
| **ISP1907-LL** | Price Sensitive Home and Building Networks  
Based on nRF52811  
BT 5.1 Long Range & AoA  
192 kB Flash & 24 kB RAM  
13 IOs |
## NRF52 Based Platform

<table>
<thead>
<tr>
<th>Module Type</th>
<th>iSP1507-AL</th>
<th>iSP1507-AX</th>
<th>iSP1907-LL</th>
<th>iSP1807-LR</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLE Radio</td>
<td>2.4 GHz + Balun + Antenna</td>
<td>2.4 GHz + Balun + Antenna</td>
<td>2.4 GHz + Balun + Antenna</td>
<td>2.4 GHz + Balun + Antenna</td>
</tr>
<tr>
<td>NFC</td>
<td>None</td>
<td>Type 2 NFC-A Tag</td>
<td>None</td>
<td>Type 2 NFC-A Tag</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>1.7-3.6 V + LDO/DCDC</td>
<td>1.7-3.6 V + LDO/DCDC</td>
<td>1.7-3.6 V + LDO/DCDC</td>
<td>1.7-5.5 V + LDO/DCDC</td>
</tr>
<tr>
<td>Peak current Tx</td>
<td>4.6 mA @ 0 dBm</td>
<td>5.3 mA @ 0 dBm</td>
<td>4.6 mA @ 0 dBm</td>
<td>4.8 mA @ 0 dBm</td>
</tr>
<tr>
<td>Peak current Rx</td>
<td>4.6 mA</td>
<td>5.4 mA</td>
<td>4.6 mA</td>
<td>4.6 mA</td>
</tr>
<tr>
<td>Deep sleep</td>
<td>0.3 µA</td>
<td>0.3 µA</td>
<td>0.3 µA</td>
<td>0.4 µA</td>
</tr>
<tr>
<td>Output Power</td>
<td>-20 to +4 dBm</td>
<td>-20 to +4 dBm</td>
<td>-20 to +4 dBm</td>
<td>-20 to +8 dBm</td>
</tr>
<tr>
<td>Rx sensitivity</td>
<td>-96 dBm</td>
<td>-96 dBm</td>
<td>-103 dBm (BT5)</td>
<td>-103 dBm (BT5)</td>
</tr>
<tr>
<td>Range</td>
<td>70 m</td>
<td>70 m</td>
<td>300 m</td>
<td>400 m</td>
</tr>
<tr>
<td>CPU</td>
<td>32-bit ARM Cortex M4</td>
<td>32-bit ARM Cortex M4F</td>
<td>32-bit ARM Cortex M4</td>
<td>32-bit ARM Cortex M4F</td>
</tr>
<tr>
<td>CPU Option</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>ARM CryptoCell 310</td>
</tr>
<tr>
<td>Memory</td>
<td>192 kB flash / 24 kB RAM</td>
<td>512 kB flash / 64 kB RAM</td>
<td>192 kB flash / 24 kB RAM</td>
<td>1 MB flash / 256 kB RAM</td>
</tr>
<tr>
<td>Stack</td>
<td>BT5 Ready, ANT+ Mesh</td>
<td>BT5 Ready, ANT+, Mesh</td>
<td>BT5 Long Range, ANT+ Mesh</td>
<td>BT5 Long Range, ANT+ Mesh</td>
</tr>
<tr>
<td>Crystal</td>
<td>32 MHz and 32 kHz</td>
<td>32 MHz and 32 kHz</td>
<td>32 MHz and 32 kHz</td>
<td>32 MHz and 32 kHz</td>
</tr>
<tr>
<td>GPIOs</td>
<td>13 configurable GPIOs</td>
<td>30 configurable GPIOs</td>
<td>13 configurable GPIOs</td>
<td>46 configurable GPIOs</td>
</tr>
<tr>
<td>Main Interfaces</td>
<td>SPI, I2C, UART, ADC</td>
<td>SPI, I2C, UART, ADC</td>
<td>SPI, I2C, UART, ADC</td>
<td>SPI, I2C, UART, ADC</td>
</tr>
<tr>
<td>Other Interfaces</td>
<td>Comp, T° Sens, PWM, PDM</td>
<td>Comp, T° Sens, PWM, PDM</td>
<td>Comp, T° Sens, PWM, PDM</td>
<td>Comp, T° Sens, PWM, PDM</td>
</tr>
<tr>
<td>Size (mm)</td>
<td>8 x 8 x 0.95</td>
<td>8 x 8 x 0.95</td>
<td>8 x 8 x 0.95</td>
<td>8 x 8 x 0.95</td>
</tr>
</tbody>
</table>
Low Cost BLE

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
iSP1507-AX

High Performance Module for BLE / ANT+ / NFC Applications

Ultra Low Consumption

Key Features

✓ 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
**Long Range BT5**

**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

---

**Applications**

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

---

**Market Introduction**

- Samples & Kits available
- Certification in progress
- Mass Production April 2019
iSP1907-LL

Long Range & AoA BT 5.1 Module for Price Sensitive Applications

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 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

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

Market Introduction
✓ Samples & Kits schedule June 2019
✓ Certification pending
✓ Mass Production tbd
**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

**iSP1880 BLE Miniature Multi Sensor Based on iSP1807**
▪ **GLOBAL ROADMAP**
▪ **SHORT RANGE MODULES**
▪ **WIDE AREA NETWORK MODULES**
▪ **POSITIONING MODULES**
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**
  - Multi band transceiver SX1261 for Europe and Japan and SX1262 for USA
- **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
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)

<table>
<thead>
<tr>
<th>Spreading factor (at 125 kHz)</th>
<th>Bitrate (indicative value, depending on propagation conditions)</th>
<th>Range (km)</th>
<th>Time on Air (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF7</td>
<td>5470 bps</td>
<td>2</td>
<td>56</td>
</tr>
<tr>
<td>SF8</td>
<td>3125 bps</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>SF9</td>
<td>1760 bps</td>
<td>6</td>
<td>200</td>
</tr>
<tr>
<td>SF10</td>
<td>980 bps</td>
<td>8</td>
<td>370</td>
</tr>
<tr>
<td>SF11</td>
<td>440 bps</td>
<td>11</td>
<td>740</td>
</tr>
<tr>
<td>SF12</td>
<td>290 bps</td>
<td>14</td>
<td>1400</td>
</tr>
</tbody>
</table>

- 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.

<table>
<thead>
<tr>
<th>Region</th>
<th>Supported</th>
<th>Band [MHz]</th>
<th>Duty cycle</th>
<th>Output power</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>Y</td>
<td>868</td>
<td>&lt;1 %</td>
<td>+14 dBm</td>
</tr>
<tr>
<td>EU</td>
<td>Y</td>
<td>433</td>
<td>&lt;1 %</td>
<td>+10 dBm</td>
</tr>
<tr>
<td>US</td>
<td>Y</td>
<td>915</td>
<td>&lt;2 % (BW&lt;250 kHz) or &lt;4 % (BW&gt;=250 kHz) Transmission slot &lt; 0.4 s</td>
<td>+20 dBm</td>
</tr>
<tr>
<td>CN</td>
<td>N</td>
<td>779</td>
<td>&lt;0.1 %</td>
<td>+10 dBm</td>
</tr>
</tbody>
</table>
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)
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

**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**
MULTI BAND COMBO LoRa

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

Typical Application
✓ Smart Cities / Smart Retail
✓ Industrial Internet
✓ Big Data / Data science
✓ Energy Engagement / Smart grids
# Multi Band Combo LoRa

## 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 EU version available
- Samples & Kits US and JP version June 2019
- Mass Production starts in Q2 2019
- Certifications: tbd

## Specifications:

<table>
<thead>
<tr>
<th>Specification</th>
<th>iSP4520-EU</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Radio</strong></td>
<td></td>
<td><strong>LoRaSection</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Europe = 867-869 MHz + Balun + Antenna</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>BLE Section</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4 GHz + Balun + Antenna</td>
</tr>
<tr>
<td><strong>NFC</strong></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td><strong>SupplyVoltage</strong></td>
<td></td>
<td>2.8 / 3.6 V + DCDC</td>
</tr>
<tr>
<td><strong>Peak current Tx</strong></td>
<td>30 mA</td>
<td>5.3 mA @ 0 dBm</td>
</tr>
<tr>
<td><strong>Peak current Rx</strong></td>
<td>12 mA</td>
<td>5.4 mA</td>
</tr>
<tr>
<td><strong>Deep sleep Current</strong></td>
<td>0.1 µA</td>
<td>0.3 µA</td>
</tr>
<tr>
<td><strong>Tx Power</strong></td>
<td>+13 dBm</td>
<td>-20 to +4 dBm</td>
</tr>
<tr>
<td><strong>Rx sensitivity</strong></td>
<td>-132 dBm</td>
<td>-96 dBm</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>10 km</td>
<td>70 m</td>
</tr>
<tr>
<td><strong>CPU</strong></td>
<td>-</td>
<td>32-bit ARM Cortex M4F</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>-</td>
<td>512 kB flash / 64 kB RAM</td>
</tr>
<tr>
<td><strong>Crystal</strong></td>
<td>32 MHz</td>
<td>32 MHz and 32 kHz</td>
</tr>
<tr>
<td><strong>Interfaces</strong></td>
<td>SPI</td>
<td>GPIO, SPI, I2C, UART, ADC</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>9.8 x 17.2 x 1.7 mm</td>
<td></td>
</tr>
</tbody>
</table>
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
Insight SiP is developing NB-IoT & BLE combo solution with Built-in Antennas

▪ NB-IoT section based on Nordic nRF91 transceiver
  ✓ Narrowband technology standard that operates in a fixed European LTE channel with bandwidth of 200 kHz, giving longer range and low throughput compared to LTE-M
  ✓ Initial offering in Band 3 or Band 20 depending on technology compromise

▪ BLE section based on Nordic nRF52 chipset
  ✓ Providing over the air configuration of NB-IoT through smartphone or tablet

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

▪ More information available in Q3-2019
▪ **GLOBAL ROADMAP**
▪ **SHORT RANGE MODULES**
▪ **WIDE AREA NETWORK MODULES**
▪ **POSITIONING MODULES**
Insight SiP offers Built-in Antenna BLE Modules for Direction Finding and Positioning Applications

- **Tiny module size**
  - ✔ SIP package = smallest solution on the market for antenna integrated module

- **Proven available high performance**
  - ✔ Outstanding antenna performance verified by major companies
  - ✔ Hardware support for standard application: Sensor demo, Beacon Demo
  - ✔ Very high quality hardware support from true RF experts: possible RF and range simulation of customer design

- **Based on Nordic Semiconductor chipset**
  - ✔ Established player in BLE for many years
  - ✔ Proven and well supported protocol stack, with huge firmware library

- **Fully certified**
  - ✔ BT SIG, CE, FCC, IC, TELEC
Direction Finding is the main new feature of Bluetooth 5.1

- Former BT location systems were based on RSSI only, with poor precision.
- It will offer enhanced 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) make 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 a line of sight manner.
- Antenna arrays at both sides 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

Long Range & AoA BT 5.1 Module for Price Sensitive Applications

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

Applications

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

Market Introduction

✓ Samples & Kits schedule June 2019
✓ Certification pending
✓ Mass Production tbd
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
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
**UWB EXPERTISE**

- **2-Way Ranging**
  - Anchor
  - Tag
  - Simple measurement of time of flight
  - Location determined by a multi-lateration algorithm
  - Need to have all Anchors perfectly synchronized

- **Time Difference of Arrival (TDOA)**
  - Coverage area
  - Listen for poll
  - Calculate range
  - Poll
  - Response
  - Final
  - Report optional
  - Need to have all Anchors perfectly synchronized
**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

**Typical Application**

- Precision Real Time Location Systems (RTLS)
- Security bubble
- Access control
- Indoor positioning
### COMBO UWB & BLE

#### iSP3010-UX

<table>
<thead>
<tr>
<th>Specification</th>
<th>UWB Section</th>
<th>BLE Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio</td>
<td>6.5 GHz (Channel 5) + Balun + Antenna</td>
<td>2.4 GHz + Balun + Antenna</td>
</tr>
<tr>
<td>NFC</td>
<td>-</td>
<td>Type 2 NFC-A Tag</td>
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<tr>
<td>Supply Voltage</td>
<td>2.8 / 3.6 V + DCDC</td>
<td>1.8 / 3.6 V + DCDC</td>
</tr>
<tr>
<td>Peak current Tx</td>
<td>140 mA</td>
<td>5.3 mA @ 0 dBm</td>
</tr>
<tr>
<td>Peak current Rx</td>
<td>180 mA</td>
<td>5.4 mA</td>
</tr>
<tr>
<td>Deep sleep Current</td>
<td>1 µA</td>
<td>0.3 µA</td>
</tr>
<tr>
<td>Tx Power</td>
<td>-39 dBm / MHz</td>
<td>-20 to +4 dBm</td>
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<td>Rx sensitivity</td>
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<td>Spatial Resolution</td>
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</tr>
<tr>
<td>Size</td>
<td>14 x 14 x 1.5 mm</td>
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</tr>
</tbody>
</table>

#### 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

- Engineering samples in June 2019
- Samples & Kits: July 2019
- Certifications: tbd
- Mass Production starts in Q3 2019
UWB Demo

iSP1510-AN  UWB & BLE
iSP1510-TG  Multi Sensor Demo
Based on iSP1510-UX

Key Features

✓ Range calculation between anchor and tag using UWB and results are sent via BLE
✓ Anchor board iSP1510-AN
✓ Tag board iSP1510-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
ANY QUESTION

... FEEL FREE TO CONTACT US
contact@insightsip.com

THANK YOU!