



Bluetooth®

SoC and Module Selector Guide for Consumer IoT

Selecting the Right Bluetooth Devices for Smart Home,
Wearables, and Connected Medical Devices



Bluetooth® SoC and Module Selector Guide

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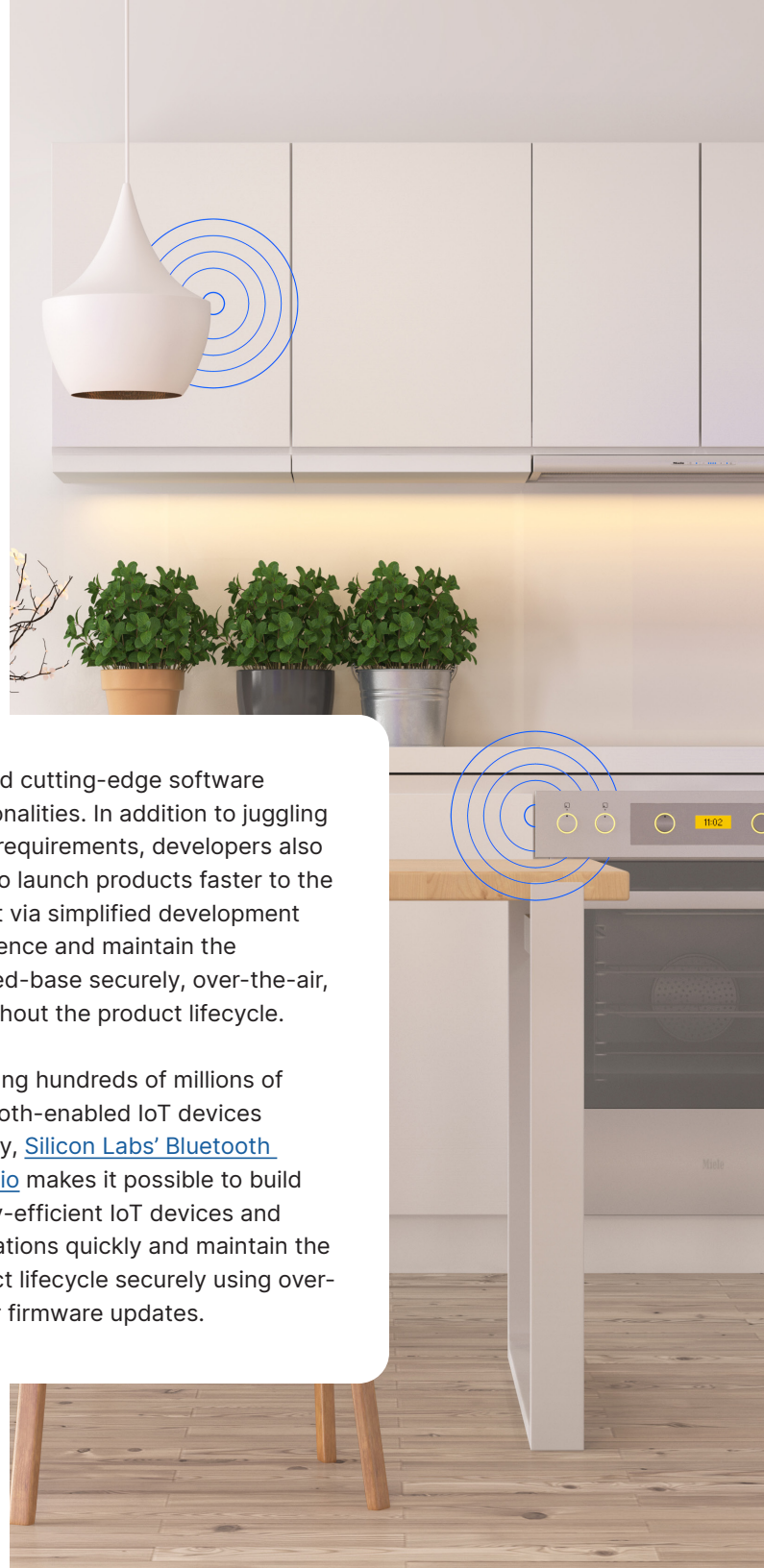
Making Consumer IoT Products on the World's Largest and Fastest Growing Wireless Technology - Bluetooth®

Bluetooth offers developers and manufacturers one of the world's fastest growing wireless connectivity technologies. In fact, 5.4 billion Bluetooth-enabled IoT devices are expected to be shipped by 2023. However, succeeding in this intensely competitive market isn't easy; it takes more than a myopic focus on chip footprint or hardware specs.

Today's IoT products need to place an emphasis on protecting users' privacy against constantly evolving security threats while delivering great user-experiences through superior RF performance, smooth connectivity, long battery

life, and cutting-edge software functionalities. In addition to juggling these requirements, developers also need to launch products faster to the market via simplified development experience and maintain the installed-base securely, over-the-air, throughout the product lifecycle.

Powering hundreds of millions of Bluetooth-enabled IoT devices globally, [Silicon Labs' Bluetooth portfolio](#) makes it possible to build energy-efficient IoT devices and applications quickly and maintain the product lifecycle securely using over-the-air firmware updates.



The portfolio comprises five elements: hardware, software, security, development kits, and learning resources for Bluetooth Low Energy as well as Bluetooth mesh.



Hardware
SoCs and Modules



Software
SDKs, Stacks & Tools



Security
Hardware and Software



Development
Kits and Boards



Support
Knowledge Base & Community



This guide provides you with a quick overview of our Bluetooth® hardware so you can make an informed decision when selecting the SoCs and modules for your next project.

Five Bluetooth® Hardware Highlights

Learn more about our Bluetooth Development Kits [here](#).



The BG21 has the industry's longest range and is the only SoC with +20 dBm TX power



The BG22 is the most energy-efficient SoC enabling 10+ years lifetime with a coin cell battery



The BGM220S is our smallest SiP module for accelerated time-to-market for small designs



The ultra-low power [BG24](#) features the largest Flash and RAM capacities in our portfolio and PSA Level 3 Secure Vault™ protection and AI/ML Acceleration. Available in WLCSP package for small form factor applications



The BG27 is our most Battery Versatile SoC, available with DCDC Boost in WLCSP packaging for small form factor applications, from medical devices to wearables and beyond.

Why the Silicon Labs Bluetooth® SoCs and Modules are Ideal



Hardware

The broad range of Bluetooth SoCs (system-on-chip) and modules Silicon Labs offers means there's an optimal solution for every IoT consumer IoT application. Our hardware is renowned for superior RF performance, equipping your products with the best connectivity, reliability, and user-experience available.



ULTRA-LOW ENERGY CONSUMPTION

Our innovative transmitter performance provides your IoT devices with up to +10 years of life from a single coin cell battery.



LONGEST RANGE

For IoT applications requiring extreme range, Silicon Labs hardware delivers the world's highest transmit power up to +20 dBm.



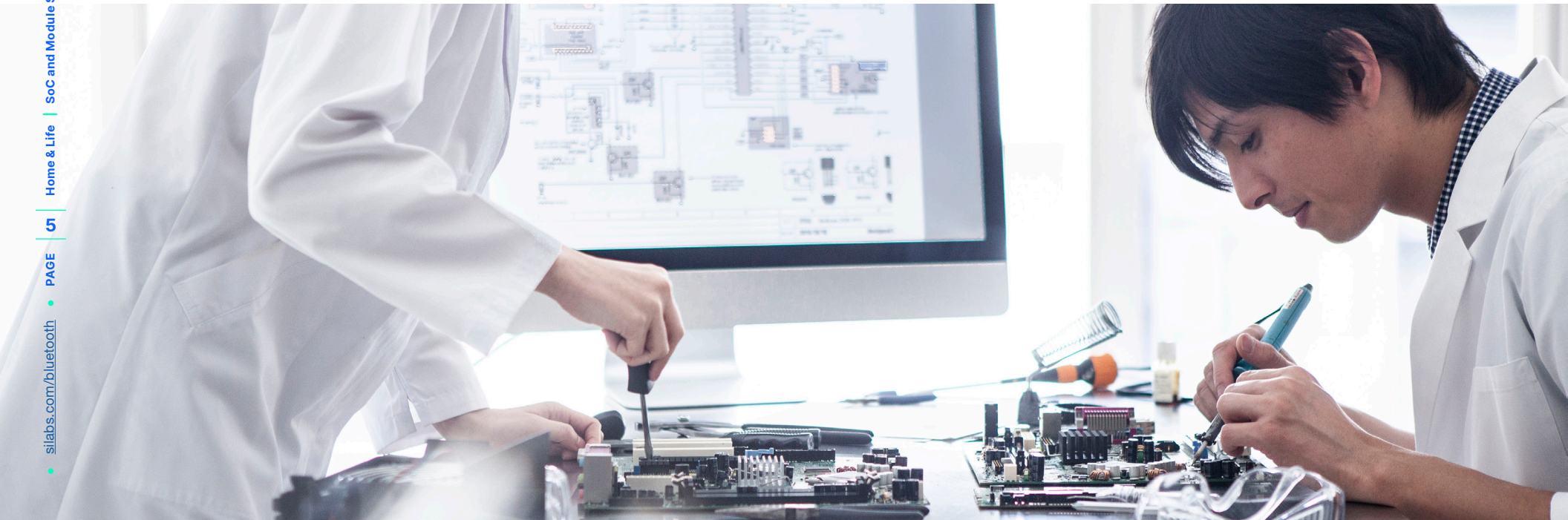
SUPERIOR RECEIVER SENSITIVITY

For the most reliable and resilient connectivity, our hardware offers superb receiver sensitivity down to -107 dBm.



SMALL SIZE

Many compact Bluetooth solutions starting from a 2.3 × 2.6 mm WLCSP to a SiP module of 6 × 6 mm enable smaller product form factors, more functionalities, and enhanced design possibilities.





SOFTWARE

Silicon Labs helps you keep your products ahead of the competition by continually developing our Bluetooth software development kits (SDK) at the forefront of the industry – delivering the latest protocols and high-quality implementations of all the essential features on Bluetooth Low Energy and Bluetooth mesh.

The dynamic multiprotocol support, Apple HomeKit®, Wi-Fi coexistence, and direction finding are just a few highlights of our market-leading Bluetooth feature parity.

Thanks to our hardware-agnostic stacks, you can reuse your Bluetooth application software, APIs, and integrated development environment across our hardware portfolio, radically minimizing software and hardware migration efforts when you develop new Bluetooth-enabled products.



LONG-TERM SDK SUPPORT SERVICE

Maintaining software, security, and device certifications up to date requires constant development. However, technology evolution accelerates, narrowing down codebase maintenance windows. Our Long-Term SDK Support Service guarantees long-term support for up to 10 years through major bug fixes, security patches, and quality control regression testing for the SDK branch under contract.





SECURITY

When you want your products to withstand the most sophisticated cyber-security attacks, you can trust our technology to safeguard your customers' privacy and your brand by implementing robust [security](#) at all levels:



Bluetooth® Stack

Our Bluetooth® stack implements the standard security features to protect your applications against the common wireless threats.



Software

The mbed TLS software execution layer allows your applications to use our advanced chip-level secure hardware capabilities.



Device-level

Our hardware implements robust security via secure boot with root of trust and secure loader, secure over-the-air update, crypto engine, true random number generator, and Silicon Labs' cutting-edge Secure Vault technology.



DEVELOPMENT

Silicon Labs SDKs work with C programming as well as GCC and IAR based compilers. For ultimate ease, you can download [Simplicity Studio](#), our unified development environment for all Silicon Labs technologies. When installed, it automatically customizes your development environment and SDKs based on the target hardware into an intuitive, end-to-end development experience. Simplicity Studio offers the most powerful utility toolbox at no cost.

Silicon Labs Secure Vault technology enabled the world's first wireless SoCs to achieve [PSA Certified Level 3 certification](#).

Based on the strength of Secure Vault, Silicon Labs' received the 2022 Leadership in Engineering Achievement Program (LEAP) for connectivity award.





RAIL

Silicon Labs RAIL (Radio Abstraction Interface Layer) provides an intuitive and easily-customizable radio interface that is designed to support proprietary or standards-based wireless protocols. RAIL allows customers to adopt the latest RF technology without sacrificing the previous development investment and future-proofs the code migration to future EFR32 ICs. The unified radio software API abstracts the significant number of hardware registers and complexity of the lower-level radio block, allowing customers to focus on their proprietary wireless application development instead of mastering device-specific details.



SUPPORT

There is a complete set of in-depth [Bluetooth technical documents](#) and development resources to get you ahead fast. Silicon Labs is renowned for its ambitious community support and quick turnaround time.



CUSTOM PART MANUFACTURING SERVICE

Security is critical for IoT devices, but developing secure products is complex. Our new [Custom Part Manufacturing Service](#) (CPMS) simplifies the process by making it possible for IoT device makers and application developers to configure and order customized wireless hardware and MCUs directly from Silicon Labs. In addition to flash programming, CPMS also provides more advanced security provisioning such as secret key injection, anti-tamper configuration, secure boot, and debug lock configuration.



Bluetooth® Technology Leader

As an Associate Member of Bluetooth [SIG](#) and a leading influencer in the standardization body, we drive the future of Bluetooth based on our world-class R&D and customer feedback. This in-depth knowledge of future use-cases and requirements allows us to develop better solutions, delivered to you in the industry forefront.



Silicon Labs Bluetooth® Portfolio for Consumer IoT

Silicon Labs offers a broad range of Bluetooth® wireless SoCs and modules for every consumer IoT application and device category. To simplify your selection process, the table here gives you a quick overview to match our SoCs and modules to your application.

Home Automation								Home Security			Appliances				Entertainment		Medical & Wearables									
LED Lighting	Gateways	Outdoor Living	Switches	Sensors	Locks	HVAC	Shades Blinds	Cameras	Sensors	Control Panels	Whitegoods	Kitchen	Chores Automation	Personal Hygiene	AR/VR	Television	Portable Medical	Wearables								
BG21				BG21																						
BG22															BG22		BG22									
BG24								BG24										BG24 CSP								
BG27						BG27			BG27		BG27		BG27 CSP													
BGM 210L	BGM210P			BGM210P																						
				BGM220P/S				BGM220S			BGM220P		BGM220P/S		BGM220S											
BGM240P/S								BGM 240P/S	BGM240P			BGM240S														

 SoCs  Modules

How to Choose the Right Bluetooth® SoC and Module

To narrow down your selection, the product summaries here highlight the key capabilities, features, and properties of each family. This will help you to choose the correct product family based on your design requirements such as range, security, form-factor, and power credentials. If you need to accelerate your time to market, most of our Bluetooth® SoCs offer RF pre-certified modules that will save you development time and costs.

Key Properties of our Bluetooth SoC Families



- For Line Powered Devices
- Long Range +20dBm Tx
- High Temp +125°C
- CA Title 20
- Secure Vault High (Sesip L3 / PSA L3)
- BGM210L Module with flexible mount-ability (Vertical or Horizontal) integrated antenna and RF certifications for faster time to market



- For Battery Powered Devices
- High Temp +125°C
- CA Title 20
- Ultra-Low Power
- Secure Vault Mid
- BGM220P/S modules with integrated antenna and RF certifications for faster time to market



- For Battery Powered Devices
- Long Range – Low Power
- Large Memory
- AI/ML accelerator for tiny edge processing
- Secure Vault High (Sesip L3 / PSA L3)
- BGM240P/S modules with integrated antenna and RF certifications for faster time to market
- 20-bit ADC for High Accuracy Mode
- Small 3.1x3.0mm CSP form-factor



- For Small Form Factor Battery Operation
- Ultra small form-factor 2.3x2.6mm
- Exceptional Receiver Sensitivity
- Ultra-low Transmit Power
- Battery Life Tracking (Coulomb Counter)
- DC-DC Converter
- Wakeup Pin
- Secure Vault Mid
- Standards IEEE 2621 & IEC62304 complia

Bluetooth® SoC Lineup



Bluetooth features	5.4 and mesh 1.1 (1M, 2M, LE Coded PHYs and AE)	5.4 and Bluetooth mesh LPN (1M, 2M, LE Coded PHYs, AE and Bluetooth direction finding)	5.4 and Bluetooth mesh 1.1 (1M, 2M, LE Coded PHYs, AE and Bluetooth direction finding hardware accelerator)	5.4 and Bluetooth mesh 1.1 (1M, 2M, LE Coded PHYs, and AE)
Proprietary 2.4G	2(G)FSK, (G)MSK, OQPSK DSSS	2(G)FSK, (G)MSK, OQPSK DSSS	2(G)FSK, (G)MSK, OQPSK DSSS	2(G)FSK, (G)MSK, OQPSK DSSS
TX / RX (1M,GFSK)	+20 dBm / -97.5 dBm	+6 dBm / -98.9 dBm	+19.5 dBm/-97.6 dBm	+8 dBm/-99.2 dBm
TX Current (MCU + radio value)	9.3 mA (0 dBm) 33.8 mA (10 dBm)	4.1 mA (0dBm) 8.2 mA (6 dBm)	5mA (0 dBm) 19.1mA (10 dBm)	4.1 mA (0 dBm) 11.3 mA (8 dBm)
RX Current (1M, GFSK)	8.8 mA	3.6 mA	4.4 mA	3.6 mA
CPU / Clock Speed	Cortex M33 (80 MHz) Cortex M0+ (Security)	Cortex M33 (up to 76.8 MHz) Cortex M0+ for radio	Cortex-M33 (up to 78 MHz) Cortex M0+ for radio	Cortex M33 (up to 76.8 MHz) Cortex M0+ for radio Cortex M0+ (Security)
Flash (kB)	Up to 1024kB	Up to 512kB	Up to 1536kB	768kB
RAM (kB)	Up to 96kB	32kB	Up to 256kB	64kB
Sleep Current (EM2)	4.5 µA (16 kB RAM)	1.2 µA (8 kB RAM)	1.3 µA (16 kB RAM)	1.6 µA (64 kB RAM)
Active Current (EM0)	50.9 µA / MHz	27 µA / MHz	33.4 µA/MHz	29 µA/MHz
Security	Secure Vault - Mid Secure Vault - High	Secure Vault - Mid	Secure Vault - Mid Secure Vault - High	Secure Vault - Mid
Operating Voltage	1.71V - 3.8V	1.71V - 3.8V	1.71V - 3.8V	0.8V - 1.7V 1.8V - 3.8V
Packages (mm)	4×4 QFN32	4×4 QFN32 4×4 TQFN32 5×5 QFN40	5×5 QFN40 6×6 QFN48 3.1×3.0 WLCSF	5×5 QFN40 4×4 QFN32 2.3x.2.6 CSP

Bluetooth® SoC Module Lineup



BGM210P



BGM210L



BGM220P



BGM220S



BGM240P



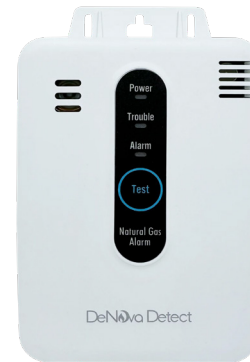
BGM240S

Protocols	5.4 and mesh 1.1 (1M, 2M, Coded PHY and AE)	5.4 and mesh 1.1 (1M, 2M, Coded PHY and AE)	5.4 and mesh 1.1 LPN (1M, 2M, Coded PHY, AE and Bluetooth direction finding)	5.4 and mesh 1.1 LPN (1M, 2M, Coded PHY, AE and Bluetooth direction finding)	5.4 and Bluetooth mesh (1M, 2M, LE Coded PHYs, AE and Bluetooth direction finding)	5.4 and Bluetooth mesh (1M, 2M, LE Coded PHYs, AE and Bluetooth direction finding)
EFR32 SoC	BG21	BG21	BG22	BG22	BG24	BG24
Antenna	Built-in or RF pin	Built-in	Built-in	Built-in or RF pin	Built-in or RF pin	Built-in or RF pin
Max TX power	+10 / +20 dBm	+12.5 dBm	+8 dBm	+6 dBm	+10 / +20 dBm	+10 dBm
Sensitivity (1M)	-97 dBm	-97 dBm	-98 dBm	-98 dBm	-98.5 dBm	-97.0 dBm
Flash (kB)	1024	1024	512	512	1536	1536
RAM (kB)	96	96	32	32	256	256
GPIO	20	12	24, 25	25	26	32
Operating Voltage	1.8V - to 3.8V	1.8V - 3.8V	1.8V - to 3.8V	1.8V - to 3.8V	1.8V - to 3.8V	1.8V - to 3.8V
Operating Temp.	-40 to +125°	-40 to +125°	-40 to +105°	-40 to +105°	-40 to +105°	-40 to +105°
Dimensions W x L x H (mm)	12.9 x 15.0 x 2.2	15.5 x 22.5 x 2.2	12.9 x 15.0 x 2.2	6 x 6 x 1.3	12.9 mm x 15.0 mm	7 mm x 7 mm x 1.18mm
Certifications	BT, CE, FCC, ISED, Japan & S-Korea	BT, CE, FCC, ISED, Japan & S-Korea	BT, CE, FCC, ISED, Japan & S-Korea	BT, CE, FCC, ISED, Japan & S-Korea	CE, UKCA, FCC, ISED, MIC, KC	FCC, ISED, CE, UKCA, MIC, KC



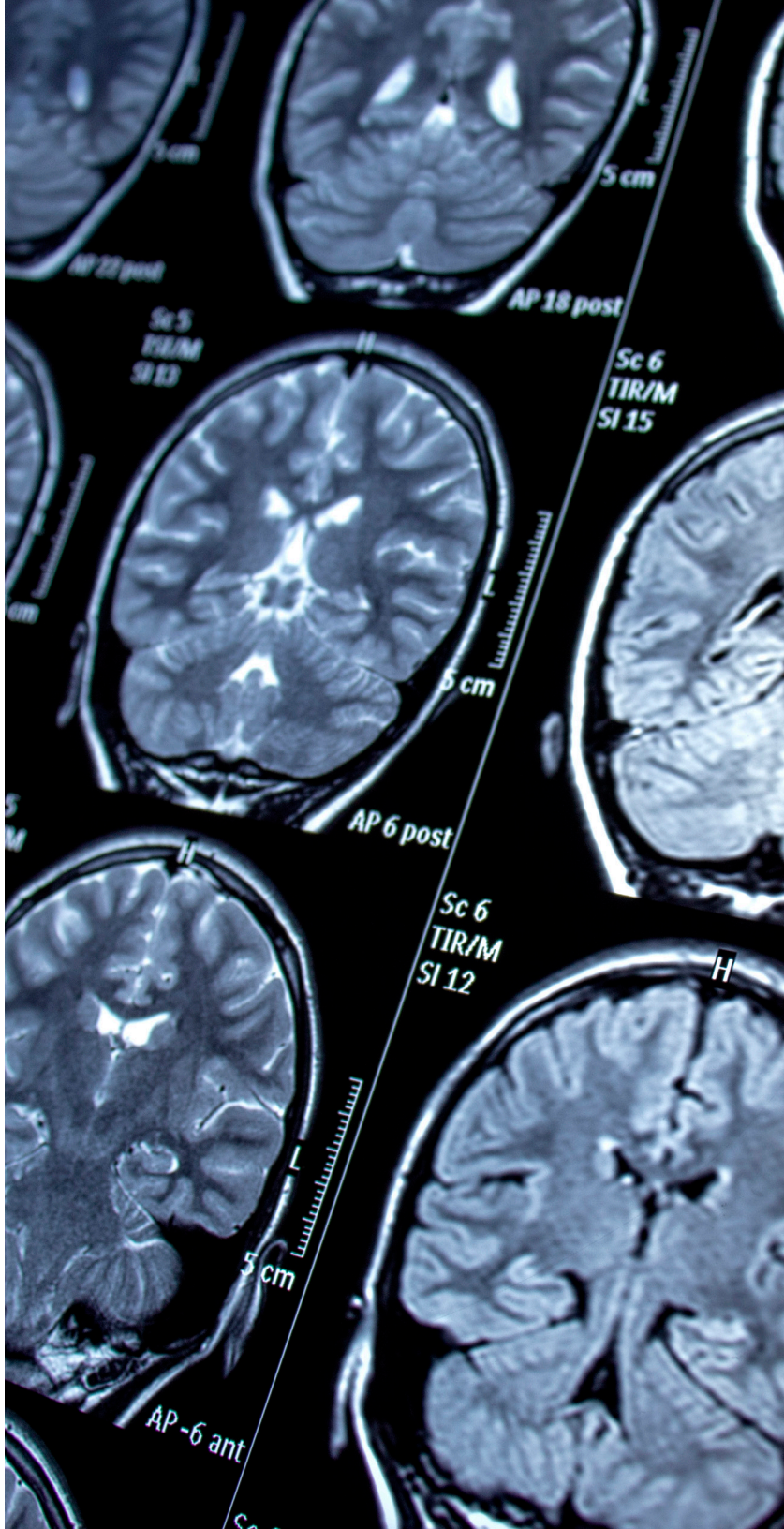
Bluetooth® Application Example

Though natural gas is considered relatively safe, aging infrastructure and outdated standards put people and residential properties at risk. According to a 2018 report from the National Fire Protection Association (NFPA), an estimated 4,200 house fires per year start with the ignition of natural gas, causing an average of 40 deaths. Working with Silicon Labs' Bluetooth BG24 SoC and [Oxit](#) developers, [New Cosmos](#) designed a safety-optimized, low-power solution that can sense gas leaks for up to 7 years without AC power.



“When safety is critical, we have to make sure the device is stable, so it’s important for us to collaborate closely with OEMs and silicon providers. There are other OEMs that provide tools and automation to reduce development time, but I don’t see them offering devices that are as stable as Silicon Labs.”

Paresh Avaiya, Lead Embedded Engineer, **Oxit**



Bluetooth® Application Example

Pediatric epileptologist, Dr. Dave Clarke, set out to provide an early warning system for caregivers of epilepsy patients, which can be incredibly difficult to identify and treat. Seizures can become life-threatening due to cardiac or respiratory complications – sometimes tragically leading to sudden unexpected death in epilepsy. This risk is particularly high for those who have frequent, unrecognized seizures. So early detection is critical. Silicon Labs' [EFR32BG22](#) was selected for this project and offers an application MCU, Bluetooth 5.2 connectivity, ultra-low power consumption, compact size, and a range of peripherals for sensor integration – all in a single device.



The Silicon Labs portfolio features several modules and SoCs for building similar medical devices.

“There are conditions like infantile spasms that need to be treated immediately or they can be devastating. If you could better define what may be a seizure or another type of movement in a safe and effective way, it would be helpful to everyone in medical management.”

Dr. Dave Clarke, **Pediatric Epileptologist**



Bluetooth® Application Example

Allegion is a manufacturer of mechanical building locks and entry systems for residential and commercial buildings. The company has been working closely with Silicon Labs as it works to address the growing opportunity for IoT-connected products. Allegion is particularly interested in the opportunity to develop a new range of products that allow delivery personal access into homes without the homeowner having to be there.

Provisioning remote access control both to open or lock a door or external gate on a limited basis, a function that can be paired up with a camera, is also targeted for use in schools. School administrators need a simple solution to achieve this without having to walk around the facility and check every lock. With time-to-market challenges paramount, Allegion worked with Silicon Labs to specify and select a pre-certified module that would significantly speed the development cycle by removing much of the compliance and certification process.






[Contact sales](#) to get product information, pricing or a quote.

“We found the Silicon Labs’ offering of both SoC and pre-certified module solutions extremely valuable to us. Decreasing time to market but maintaining the highest levels of safety and security was another reason why we selected Silicon Labs.”

Ryan Kincard, Global Hardware Architect, **Allegion**

Bluetooth® Development Kits

Our Bluetooth development kits are designed to help you get up and running as quickly as possible and are divided into three categories based on your development need. Silicon Labs offers kits for experimenting, prototyping, or developing your product.

-  Supported
-  Not Supported
-  Optional or not mounted

Explorer Kit

Our entry-level kit offers five powerful development features, including an onboard debugger, traffic analyzer, virtual COM port, mobile tester app, and connectors for MikroE and Qwiic peripheral boards. It's also fully supported by [Simplicity Studio](#), the unified development environment for all Silicon Labs technology.

Development Kit

To simplify prototyping or field trials, our development kits support both a coin cell and a connector for external batteries or power supplies. The Arm Cortex-M series-based development kits also provide a 2.4 GHz chip antenna, a board controller, J-Link debugger, packet tracing, virtual COM, and various on-board sensors.

Pro Kit

Developing production products require additional development features such as an energy profiler and a network analyzer to optimize your code and RF design. This kit also includes an LCD display, Ethernet port, 8-channel logic, and a standardized interface for all Silicon Labs radio board products.

	1.6MHz	1.6MHz	8MHz
Debug Speed	1.6MHz	1.6MHz	8MHz
Debug USB	Full Speed	Full Speed	High Speed
Packet Trace Interface (PTI)			 2x
Breakout Pads			
Pushbutton s & User LEDs			
Virtual COM			
Coin cell battery holder	—		
On-board Sensors	—		
Battery Pack Connector	—		
Radio Board Connectors	—	—	
EXP Connectors	—	—	
Display	—	—	
Debug OUT	—	—	EFM8/32, EFR32, EZR32
Debug Ethernet	—	—	100 Mbit/s
Energy Monitor (AEM)	—	—	
3 rd Party Hardware addons		—	—

About Silicon Labs

Silicon Labs is the leading provider of silicon, software, and solutions for a smarter, more connected world. Our industry-leading wireless solutions feature a high level of functional integration. Multiple complex mixed-signal functions are integrated into a single IC or system-on-chip (SoC) device, saving valued space, minimizing overall power consumption requirements, and improving customer end products' reliability. We are the trusted partner for the world-leading consumer and industrial brands and small and medium sized companies. Our customers develop solutions for wide range of applications, from medical devices to smart lighting to building automation, and much more.

