Integrated Connections

The Wireless Guide
The Wireless Guide

Advancements in wireless technology have opened the door to unprecedented innovation across a wide range of market segments. Consumers and business users have come to expect continuous network access and wireless connectivity is the underlying foundation of the Internet of Things (IoT). Designers integrating wireless technology into new or legacy applications have numerous complex factors to evaluate as they go through product definition. Among these considerations are transmission distance and frequency, power consumption and interoperability with other devices in the overall system. These decisions are further compounded by the need to align with a standard at a time when several are still competing to be primary along with the need to obtain regulatory certification. Finally, engineering departments may not have the necessary in-house resources for executing critical features such as antenna design. A mistake here could prove costly if re-designs are needed to acquire regulatory certifications not to mention the ramifications of missing market windows.

Developers can turn to Avnet for support when building wireless technology into their application. Avnet has a broad offering of wireless modules and components to support everything from near field communication (NFC) to Bluetooth® to local and wide area networking. Avnet’s field based engineers are able to address the trade-offs between different technology options and standards so you get it right the first time. The Avnet team also brings extensive practical experience to each opportunity sharing best practices to complete the design. Their knowledge spans drivers, software and the nuances of developing with coexistent modalities of wireless communications.

Your Avnet team is ready to support your wireless design requirements. As you review the innovative products featured in this guide, you can rely on Avnet to support every step of your product development process. From design consideration, prototyping and regulatory certification to new product introduction and ramping up volume production; Avnet is the right choice for design and supply-chain support.

Table of Contents

4 Products
  6 Cypress
  8 Laird / LSR
  10 Microchip
  12 Molex
  14 ON Semiconductor
  16 TDK
  18 Texas Instruments

20 Kits, Tools and Reference Designs
  22 Cypress
  24 Laird / LSR
  26 Microchip
  28 ON Semiconductor
  30 Texas Instruments

32 Services and Tools
Products
Cypress wireless solutions share the unique qualities of high reliability, low-power, and are designed for a variety of end-applications. Cypress has a complete range of products to suit the need of all wireless application segments. The product portfolio includes tailor-made wireless solutions for consumer products & embedded control along with a feature rich assortment of RF companion MCU.

Bluetooth Low Energy (BLE) (also called Bluetooth Smart) is the power and application-friendly version of Bluetooth, built for the Internet of Things (IoT). The power-efficiency of Bluetooth with low energy functionality makes it ideal for devices that run for long periods on power sources such as coin cell batteries or energy-harvesting devices. With the release of the Bluetooth 4.2 specification, Bluetooth Low Energy has become faster, smarter and more secure. Cypress is one of the first solution providers to support all the new Bluetooth 4.2 features.

The perfect complement to Bluetooth Low Energy is a renewable power source that enables infinite battery life. Using Energy Harvesting PMICs from Cypress are part of an Energy Harvesting System (EHS) that includes the Energy Harvesting Devices (EHDs) and a Storage Device. The PMIC receives the intermittent, very low energy generated by the EHD and transforms that energy for storage in the Storage Device. The Storage Device, which is typically a battery, conventional capacitor, or super capacitor, then is connected to the rest of the system, providing the power needed to operate. Cypress has a full line of Energy Harvesting PMICs that are tailored to different application requirements.

**Energy Harvesting Power Management Integrated Circuits (PMICs)**

Introducing Cypress’s S6AE101A/102A/103A Energy Harvesting Power management ICs enable tiny, solar-powered Internet of Things (IoT) devices. They are the world’s lowest-power, single-chip Energy Harvesting PMICs, and can be used with solar cells as small as 1 cm² due to their low startup and quiescent current. The PMICs are highly integrated, with family members offering power-gated outputs, low dropout regulators, CR timers, comparators, and battery backup operation. They are ideal for battery-less Wireless Sensor Nodes (WSNs) that monitor physical and environmental conditions for smart homes, commercial buildings, factories, infrastructure and agriculture.
Easy-to-use Bluetooth Low Energy Modules

Bluetooth® Low Energy (BLE)
Cypress’s EZ-BLE™ family of modules are production-ready, full-certified Bluetooth® Low Energy (Bluetooth Smart™) modules that integrate Cypress’s PSoC® 4 BLE or PRoC™ BLE silicon, crystals, antenna and passive components. The EZ-BLE family of modules are Bluetooth qualified and have regulatory certifications for U.S.A. (FCC), Canada (IC), Europe (CE), Japan (TELEC) and Korea (KC). All EZ-BLE modules support development using Cypress’s free PSoC Creator™ IDE. Customers using the EZ-BLE modules can seamlessly migrate to Cypress PSoC 4 BLE or PRoC BLE silicon simply by changing the device on the PSoC Creator IDE. This unique benefit enables customers to reduce the cost by migrating from module to silicon solutions when the end product starts shipping in high volumes.

PSoC® 4 BLE (Bluetooth Smart)
PSoC 4 BLE is a ARM® Cortex®-M0-based, PSoC device that integrates programmable analog front ends, programmable digital logic, industry-leading CapSense® user interface and a Bluetooth® Low Energy (Bluetooth Smart) radio. It includes a royalty-free BLE Protocol Stack compatible with Bluetooth 4.2.

PRoC™ BLE (Bluetooth Smart)
PRoC BLE is an easy-to-use, ARM® Cortex®-M0 based connectivity MCU that integrates peripherals like CapSense® for touch-sensing, a high-performance ADC, serial interfaces and a Bluetooth® Low Energy (BLE) or Bluetooth Smart radio. It includes a royalty-free BLE Protocol Stack compatible with Bluetooth 4.2.

EZ-BLE Module (Bluetooth Smart)
EZ-BLE Modules are fully integrated, fully certified, programmable modules designed for ease-of-use and reducing time-to-market. Each Bluetooth Smart module contains Cypress’s PRoC or PSoC 4 BLE chip, two crystals, chip or trace antenna, shield and passive components.

EZ-BLE Module Portfolio (CYBLE-xxxxxx-xx)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Output Channels</th>
<th>Input Voltage Range (V)</th>
<th>Output Voltage Range (V)</th>
<th>Quiescent Current (nA)</th>
<th>Min Startup Power (μW)</th>
<th>Power Gating Switch</th>
<th>Storage Control</th>
<th>LDQ</th>
<th>IRQ</th>
<th>CR Timer</th>
<th>Comparator</th>
<th>Package</th>
</tr>
</thead>
<tbody>
<tr>
<td>S6AE101A</td>
<td>1</td>
<td>2.0 – 5.5V</td>
<td>1.1 – 5.2V</td>
<td>250</td>
<td>1.2</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>10-pin SDN</td>
</tr>
<tr>
<td>S6AE102A</td>
<td>2</td>
<td>2.0 – 5.5V</td>
<td>1.1 – 5.2V</td>
<td>280</td>
<td>1.2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>20-pin QFN</td>
</tr>
<tr>
<td>S6AE103A</td>
<td>2</td>
<td>2.0 – 5.5V</td>
<td>1.1 – 5.2V</td>
<td>280</td>
<td>1.2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>24-pin QFN</td>
</tr>
</tbody>
</table>

Bluetooth® Low Energy (BLE)

Cypress's EZ-BLE™ family of modules are production-ready, full-certified Bluetooth® Low Energy (Bluetooth Smart™) modules that integrate Cypress's PSoC® 4 BLE or PRoC™ BLE silicon, crystals, antenna and passive components. The EZ-BLE family of modules are Bluetooth qualified and have regulatory certifications for U.S.A. (FCC), Canada (IC), Europe (CE), Japan (TELEC) and Korea (KC). All EZ-BLE modules support development using Cypress's free PSoC Creator™ IDE. Customers using the EZ-BLE modules can seamlessly migrate to Cypress PSoC 4 BLE or PRoC BLE silicon simply by changing the device on the PSoC Creator IDE. This unique benefit enables customers to reduce the cost by migrating from module to silicon solutions when the end product starts shipping in high volumes.

PSoC® 4 BLE (Bluetooth Smart)
PSoC 4 BLE is an ARM® Cortex®-M0-based, PSoC device that integrates programmable analog front ends, programmable digital logic, industry-leading CapSense® user interface and a Bluetooth® Low Energy (Bluetooth Smart) radio. It includes a royalty-free BLE Protocol Stack compatible with Bluetooth 4.2.

PRoC™ BLE (Bluetooth Smart)
PRoC BLE is an easy-to-use, ARM® Cortex®-M0 based connectivity MCU that integrates peripherals like CapSense® for touch-sensing, a high-performance ADC, serial interfaces and a Bluetooth® Low Energy (BLE) or Bluetooth Smart radio. It includes a royalty-free BLE Protocol Stack compatible with Bluetooth 4.2.

EZ-BLE Module (Bluetooth Smart)
EZ-BLE Modules are fully integrated, fully certified, programmable modules designed for ease-of-use and reducing time-to-market. Each Bluetooth Smart module contains Cypress's PRoC or PSoC 4 BLE chip, two crystals, chip or trace antenna, shield and passive components.

EZ-BLE Module Portfolio (CYBLE-xxxxxx-xx)
Laird & LSR Connectivity Solutions

Together, Laird’s Connectivity Solutions and recently acquired LSR offer an extensive range of embedded wireless products and innovative antenna options that help you connect and protect your wireless deployments. Our straightforward Bluetooth®, Bluetooth Smart, Zigbee®, and both Enterprise and Professional Series Wi-Fi® solutions are ideal for robust data connectivity, mobile computers, medical devices, and other business-critical applications.

Some of Laird’s recent developments include Industrial Frequency Hopping modules for Point-to-Point and Point-to-Multipoint M2M applications, as well as a new module series featuring LoRaWAN™ technology. All Laird embedded modules feature the Laird stamp of reliability and are fully supported for any issues that occur in the field.

Complementing their wireless modules and antennas, Laird also offers wireless product development services as well as EMC testing and certification. Laird’s Products and Services are here to help, simplifying wireless technology to accelerate the development of connected IoT solutions.

Add Wireless Innovations to Your Products in Record Time

Be the Hero.
Laird and LSR are here to help you create connection solutions fast through:

• Certified wireless modules
• Innovative development tools
• Industry-renowned support and services

Wi-Fi® + Bluetooth® Combo Modules
Sterling-LWB™: 2.4 GHz Wi-Fi® and Bluetooth® Smart Ready Multi-Standard Module

LSR’s Sterling-LWB™ 2.4 GHz Wi-Fi and Bluetooth Smart Ready Multi-Standard Module provides your customers with more options, more certifications and a greater variety of antenna options, which altogether provides greater flexibility to meet the challenging requirements of many wireless designs. This certified module is based upon the Broadcom 4343W chipset, and supports IEEE 802.11 b/g/n, BT 2.1+EDR, and BLE 4.1 wireless connectivity. The module comes in three configurations to best address specific applications, and features an industrial temperature rating (-40° to +85° C) and an industry-leading breadth of certifications and antenna options.

• Three configuration options available:
  • SiP Module (10 mm x 10 mm x 1.2 mm)
  • Module with chip antenna (15.5 mm x 21 mm x 2 mm)
  • Module with External U.FL antenna port (15.5 mm x 21 mm x 2 mm)
• Enhanced collaborative co-existence algorithms
• Best-in-class Output Power and Rx Sensitivity
• Direct driver support for both Linux and Android
• SIG certified Bluetooth driver
• Multiple certified 2.4 GHz antenna options
  • Chip, Dipole, FlexPIFA™ & FlexNotch™
  • LSR offers in-house certification of additional antennas at little to no cost

**Bluetooth® & Bluetooth® Smart Modules**

**BT900 Series: Intelligent Dual-Mode Bluetooth® v4.0 Modules Featuring smartBASIC**

Laird’s innovative BT900 series of modules reduce the engineering burden and design risk of integrating Bluetooth and Bluetooth Low Energy into any OEM device. The BT900’s tiny form factor, on-module MCU and BT stack for hostless operation, and integrated antenna and U.FL port options provide a secure, stable Bluetooth environment for your embedded design. A USB dongle form factor (BT900-US) is also available. Let Laird’s innovative BT900 series, smartBASIC programming language, and decades of expertise in Bluetooth module design speed your product to market.

**SaBLE-x: 2.4 GHz Bluetooth® Low Energy (BLE) Module**

LSR’s SaBLE-x certified Bluetooth Smart module is built to deliver unmatched RF and power performance. This module can deliver over twice the signal range and can operate at nearly 1/3 the average power for a 1 second connection interval when compared to the previous generation Bluetooth low energy technology. Based on the new TI SimpleLink™ Bluetooth Smart CC2640 wireless microcontroller (MCU), this self-contained module provides unmatched integration, including an ARM Cortex-M3 application processor, an ARM Cortex-M0 processor for the RF core, separate Sensor Processor Engine, FLASH memory, and both high- and low-speed clocks. And the innovative Serial-to-BLE API and development tools make it simpler than ever to implement BLE connectivity with an existing microcontroller in your design.

**LoRa® + Bluetooth® Smart Modules**

**RM1xx Series: LoRa™ + Bluetooth® Low Energy (BLE) Integrated Solution**

The all-new RM1xx LoRaWAN + BLE series of modules offer a powerful, convenient solution for long-range Enterprise IoT (EIoT) deployments. Laird innovatively combines Bluetooth v4.0 with LoRaWAN™, the emerging standard in Low Power Wide Area Networks (LPWAN), into one module. RM1xx modules aggregate and transmit data from hardwired or Bluetooth® Smart (BLE) devices and sensors over LoRa® to gateways as far as 15 km (~10 miles) away. This bridges the personal area network to the wide area network in a unique way. The RM1xx Series is LoRa® Alliance certified and fully interoperable with any LoRaWAN™-adherent gateway. In addition, on-module MCU with both LoRa and BLE stack allows for hostless operation, with your business-specific application seamlessly added using Laird’s intuitive smartBASIC programming language.
Microchip offers a broad portfolio of wireless solutions which are cost effective and very easy to implement. Depending on your application requirements, you can choose the product that fits your needs from our various transmitters, receivers, transceivers and agency certified modules for Bluetooth®, Wi-Fi®, IEEE 802.15.4/ ZigBee®, ISM Band Sub-GHz and LoRa® Technology.

**Embedded Wireless**

**2.4 GHz**

Microchip provides transceiver-based solutions to customers which complement the PIC® family of microcontrollers. These products provide a flexible, cost-effective platform for customers to create the optimum wireless products, and solutions for their given application.

<table>
<thead>
<tr>
<th>Transceiver</th>
<th>Data Rate</th>
<th>Frequency Range (MHz)</th>
<th>Sensitivity (dBm)</th>
<th>Tx Power</th>
<th>Rx Mode</th>
<th>Output Power (dBm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRF24J40</td>
<td>250 kbps</td>
<td>2.405 - 2.475</td>
<td>-94</td>
<td>23 mA</td>
<td>19 mA</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module</th>
<th>Data Rate</th>
<th>Frequency Range (MHz)</th>
<th>Sensitivity (dBm)</th>
<th>Tx Power</th>
<th>Rx Mode</th>
<th>Output Power (dBm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRF24J40MA</td>
<td>250 kbps</td>
<td>2.405 - 2.475</td>
<td>-94</td>
<td>23 mA</td>
<td>19 mA</td>
<td>0</td>
</tr>
<tr>
<td>MRF24J40MD</td>
<td>250 kbps</td>
<td>2.405 - 2.475</td>
<td>-102</td>
<td>130 mA</td>
<td>25 mA</td>
<td>20</td>
</tr>
<tr>
<td>MRF24J40ME</td>
<td>250 kbps</td>
<td>2.405 - 2.475</td>
<td>-104</td>
<td>140 mA</td>
<td>32 mA</td>
<td>19</td>
</tr>
</tbody>
</table>

**LoRa®**

LoRa® Technology is a wireless modulation for long-range, low-power, low-data-rate applications.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Output Power (dBm)</th>
<th>Frequency (MHz)</th>
<th>Package</th>
<th>Sensitivity (dBm)</th>
<th>Range</th>
<th>Size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN2483</td>
<td>+10 @ 433 MHz</td>
<td>433, 868 (Europe)</td>
<td>Surface Mount Module</td>
<td>-148</td>
<td>&gt;15 km (suburban)</td>
<td>17.8 x 26.7 x 3.0</td>
</tr>
<tr>
<td></td>
<td>+14 @ 868 MHz</td>
<td>433, 868 (Europe)</td>
<td>Surface Mount Module</td>
<td>-148</td>
<td>&gt;15 km (suburban)</td>
<td>17.8 x 26.7 x 3.0</td>
</tr>
<tr>
<td>RN2903</td>
<td>Adjustable</td>
<td>915</td>
<td>Surface Mount Module</td>
<td>-146</td>
<td>&gt;15 km (suburban)</td>
<td>17.8 x 26.7 x 3.0</td>
</tr>
<tr>
<td></td>
<td>Up to +18</td>
<td>915</td>
<td>Surface Mount Module</td>
<td>-146</td>
<td>&gt;15 km (suburban)</td>
<td>17.8 x 26.7 x 3.0</td>
</tr>
</tbody>
</table>

**Sub-GHz**

Microchip provides Sub-GHz RF solutions that are ideal for many short-range, low-data rate and low-power wireless applications.

| Transmitters | | | | |
|--------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| MICRF114     | Transmitter      | OOK               | 115.2 (NRZ), 57.6 (Manchester Encoded) | 285 – 445 | 13 | |
| MICRF113     | Transmitter      | ASK               | 20               | 300 – 450 | 10 | |
| MICRF112     | ASK/FSK          | 50 (ASK), 10 (FSK) | 300 – 450 | 10 | |
Receivers

<table>
<thead>
<tr>
<th>Radio</th>
<th>Type</th>
<th>Modulation</th>
<th>Data Rate (kbps)</th>
<th>Frequency Range (MHz)</th>
<th>Tx Power (dBm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICRF219A</td>
<td>Receiver (with Auto-Poll)</td>
<td>ASK/OOK</td>
<td>20</td>
<td>300 - 450</td>
<td>-110</td>
</tr>
<tr>
<td>MICRF220</td>
<td>Receiver</td>
<td>ASK/OOK</td>
<td>20</td>
<td>300 - 450</td>
<td>-110</td>
</tr>
<tr>
<td>MRFR39RA</td>
<td>Receiver</td>
<td>FSK/GFSK/MSK/GMSK/OOK</td>
<td>300</td>
<td>290 - 1020</td>
<td>-120</td>
</tr>
<tr>
<td>MICRF221</td>
<td>Receiver (Auto-Poll &amp; RSSI)</td>
<td>ASK/OOK</td>
<td>10 (Manchester Encoded)</td>
<td>850 - 950</td>
<td>-109</td>
</tr>
<tr>
<td>MICRF229</td>
<td>Receiver (Auto-Poll &amp; RSSI)</td>
<td>ASK/OOK</td>
<td>20</td>
<td>400 - 450</td>
<td>-112</td>
</tr>
<tr>
<td>MICRF230</td>
<td>Receiver (RSSI &amp; Squelch)</td>
<td>ASK/OOK</td>
<td>20</td>
<td>400 - 450</td>
<td>-112</td>
</tr>
</tbody>
</table>

Transceivers

<table>
<thead>
<tr>
<th>Radio</th>
<th>Type</th>
<th>Modulation</th>
<th>Data Rate (kbps)</th>
<th>Frequency Range (MHz)</th>
<th>Tx Power (dBm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRFR89XA</td>
<td>Transceiver</td>
<td>FSK/OOK</td>
<td>200</td>
<td>868/915/955</td>
<td>-113</td>
</tr>
<tr>
<td>MRFR49XA</td>
<td>Transceiver</td>
<td>FSK</td>
<td>256</td>
<td>434/868/915</td>
<td>-110</td>
</tr>
</tbody>
</table>

Bluetooth® Modules

Microchip offers ultra-low power embedded Bluetooth® modules, ideal for adding Bluetooth connectivity to embedded applications.

<table>
<thead>
<tr>
<th>Product</th>
<th>Bluetooth Classic-Data/SPP</th>
<th>Bluetooth Classic Audio</th>
<th>Bluetooth Low Energy</th>
<th>FCC Certified</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM20</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>BM23</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>BM62</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>BM63</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>BM64</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>BM70</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>BM71</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>BM78</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>BM90</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RN4020</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>RN41</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RN42</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RN4678</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RN4870</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RN4871</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RN52</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>BTLC1000</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>SAMB11</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Wi-Fi® Modules

Microchip provides embedded Wi-Fi® solutions designed for adding low power Wi-Fi connectivity to enable the “Internet of Things.”

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Radio</th>
<th>Antenna</th>
<th>Power Consumption</th>
<th>Output Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN1810/RN1810E</td>
<td>802.11 b/g/n</td>
<td>PCB/W.FL</td>
<td>N/a 40 μA N/a 64 mA</td>
<td>246 mA (+18 dBm) +18 dBm</td>
</tr>
<tr>
<td>MRF24WN0MA/B</td>
<td>802.11 b/g/n</td>
<td>PCB/W.FL</td>
<td>10 μA N/a N/a 64 mA</td>
<td>246 mA (+18 dBm) 0 dBm to +18 dBm</td>
</tr>
<tr>
<td>ATWINC1500D-XSTK</td>
<td>802.11 b/g/n</td>
<td>PCB/ U.FL</td>
<td>&lt;4 μA 380 μA N/a 80 mA</td>
<td>312 mA (+20 dBm) 20 dBm</td>
</tr>
<tr>
<td>ATSAMW25</td>
<td>802.11 b/g/n</td>
<td>PCB/ U.FL</td>
<td>&lt;4 μA 380 μA N/a 80 mA</td>
<td>312 mA (+20 dBm) 20 dBm</td>
</tr>
</tbody>
</table>
Wireless mobile devices and broadband connectivity are becoming more embedded than ever in society and business around the world, and are key drivers of trends such as mobile payments, video streaming, and the Internet of Things (IoT). The number of connected devices continues to grow as the use of mobile technology and smart devices grows exponentially.

Machine-to-machine (M2M) technology is also expected to change the way we do business. It will also increase productivity and efficiency while remaking monitoring and measurement applications, quality control, decision-making, customer relationship management and more.

Molex has extensive mechanical and RF design experience in all frequency bands used by wireless services.

**Wireless Module Interconnect Solutions**

**MCX RF Connectors**

The MCX RF connectors are designed for use in any wire-to-board application where quick and easy snap-on mating is needed. Available in 50 and 75 Ohm and frequencies up to 6 GHz, the MCX subminiature snap-on connectors offer a stable and durable connection. The subminiature design allows other electronic assemblies to be densely packaged on the PCB. MCX connectors are approximately 30% smaller than SMB connectors, and are available in both 50 and 75 Ohm versions and provide good electrical performance to 6 GHz. These connectors are used in telecommunications systems as well as wireless and GPS applications. For medical MRI applications, non-magnetic versions are available. Molex also provides multi-port MCX connectors for coplanar board-to-board and cable-to-board applications.

**FAKRA II SMB Connector System**

FAKRA II SMB connectors, with 360° rotation and secondary locking latch deliver easy cable routing between antennas and multi-media units while meeting the USCAR requirements for on-board telematics systems. Molex’s FAKRA II SMB product offering meets both American USCAR and German FAKRA automotive standards. The FAKRA II SMB connector system retains the high-performing, cost-effective RF attributes as the original FAKRA connector series. The enhanced features offered by the FAKRA II connector system demonstrate Molex’s dedication to meet the continued mechanical and environmental requirements of the automotive industry.
Molex High-Performance Standard Antenna Solutions

Multi-band Cellular and Combo Cellular/Wi-Fi® Flexible Antennas with Balanced Transmission Advanced Flexible Antenna Technology

Combine extended cellular coverage with Wi-Fi capabilities for better connectivity and faster wireless-device processing. This balanced combo antenna with ground-plane independent design, reduces engineering resources and costs needed to mitigate PCB ground-induced radiation. High radiation efficiencies support high-performance RF application needs. Poly-flexible, double-sided adhesive tape on antenna enables easy peel-and-stick mounting anywhere within the device casing.

2.4 GHz Surface Mount Device (SMD) On-ground Antenna

Developed with the power and precision of Laser Direct Structuring (LDS) technology, Molex's 2.4 GHz SMD on-ground antenna is the smallest on-ground MID (Molded Interconnect Device) antenna in the market. The lightweight Molded Interconnect Device (MID) chip antenna weighs only 0.03g and is used in portable electronic devices based on Bluetooth®, Wi-Fi®, ZigBee® and other wireless standards. Measuring only 3.00mm by 3.00mm by 4.00mm (0.118” by 0.118” by 0.157”) and used on one side of the PCB, the antenna allows board makers to realize significant PCB real estate savings by leaving the ground layers in the PCB intact while freeing up space on the reverse side of the PCB for other component assemblies.

2.4/5GHz Wi-Fi® Flexible Antenna with Balanced Transmission, RoHS-compliant, Halogen-free

Dual-band transmission-balanced antennas combine ground-plane independence with high-radiation efficiency for better connectivity and faster wireless device processing. Balanced antenna with ground-plane independent design reduces engineering resources and costs needed to mitigate PCB ground-induced radiation. High radiation efficiency with 34.90 by 9.00 mm strip antenna offers total efficiency values of 75% minimum in the 2.4GHz band and 70% minimum in the 5GHz band. Poly-flexible, double-sided adhesive tape on antenna enables easy peel-and-stick mounting anywhere within the device casing.

Online Product Design Tools

Molex RF Cable Assembly Configurator

The RF Cable Assembly Configurator allows users to have the flexibility to select from many requirements. A multitude of RF connector interface types and styles are available. If specific interface or cable types are not known, your electrical and mechanical needs, which are also allowed to be purposed within the Configurator, will be addressed by Molex's engineers and the correct connectors and cable types will be suggested for your specific application. By selecting from this list, you can choose the specific layout that you need, speeding up your design process and, in turn, bringing products to market faster.
ON Semiconductor’s sub-1 GHz family of devices provides easy entry to high-performance wireless connectivity. ON Semiconductor RF products are designed to provide maximum performance and ultra-low power consumption for every major wireless sub-1 GHz standard, as well as proprietary wireless solutions. These solutions combine RF and baseband components, ultra-low-power microcontroller technology, and support for high-performance firmware stacks to provide single chip solutions.

RF Transceivers, Transmitters, and Receivers
ON Semiconductor provides a wide range of sub-1 GHz RF transceivers, receivers, and transmitters covering multiple standards including Sigfox, KNX, Wireless M-Bus, and EnOcean, as well as proprietary solutions. ON Semiconductor transceivers are known for high efficiency and excellent sensitivity in the range of -110 dBm to -126 dBm for 1.2 kbps (narrow-band or general-purpose).

AX5043: Ultra-low Power RF Transceiver for 27-1050 MHz Frequency Bands
The AX5043 is a true single chip, narrow-band, ultra-low-power ASK and FSK RF transceiver for the 27 MHz to 1050 MHz frequency bands. It offers the unique combination of ultra-low power consumption for transmit and receive operation combined with highest sensitivity and high selectivity. A link budget of 143 dB at 1 kbps is achieved, if the built-in forward error correction (FEC) is used this can be extended to 146 dB without additional external components. The AX5043 operates down to 1 kbps in a 6.25 kHz channel.

The AX5043 supports FSK, MSK, 4-FSK, GFSK, GMSK, AFSK and ASK modulations. In transmit mode, all modulations are shaped. For FSK Gaussian filters with BT=0.3 or BT=0.5 are available to meet the most stringent regulatory requirements. Power ramping can be configured without restrictions. Maximum output power level is 16 dBm.
RF Microcontrollers and SoCs
In addition to leading-edge RF transceiver technology, ON Semiconductor offers fully integrated system-on-chip (SoC) solutions to support the implementation of wireless networks with a minimal number of components. These solutions combine the superb performance of ON Semiconductor wireless transceivers with an ultra-low-power micro-controller core with 64 kByte Flash, 8.25 kByte RAM, and sleep current consumption of 500-1500 nA.

AX8052F143: Ultra-low Power RF Transceiver for 27-1050 MHz Frequency Bands
The AX8052F143 is a one chip solution compatible with many standard applications in the Internet of Things. A sensitivity of -126 dBm at 868 MHz and 1.2 kbps with a current consumption of only 9.5 mA make the AX8052F143 an outstanding device in its field. Frequency range support from 27 MHz to 1050 MHz, low phase noise, and a high efficiency 16 dBm transmitter allows this RF-microcontroller to be the ideal device for many applications including automatic meter reading and security. The average 4.5 µA duty-cycle receive current is just one of the many outstanding parameters.

The AX8052F143 microcontroller core executes the industry standard 8052 instruction set. The system clock can be programmed freely from DC to 20 MHz. As instructions are executed in a single cycle, the core can deliver 20 MIPS. A 64 kByte flash memory is provided, allowing the programming of applications in C. A fully associative cache and a pre-fetch controller hide the latency of the flash memory.

The AX8052F143 features a dual channel DMA engine that can transfer data to and from XRAM to any peripheral on chip. A dedicated AES engine with its own DMA engine is provided for encryption. Further peripherals include three general purpose timers with optional sigma-delta output mode. The timers can be used as baud rate generators for the two UARTs. A master/slave SPI interface is provided. A 10-bit, 500 kSample/s ADC with flexible input modes, as well as comparators allow to interface with analog data streams.

AX-Sigfox & AX-Sigfox-API: Ultra-low Power Sigfox Compliant SoCs
In the Internet of Things, the demand for nationwide coverage and ultra-low power consumption for small amounts of data cannot be addressed by established standards such as GPRS or LTE. This void is now filled by Sigfox, the ultra-low power cellular connectivity solution. It combines a low cost and simple approach together with ultra-low power consumption.

AX-Sigfox is a single chip solution for a node on the Sigfox network with both up- and down-link functionality. The AX-Sigfox chip is delivered fully ready for operation and contains all the necessary firmware to transmit and receive data from the Sigfox network. It connects to the customer product using a logic level RS232 UART. AT commands are used to send frame and configure radio parameters. AX-Sigfox-API is not delivered with any firmware and requires the purchase of the Sigfox protocol library. This version is ideal for customers who do not want another microcontroller in their product and prefer to implement product functionality on the AX-Sigfox-API chip. AX-Sigfox-API is Sigfox ready certified for end products.
Saw Filters for Wireless Connectivity Applications
Surface Acoustic Wave (SAW) filters provide a filtering function for RF signals at defined frequencies. By using SAW filters, interferers can be suppressed and the sensitivity and reliability of receivers can be enhanced. In transmitting systems, for example, SAW filters provide suppression of unwanted emissions and help fulfill international standards such as FCC or ETSI.

EPCOS brand RF / SAW filters provide a large breadth of devices, including sub GHz ISM, 2.4GHz, and cellular, telematics and IoT discrete filters, duplexers, and modules.

Wireless Connectivity Portfolio
Classic connectivity applications include 2.4GHz Wireless Local Area Network (WLAN), Bluetooth®/BLE, and ZigBee®. TDK offers a wide portfolio of 2.4GHz filters, including filters to assure LTE co-existence (e.g. Band 7, Bands 40/41).

Sub GHz connectivity applications are growing, especially in the IoT market. Application standards include Z-Wave, Zigbee, HaLOW, (sub GHZ WLAN), and LPWAN solutions such as LoRa® and SIGFOX. As these are geared for the industrial and automotive markets, components are required to operate at extended temperature and for automotive they are required to be AEC-Q200 compliant. EPCOS has the largest industrial grade temperature and AEC-Q200 qualified SAW and BAW filter portfolio in the industry!

BAW RF Filter for Bluetooth®/WLAN with LTE Co-existence

TDK simplifies your choice by breaking through the decision maze with superior product and application guidance. EPCOS SAW devices are an ideal match for every wireless RF application.
## EPCOS SAW Devices by TDK

<table>
<thead>
<tr>
<th>Wireless Connectivity Spectrum</th>
<th>Part Number</th>
<th>Ordering Code</th>
<th>Package Size (mm)</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4GHz WLAN/BT</td>
<td>B9604</td>
<td>B39242B9604P810</td>
<td>1.4 x 1.1</td>
<td>Industry Standard with LTE B7, B40, B41 co-existence</td>
</tr>
<tr>
<td></td>
<td>B8328</td>
<td>B39242B8328P810</td>
<td>1.4 x 1.1</td>
<td>Low insertion loss</td>
</tr>
<tr>
<td></td>
<td>B8852</td>
<td>B39242B88524P810</td>
<td>1.1 x 0.9</td>
<td>High Attenuation in B40</td>
</tr>
<tr>
<td></td>
<td>B4346</td>
<td>B39242B4346P810</td>
<td>1.4 x 1.1</td>
<td>Automotive grade with LTE B7, B40, B41 co-existence</td>
</tr>
<tr>
<td></td>
<td>B9634</td>
<td>B39242B9634P810</td>
<td>1.4 x 1.1</td>
<td>Industrial grade with LTE B7, B40, B41 co-existence</td>
</tr>
<tr>
<td></td>
<td>B3912</td>
<td>B39242B3912U410</td>
<td>3.0 x 3.0</td>
<td>Automotive grade</td>
</tr>
<tr>
<td>Sub GHz (869MHz)</td>
<td>B3440</td>
<td>B39242B9604P810</td>
<td>3.0 x 3.0</td>
<td>Industry Standard with LTE suppression</td>
</tr>
<tr>
<td></td>
<td>B3725</td>
<td>B39871B3725U410</td>
<td>3.0 x 3.0</td>
<td>Industry Standard with high nearby suppression</td>
</tr>
<tr>
<td></td>
<td>B4316</td>
<td>B39871B4316P810</td>
<td>1.4 x 1.1</td>
<td>Industry Standard / small size with low loss</td>
</tr>
<tr>
<td>Sub GHz (915MHz)</td>
<td>B3588</td>
<td>B39921B3588U410</td>
<td>3.0 x 3.0</td>
<td>Industry Standard with high ultimate rejection</td>
</tr>
<tr>
<td></td>
<td>B3728</td>
<td>B39921B3728U410</td>
<td>3.0 x 3.0</td>
<td>Industry Standard with low loss</td>
</tr>
<tr>
<td></td>
<td>B4301</td>
<td>B39921B4301F210</td>
<td>1.4 x 1.1</td>
<td>Industry Standard / small size with low loss</td>
</tr>
</tbody>
</table>
Texas Instruments (TI), is committed to delivering a broad portfolio of wireless connectivity solutions which consume the lowest power and are the easiest to use. Ranging from certified modules to easy to design with QFN package ICs, with TI innovation supporting your designs you can share, monitor and manage data wirelessly for applications in wearable devices, home and building automation, manufacturing, smart cities, healthcare and automotive.

**High Performance Wi-Fi® (WiLink Wi-Fi) Modules**

The TI WiLink™ 8 FCC/IC/ETSI/Telec certified module family enables manufacturers to easily add fully integrated 2.4 and 5-GHz versions of Wi-Fi and dual-mode Bluetooth® 4.0 solutions to embedded applications such as industrial, home and building automation, audio and wearables. Offers high throughput, robust Bluetooth and TI ZigBee coexistence mechanism, and now Wi-Fi Mesh for greater network coverage.

**WL1801MOD - WiLink™ 8** - Single band 2.4 GHz, Wi-Fi only module
**WL1835MOD - WiLink™ 8** - Single band 2.4 GHz combo 2x2 MIMO Wi-Fi, Bluetooth & Bluetooth Smart module
**WL1837MOD - WiLink™ 8** - Industrial dual band, 2.4 GHz + 5 GHz 2x2 MIMO Wi-Fi, Bluetooth & Bluetooth Smart module

**Embedded Wi-Fi® (SimpleLink Wi-Fi) Modules**

TI makes connectivity even easier with the next-generation SimpleLink Wi-Fi solutions. The product family features Internet-on-a-chip™, Wi-Fi CERTIFIED™ solutions solving industry challenges for broad embedded applications. With SimpleLink CC3100 and CC3200 pin-to-pin compatible solutions you can:

- Add Wi-Fi to any MCU very easily or program applications on the industry’s first Internet-on-a-chip solution with dedicated MCU
- Add Wi-Fi to battery-operated designs for more than a year on two AA batteries
- Start quickly, no Wi-Fi experience needed

**CC3100MOD** - Add Wi-Fi to your application: SimpleLink™ Wi-Fi and Internet-of-Things solution connecting easily to your MCU.
**CC3200** - A Single-Chip Wireless MCU, SimpleLink™ Wi-Fi and Internet-of-Things solution.

**Bluetooth® Dual-Mode Module**

TI’s dual-mode Bluetooth module transceiver (classic and BLE on one single device) is Bluetooth 4.1 certified (FCC, IC and CE) and Bluetooth 4.1 controller subsystem qualified (QDID 64631), compliant up to the HCI Layer, providing a fast and easy installation. Bluetooth software is delivered and supported by Texas Instruments. Easily connects to TI micro-controller including ultra-low power MSP432. Additional support available for STM32F4 MCUs.

**CC2564MODA** - Certified Dual-mode Bluetooth module with integrated antenna
Bluetooth® Low Energy (BLE) Solutions

TI offers a large choice of easy to use wireless MCU for BLE. Portfolio delivers Lowest power, longest range and most integrated across easy to design with QFN package ICs and certified modules.

- **CC2640** – SimpleLink ultra-low power BLE wireless MCU (pin to pin and SW compatible with Sub-1 GHz CC1310)
- **CC2540** – BLE + USB Interface Wireless MCU
- **CC2540T** – Extreme temperature BLE (+125 degree Celsius) Wireless MCU
- **CC2541-Q1** – Automotive qualified BLE Wireless MCU

Sub 1-GHz

When range matters, combined with ultra-low power and robustness, Sub-1 GHz ISM bands technology is a perfect fit. With the new generation SimpleLink CC1310 ultra-low power wireless MCU, TI delivers 20km on a coin cell battery. CC1310 is the most integrated solution with ARM® Cortex®-M3 MCU and RF in a 4x4 mm WFN single chip.

- **CC1310** – SimpleLink ultra-low power Sub-1 GHz wireless MCU (pin to pin and SW compatible with 2.4GHz CC26xx)
- **C1120** – Narrowband performance line transceiver, SigFox support
- **CC1200** – 802.15.4g performance line transceiver
- **CC1125** – Ultra narrowband performance line transceiver

Multi-protocol

TI SimpleLink Ultra-low power wireless MCU platform offers a unique pin to pin and SW compatibility between 2.4GHz and Sub-1 GHz enabling developers to leverage their investment and address more markets quicker.

In addition, developers can leverage the platform flexibility with multi-protocol solutions.

- **CC2650** – One Hardware, 6 different technologies with SW change: 2.4GHz SimpleLink ultra-low power wireless MCU supporting BLE, ZigBee®, 6LowPan, RF4CE and 2.4GHz proprietary
- **CC1350** – SimpleLink ultra-low power wireless MCU – BLE + Sub-1 GHz on one single chip

Near Field Communication (NFC)

Texas Instruments provides one of the industry’s largest, most differentiated NFC product portfolios enabling lower power solutions to meet a broad range of RF connectivity needs.

- TRF7970A Multi-Protocol Fully Integrated 13.56-MHz NFC / RFID Transceiver IC – TRF79
- RF430CL33xH: Dynamic NFC Interface Transponder for Large File Transfer –
- RF37S114 Tag-it-HF-I Type 5 NFC, ISO15693 Transponder, 4mm x 4mm –
- RF430FRL154H: NFC ISO15693 Sensor Transponder with SPI/I2C Interface
Kits, Tools and Reference Designs
CY8CKIT-042-BLE Bluetooth® Low Energy (BLE) Pioneer Kit

The Bluetooth® Low Energy Pioneer Kit enables customers to evaluate and develop Bluetooth Low Energy applications using the PSoC® 4 BLE and PRoC™ BLE devices.

Bluetooth Low Energy Made Easy:
- The BLE Pioneer Kit supports system-level designs using PSoC Creator which includes numerous example projects to enable Bluetooth Low Energy mixed signal embedded designs.
- The Bluetooth Low Energy v4.1 specification has been abstracted into the new BLE Component in PSoC Creator, allowing for easy drag-and-drop designs.
- The kit has been designed to allow for maximum design flexibility enabling Arduino™ shields hardware compatibility and easy to use, FCC-certified PSoC 4 BLE and PRoC BLE Modules.

CYBLE-022001-EVAL EZ-BLE™ PRoC™ Evaluation Board

The CYBLE-022001-EVAL EZ-BLE PRoC Evaluation Board enables you to evaluate and develop applications on the EZ-BLE PRoC Module. The CYBLE-022001-EVAL board can be used with the Bluetooth Low Energy Pioneer Kit (CY8CKIT-042-BLE) and PSoC Creator to develop BLE applications.

To enable easy prototyping, the evaluation board routes the GPIOs of the on-board EZ-BLE PRoC Module to the CapSense slider, RGB LED, switches, PSoC 5 LP and FRAM on the BLE Pioneer Baseboard. The CYBLE-022001-EVAL board can also be programmed and debugged with the PSoC MiniProg3 Program and Debug Kit (CY8CKIT-002) and PSoC Creator.

CYBLE-222005-EVAL EZ-BLE™ PRoC Evaluation Board

The CYBLE-222005-EVAL EZ-BLE PRoC Evaluation Board enables you to evaluate and develop applications with the CYBLE-222005-00 EZ-BLE PRoC Module. The CYBLE-222005-EVAL board can be used with the Bluetooth Low Energy Pioneer Kit (CY8CKIT-042-BLE) and PSoC Creator to develop BLE applications.

To enable easy prototyping, the evaluation board routes the GPIOs of the on-board EZ-BLE PRoC Module to the CapSense slider, RGB LED, switches, PSoC 5 LP and FRAM on the BLE Pioneer Baseboard. The CYBLE-222005-EVAL board can also be programmed and debugged with the PSoC MiniProg3 Program and Debug Kit (CY8CKIT-002) and PSoC Creator.

CYBLE-012011-EVAL EZ-BLE™ PRoC™ Evaluation Board

The CYBLE-012011-EVAL EZ-BLE PRoC Evaluation Board enables you to evaluate and develop applications for the CYBLE-012011-00 and CYBLE-012012-10 modules. The CYBLE-012011-EVAL applies to both the CYBLE-012011-00 and CYBLE-012012-10 modules. The CYBLE-012011-EVAL board can be used with the Bluetooth Low Energy Pioneer Kit (CY8CKIT-042-BLE) and PSoC Creator to develop BLE applications. To enable easy prototyping, the evaluation board routes the GPIOs of the on-board EZ-BLE PRoC Module to the CapSense slider, RGB LED, switches, PSoC 5 LP and FRAM on the BLE Pioneer Baseboard. The CYBLE-012011-EVAL board can also be programmed and debugged with the PSoC MiniProg3 Program and Debug Kit (CY8CKIT-002) and PSoC Creator.
Easy-To-Use Platform Solar-Powered IoT Device Kit (S6SAE101A00SA1002)

The Solar Powered IoT Device Development Kit provides an easy-to-use platform for the development of a solar-powered IoT device with BLE wireless connectivity. It includes the S6AE101A Energy Harvesting PMIC device. Also included in the kit is Cypress’ EZ-BLE™ PRoC™ Module (CYBLE-022001-00), a fully integrated Bluetooth Low Energy module solution that offers high flexibility for a wide variety of IoT device uses. A USB port is provided by Cypress’ USB-UART LP Bridge Controller device (CY7C65213).

The Solar Powered IoT Device Kit provides everything needed to develop a light-powered sensor node that transmits sensor data using BLE:

- Firmware provided for the following applications:
  - Bluetooth Low Energy (BLE) Beacon, transmitting data at 1.5 sec intervals with ambient light as low as 200 lx
  - Wireless Sensor Node (WSN), transmitting data at 6 sec intervals with ambient light as low as 200 lx

- BLE communication with a PC supported through the included BLE-USB Bridge that is pre-programmed with custom firmware for this kit.

- Operation using energy harvested from light as low as 200 lx supported with the included solar cell module, which eliminates the need for a battery
  - Use of a vibration Energy Harvesting Device with an external diode bridge also supported (not included)

- Reference schematic, BOM list, layout data provided

- Expandable terminal on the Energy Harvesting Motherboard provided, enabling support for the following:
  - Reset button for EZ-BLE Module
  - JTAG header to debug EZ-BLE Module
  - Expandable sensor interface (I2C/UART/SPI/GPIO)
  - DIP switch for future expansion (Not mounted)
  - LEDs for USB power and status
TiWiConnect™ IoT Platform
Part Number: 450-0143 (TiWiConnect™ Wi-Fi® Dev Kit)
LSR introduces the TiWiConnect™ cloud connectivity platform, the first true end-to-end IoT solution for wirelessly connecting products to the cloud. This IoT platform enables smartphone apps and web portals that can re-define the product experience for both your customers and service professionals alike.

TiWiConnect simplifies your product development efforts by providing all 3 components of a comprehensive solution, all built from the ground up to connect seamlessly: Embedded wireless modules, cloud platform and apps. This Development kit features a lifetime developers account for the TiWiConnect cloud, allowing you to begin sending and receiving data between kit and the cloud in under 5 minutes.

Sterling-LWB Wi-Fi® + Bluetooth® Development Kit
Part Number: 450-0155 (with U.FL),
450-0156 (with Chip Antenna)
The Sterling-LWB development kit features a convenient SD Card form factor for convenience compatibility with a variety of Microprocessor development platforms, such as NXP/Freescale i.MX6. Full driver support for Linux, along with step-by-step user guides, dramatically simplifies adding a powerful Wi-Fi module to your Linux-based development project.

BT900 Dual-Mode Bluetooth® Development Kit
Part Number: DVK-BT900-SA (with internal antenna),
DVK-BT900-SC (with u.FL connector)
The BT900 Development Kit offers a complete out of the box experience – no additional components needed! Just unbox, plug in and test BT / BLE operation in minutes!

A Quick Start Guide and the Laird Toolkit mobile app make it simple to begin interfacing with your BT900 kit right from your smart device. Comprehensive documentation and development tools make it easy to begin utilizing the smartBASIC programming language for the BT900, as well.
SaBLE-x BLE Development Kit
Part Number: 450-0150
LSR’s Development Kit for the SaBLE-x Bluetooth® Smart module will provide you with a fast out-of-the-box experience with all the hardware you need, including adapter boards for development with TI or Arduino platforms. A simplified evaluation kit version is also available.

Along with the Development Kit hardware, BLE developers can utilize LSR’s Developer Tool Suite software. This suite of developer tools simplifies the work to integrate the SaBLE-x module with your host MCU through LSR’s exclusive Serial-to-BLE API and Source Code, along with Boot Loader. Furthermore, the companion mobile app, ModuleLink for BLE, works seamlessly with the SaBLE-x Dev Board so you can range-test and test communications with any iOS or Android device.

RM1xx LoRa®+ BLE Development Kit
Part Number: DVK-RM191-SM (915 MHz LoRa® for US Canada), DVK-RM186-SM (868 MHz LoRa for Europe)
The Laird DVK-RM1xx development kit provides a platform for rapid wireless connectivity prototyping, providing multiple options for the development of LoRa® and Bluetooth® Low Energy (BLE) applications. The kit, which features connectivity with Arduino-style shields, also features Laird’s innovative event driven programming language - smartBASIC, along with comprehensive sample service code libraries, videos, application notes, and more.
LoRa® Technology Evaluation Kit – 915 MHz
Part Number: DV164140-2
The LoRa® Network Evaluation Kit makes it easy for customers to test LoRa® technology, range and data rate. The full-featured gateway board includes an LCD screen, SD Card for Config Data, Ethernet connection, 915 MHz antenna, and full-band capture radios. The Gateway evaluation kit also includes two RN2903 Mote boards (Part # DM164139).

The gateway uses a local version of the LoRaWAN™ network server running under Windows so it does not need an external network connection. This creates a self-contained demo network that makes testing the LoRa® network quick and easy.

915 MHz RN2903 LoRa® Technology Mote
Part Number: DM164139
The RN2903 LoRa® Mote is a LoRaWAN™ Class A end-device based on the RN2903 LoRa® modem. As a standalone battery-powered node, the Mote provides a convenient platform to quickly demonstrate the long-range capabilities of the modem, as well as to verify inter-operability when connecting to LoRaWAN™ v1.0 compliant gateways and infrastructure.

The Mote includes light and temperature sensors to generate data, which are transmitted either on a fixed schedule or initiated by a button-press. An OLED display provides feedback on connection status, sensor values and downlink data or acknowledgments. A standard USB interface is provided for connection to a host computer, providing a bridge to the UART interface of the RN2903 modem. As with all Microchip RN family of products, this enables rapid setup and control of the on-board LoRaWAN™ protocol stack using the high level ASCII command set.

RN2903 LoRa® Technology PICtail™/PICtail Plus Daughter Board
Part Number: RN-2903-PICTAIL
The RN2903 LoRa® Technology PICtail™/PICtail Plus Daughter Board is a development board that showcases the Microchip RN2903 Low-Power Long Range, LoRa® Technology Transceiver Module.

This versatile development board has PICtail™ and PICtail Plus interfaces for connecting to Microchip’s PIC18 Explorer board or Explorer 16 board. It also has an on-board USB to UART bridge for easy development with a PC.

The PICtail™ board also has an on-board PIC18 MCU available for custom user functions. It is pre-programmed to provide a simple USB-to-UART serial bridge enabling easy serial connection. Demonstration of the RN2903 is performed by plugging the daughter board into a USB port of a PC. The USB port powers the daughter board and enables the user to communicate using the RN2903’s simple ASCII command interface.
**RN1810 Wi-Fi® PICtail™/PICtail Plus**

**Part Number: RN-1810-PICTAIL**

Based on Microchip’s new low power IEEE 802.11b/g/n Wi-Fi module the RN1810, the RN1810 PICtail™/PICtail Plus Daughter Board allows customers to easily develop Wi-Fi applications using Microchip’s 8, 16 and 32-bit PIC® microcontrollers. The kit includes a fully integrated TCP/IP stack allowing for a simple serial to Wi-Fi connection to the microcontroller.

The board features an on-board USB to UART bridge for easy plug-and-play development with a PC. The board is also compatible with the Explorer 16 Development Board (DM240001), PICDEM.net2 Development Board (DM163024) and PIC32 Starter Kit (DM320001) with I/O Expansion Board (DM320002).

---

**WINC1500 Evaluation Board**

**Part Number: ATWINC1500-XPRO**

Microchip’s ATWINC1500-XPRO is an extension board to the Xplained Pro evaluation platform. The ATWINC1500-XPRO extension board allows you to evaluate the WINC1500 low cost, low power 802.11 b/g/n Wi-Fi® network controller module. Supported by the Atmel Studio integrated development platform, the kit provides easy access to the features of the WINC1500 and explains how to integrate the device in a custom design.

---

**RN4870 Bluetooth® Low Energy PICtail™/PICtail Plus**

**Part Number: RN-4870-SNSR**

The RN-4870-SNSR is a development board based on the ultra-compact Bluetooth 4.2 Low Energy RN4870 module. The RN4870 uses a simple ASCII command interface over the UART. The board enables evaluation of the RN4870 and development of Bluetooth low Energy applications in two different ways:

1) **Out of the box:** When plugged into the USB port of a PC, the board will enumerate as a Communication Device Class (CDC) Serial device. Through a terminal program, users can configure and control the module and transfer data using the easy to use provided command set.

2) **As a PICtail™/PICtail Plus:** the board interfaces to Explorer 8 or Explorer 16 Development Board. The Explorer 8/16 modular development system works with one of hundreds of available PIC 8, 16, 32 bit Microcontrollers PIM (Plug-In-Modules). The PICtail™ bridges the host MCU UART to the RN4870’s UART interface for data transfer or configuration using the straight-forward, easy-to-use ASCII style command set.
ON Semiconductor’s comprehensive suite of development kits simplifies the entry into wireless solutions. Development kits are supported by a suite of software tools consisting of code generators for full RF application C-code and an integrated development environment which comes with a source code debugger and C-compiler.

**DVK-BASE-2-GEVK: Development Kit for RF Transceivers**

**Overview**
The DVK-BASE-2-GEVK features the AX8052F100 ultra-low-power microcontroller on the main boards, allowing developers using ON Semiconductor’s radio chips and microcontrollers to design, program, and evaluate their applications under real world conditions. A range of RF-modules with different RF ICs for various carrier frequencies are available as add-on kits.

**Hardware**
The DVK-2 hardware is designed to demonstrate the features of the AX8052F100 and ON Semiconductor RF-ICs. The ultra-low-power microcontroller can be used in all operating modes including low clock speeds and sleep modes. A pair of main boards together with an RF add-on is the perfect base to evaluate and develop RF systems. All RF-modules are matched to 50 Ω and are equipped with SMA connectors that can either be used with antennas or connected to laboratory equipment.

- ADD5043-169-2-GEVK: 169 MHz Add-on kit for DVK-2 Evaluation Kit
- ADD5043-433-2-GEVK: 433 MHz Add-on kit for DVK-2 Evaluation Kit
- ADD5043-868-2-GEVK: 868/915 MHz Add-on kit for DVK-2 Evaluation Kit

**Software**
The DVK-2 comes with a productivity enhancing IDE and C-compiler. The AXCode::Blocks integrated development environment (IDE) is a complete tool suite that supports development and debugging of C and assembler code for ON Semiconductor microcontrollers. Its intuitive GUI provides an environment that accelerates the development cycle. The tabbed interface with code highlighting and folding helps to keep overview, while code completion, smart indent and a class browser help to speedup code generation.

**Code Generators**
The AX-RadioLab code generator creates fully functional sample code for a variety of applications.

**C-Compiler**
A full featured C-compiler is available for free download at [www.onsemi.com](http://www.onsemi.com), allowing the developer to begin immediately. The included optimizer can be flexibly configured for speed or code size.

**Debug Link**
The debug link features not only unlimited break-points, but also a UART style terminal link. This UART link can be used together with AXCode::Blocks for debugging without extra hardware effort.
**F143-MINI-2-GEVK: Miniature Development Kit for the AX8052F143 RF SoC**

**Overview**

The F143-MINI-2-GEVK is ON Semiconductor’s miniaturized development kit for the designer starting out with the AX8052F143 SoC RF SoC. Kit hardware consists of a USB debugging adapter and a pair of RF modules (F143-Mini-A-MOD and F143-Mini-B-MOD modules) and includes all software necessary to develop systems in shortest times. The modules have a tiny footprint of just 33 x 15 mm². One module comes with a chip antenna the other is equipped with an SMA connector.

**Hardware**

The F143-Mini-A-MOD module is equipped with an SMA connector that may be used either to connect a 50 Ω whip antenna or measurement equipment. This module does not allow for batteries to be connected but can be powered via the debug adapter. The F143-Mini-B-MOD module is equipped with two 1.5 V LR44 batteries and a chip antenna. It can be powered either by the batteries or the debug adapter. The PCB section containing the battery clips can be broken away if not used, resulting in a module equal in size to the F143- Mini-A-MOD. Modules are designed for use at a carrier frequency of 868.3 MHz.

**Software**

The F143-MINI-2-GEVK is fully compatible with the DVK-2 and ON Semiconductor’s AX8052 development software environment. The software comes with a productivity enhancing IDE and C-compiler. The AXCode::Blocks integrated development environment (IDE) is a complete tool suite that supports development and debugging of C and assembler code for ON Semiconductor microcontrollers. Its intuitive GUI provides an environment that accelerates the development cycle. The tabbed interface with code highlighting and folding helps to keep overview, while code completion, smart indent and a class browser help to speed-up code generation.

**DVK-SFEU-1-GEVK: Sigfox Development Kit**

The Sigfox DVK (DVK-SFEU -1-GEVK) is a miniaturized development kit for the designer starting out with the AX-SIGFOX chip, a ultra-low power high performance Sigfox SoC for up-link and downlink. The Sigfox DVK hardware consists of a USB debug adapter and an RF module and includes all software necessary to develop systems in shortest times. The module has a tiny footprint of just 33 x 15 mm², and is equipped with an SMA connector. The Sigfox DVK enables instant testing via AT commands for ON Semiconductor’s single chip solution for a node on the Sigfox network.
High Performance Wi-Fi® (WiLink Wi-Fi) Modules
WL1837MODCOM8I: WiLink™ 8 Dual Band 2.4 & 5 GHz Wi-Fi® + Bluetooth® COM8 Evaluation Module
The WL1837MODCOM8I, which is compatible with many processors including TI’s Sitara™ processors, easily enables customers to add both Wi-Fi® and Bluetooth® to home and building automation, smart energy, gateways, wireless audio, enterprise, wearable devices and many more industrial and Internet of Things (IoT) applications.

WL18XXCOM82SDMMC
The WiLink SDIO board is a SDMMC adapter board and is an easy to use connector between a WiLink COM8 Evaluation module like the WL1837MODCOM8I and a generic SD/MMC card slot on a host processor EVM.

Embedded Wi-Fi® (SimpleLink Wi-Fi) Modules
CC3200MODLAUNCHXL
The SimpleLink™ Wi-Fi® CC3200MOD LaunchPad (with certified module) is an evaluation development platform for the CC3200 wireless microcontroller (MCU), the industry’s first single-chip programmable MCU with built-in Wi-Fi connectivity. The board features on-board emulation using FTDI and includes sensors for a full out-of-the-box experience. This board can be directly connected to a PC for use with development tools such as CCS and IAR.

Bluetooth® Dual Mode Module
CC2564MODAEM
For a complete evaluation solution, the CC2564MODAEM board plugs directly into TI hardware development kits, including MSP-EXP430F5529, MSP-EXP430F5438, DK-TM4C123G, and DK-TM4C129X. Moreover, a certified and royalty-free TI Bluetooth Stack (TIBLUETOOTHSTACK-SDK) is available for the MSP430 and TM4C12x MCUs. Additional royalty-free SW (CC256XSTBTBLESW) works directly with the hardware development kit STM3240G-EVAL when combined with the CC256XEM-STADAPT adaptor board.

Bluetooth® Low Energy (BLE) Solutions/2.4GHz Multi-protocol
LAUNCHXL-CC2650 Wireless MCU LaunchPad™ Kit
The CC2650 LaunchPad kit brings easy Bluetooth® Smart connectivity to the LaunchPad kit ecosystem with the SimpleLink ultra-low power CC26xx family of devices. This LaunchPad kit also supports development for multi-protocol support for the SimpleLink multi-standard CC2650 wireless MCU and the rest of CC26xx family of products: CC2630 wireless MCU for ZigBee®/6LoWPAN and CC2640 wireless MCU for Bluetooth® Smart.
CC2650STK - SimpleLink™ Bluetooth Smart®/Multi-Standard SensorTag
The SensorTag IoT kit invites you to realize your cloud-connected product idea. The new SensorTag connects 10 low-power MEMS sensors to the cloud with Bluetooth Smart and get your sensor data online in 3 minutes. The SensorTag is ready to use right out the box with an iOS and Android app, with no programming experience required to get started. SensorTag can be enabled with ZigBee®/6LoWPAN technology.

Sub-1 GHz
LAUNCHXL-CC1310: SimpleLink™ Sub-1 GHz Wireless Microcontroller (MCU) LaunchPad™ Development Kit
The SimpleLink™ Sub-1 GHz CC1310 wireless microcontroller (MCU) LaunchPad™ development kit is the first LaunchPad kit with a Sub-1 GHz radio, which offers long-range connectivity, combined with a 32-bit ARM® Cortex®-M3 processor on a single chip.

TIDC-SIGFOX-CC1120-CC1190-BP
The Sub-1 GHz CC1120-CC1190 BoosterPack™ for the SIGFOX network is a certified hardware design to enable users to connect to the SIGFOX Low Power Wireless Area Network (LPWAN) platform targeted for the Internet of Things (IoT) market.

Near Field Communication (NFC)
NFCLink LaunchPad Evaluation Kit Bundle
This bundled solution contains the DLP Design NFC/RFID BoosterPack (DLP-7970ABP) which is an add-on board designed to fit all of TI’s MCU LaunchPads and the MSP-EXP430F5529LP LaunchPad. This bundle allows the software application developer to get familiar with the functionalities of TRF7970A NFC transceiver IC without having to worry about developing the RF section and the NFCLink software firmware library enables developers to quickly and easily create NFC applications in all three operating modes reader/writer, card emulation and peer-to-peer for the TRF7970A NFC transceiver. Bundle also exists for MSP430G2x and 32-bit Cortex MSP432.

All-in-One NFC Evaluation Kit
For evaluating the complete NFC solution with Dynamic NFC Transponder Interface, NFC Transceiver IC and NFCLink software, the all-in-one NFC Evaluation Kit, contains the TRF7970ATB Target Board, the MSP-EXP430F5529 USB Experimenter’s Board, RF430CL330HTB Target Board and the MSP-EXP430FR5739 Experimenter Board.
Wireless Services and Support

**Design Chain Solution**
Customers large and small can all benefit from working with Avnet engineers through design and production. Technologies are always changing and our engineering teams stay aligned with the trends that customers are integrating into their products. Our broad supplier base and expertise allow customers to have all the options necessary to get the best products to market.

**Field Application Engineers (FAEs)**
- Component and technology selections
- Developing complex solutions with multiple technologies
- Guide you from design to production

**Device Programming & Modifications**
- Device Programming
- Customized Power Supply
- Customized Thermal Management

**FPGA Design Services**
- Code Development and Validation
- Vendor and 3rd Party Tools Training
- Design Workshops with Hands On Labs

**Supply Chain Solutions**
Our comprehensive supply chain portfolio and global scale provide you with options to maximize your supply chain and keep your products in the market longer, without disrupting production or supplies. In addition, our industry-recognized supply chain experts can help you assess your supply chain health and manage future expansion.

**Inventory Management & Warehousing**
- In Plant & Out Plant Stores
- Vendor Managed Inventory / Consignment
- Inventory & Order Visibility
- Inventory Replenishment

**Risk & Time to Market**
- Risk Mitigation
- Assurance of Supply
- Obsolescence Services

**Supply Chain Assessment & Planning**
- Logistical Analysis – Rapid Benefits Estimation Tool
- Global Solutions