



Bluetooth® SDK 2.13.13.0 GA

Gecko SDK Suite 2.7

January 31, 2024

Silicon Labs is a leading vendor in Bluetooth hardware and software technologies, used in products such as sports and fitness, consumer electronics, beacons, and smart home applications. The core SDK is an advanced Bluetooth 5.3-compliant stack that provides all of the core functionality along with multiple API to simplify development. The core functionality offers both standalone mode allowing a developer to create and run their application directly on the SoC, or in NCP mode allowing for the use of an external host MCU.

Extensions to the SDK include Bluetooth Mesh and Apple® HomeKit® for customers seeking the additional capabilities.

These release notes cover SDK version(s):

- 2.13.13.0 released on January 31, 2023 (Selected quality improvements and bug fixes)
- 2.13.12.0 released on September 21, 2023 (Support for EFR32xG21, Revision C and later, one fixed issue)
- 2.13.11.0 released on November 2, 2022 (early access part support, one fixed issue)
- 2.13.10.0 released on August 18, 2021
- 2.13.9.0 released on March 3, 2021
- 2.13.9.alpha released on November 25, 2020
- 2.13.8.0 released on October 28, 2020
- 2.13.7.0 released on August 26, 2020
- 2.13.6.0 released on May 27, 2020
- 2.13.5.0 released on May 1, 2020
- 2.13.4.0 released on April 22, 2020
- 2.13.3.0 released on March 20, 2020
- 2.13.2.0 released on February 21, 2020
- 2.13.1.0 released on January 24, 2020
- 2.13.0.0 released on December 13, 2019



KEY FEATURES

- Adds directional priority PTA support for Wi-Fi Coex
- Updates to the Bluetooth Mobile app
- NVM3 support on EFR32[B|M]G1x devices
- New part support - EFR32[B|M]G22 and Thunderboard EFR32BG22
- Bluetooth 5.3 compliance

Compatibility and Use Notices

If you are new to the Silicon Labs Bluetooth SDK, see [Using This Release](#).

Compatible Compilers:

IAR Embedded Workbench for ARM (IAR-EWARM) version 8.30.1

- Using wine to build with the `IarBuild.exe` command line utility or IAR Embedded Workbench GUI on macOS or Linux could result in incorrect files being used due to collisions in wine's hashing algorithm for generating short file names.
- Customers on macOS or Linux are advised not to build with IAR outside of Simplicity Studio. Customers who do should carefully verify that the correct files are being used.

GCC (The GNU Compiler Collection) version 7.2.1, provided with Simplicity Studio.

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1 New Items

1.1 New Features

Added in release 2.13.10.0

Link Layer Radio Watchdog

This feature was added for recovering from a radio lockup without the need of resetting the device. The watchdog monitors the radio status, and will abort the scheduled radio operations when a radio lockup is detected.

This feature is disabled by default. To enable it, first declare the function `void sl_btctrl_enable_radio_watchdog(void)`, then call it around the Bluetooth initialization.

Added in release 2.13.6.0

Proprietary CTE solution

Silicon Labs' proprietary CTE solution for Angle of Arrival (AoA).

Added in release 2.13.4.0

Advertising channel index randomization

Randomly select advertising channel usage order.

Added in release 2.13.3.0

New Part Support

This release supports the new EFR32[B|M]G22 device family and Thunderboard EFR32BG22. Additionally, support for BRD4180B and BRD4181B radio boards is added.

Added in release 2.13.2.0

Advertiser Random Address

Applications can set an advertiser's random device address used in advertising packets.

Added in release 2.13.0.0

NVM3 support on EFR32[B|M]G1x devices

NVM3 is now supported on EFR32[B|M]G1x devices in addition to PS Store. These two data stores cannot be used simultaneously. The sample applications in the Bluetooth SDK continue to use PS Store by default. To replace PS Store with NVM3 please refer to [AN1135: Using Third Generation Non-Volatile Memory \(NVM3\) Data Storage](#).

Usage of NVM3 on EFR32[B|M]G1x devices is recommended only for new designs as there is no migration mechanism from PS to NVM3, when a new firmware is flashed via OTA or UART DFU. Doing DFU from PS to NVM3 will cause all PS data to be lost, which includes e.g., bonding information.

Sleep Timer

The sleep timer (`sl_sleeptimer.h`) is a platform component providing single-shot and periodic timer services. It also provides APIs for reading current tick count and conversions between ticks and milliseconds.

A Bluetooth application must include sleep timer component because the Bluetooth stack initializes and uses it for deep sleep. For more details, please refer to a Bluetooth SDK example such as the `soc-empty`.

1.2 New APIs

For additional documentation and command descriptions please refer to the [Bluetooth Software API Reference Manual](#).

Added in release 2.13.6.0

cmd_cte_transmitter_enable_silabs_cte
cmd_cte_transmitter_disable_silabs_cte
cmd_cte_receiver_enable_silabs_cte
cmd_cte_receiver_disable_silabs_cte
evt_cte_receiver_connectionless_iq_report
evt_cte_receiver_silabs_iq_report
evt_cte_receiver_dtm_iq_report

Added in release 2.13.4.0

cmd_gatt_server_enable_capabilities
cmd_gatt_server_disable_capabilities
cmd_gatt_server_get_enabled_capabilities

Added in release 2.13.2.0

cmd_le_gap_set_advertise_random_address
cmd_le_gap_clear_advertise_random_address

Added in release 2.13.1.0

cmd_coex_set_directional_priority_pulse

Added in release 2.13.0.0

cmd_gatt_server_get_mtu
cmd_le_connection_read_channel_map
cmd_coex_set_parameters

2 Improvements

2.1 Changed APIs

Changed in release 2.13.6.0

Renamed CTE APIs

| Old Name | New Name |
|---|---|
| cmd_cte_transmitter_enable_cte_response | cmd_cte_transmitter_enable_connection_cte |
| cmd_cte_transmitter_disable_cte_response | cmd_cte_transmitter_disable_connection_cte |
| cmd_cte_receiver_start_iq_sampling | cmd_cte_receiver_enable_connection_cte |
| cmd_cte_receiver_stop_iq_sampling | cmd_cte_receiver_disable_connection_cte |
| cmd_cte_receiver_start_connectionless_iq_sampling | cmd_cte_receiver_enable_connectionless_cte |
| cmd_cte_receiver_stop_connectionless_iq_sampling | cmd_cte_receiver_disable_connectionless_cte |
| evt_cte_receiver_iq_report | evt_cte_receiver_connection_iq_report |

Changed in release 2.13.2.0

Bluetooth Stack Initialization

A hardware error is returned if HFRCODPLL is not configured to 80 MHz and set as the system clock source on EFR32[B|M]G21x.

Changed in release 2.13.0.0

cmd_system_linklayer_configure

New configuration key system_linklayer_config_key_set_priority_table is added for changing task priorities at run time.

cmd_sm_store_bonding_configuration

The default maximum allowed bonding count is changed to 13.

3 Fixed Issues

Fixed in release 2.13.13

| ID # | Description |
|---------|---|
| 698320 | Fix a memory access issue in certain out-of-memory situations that may cause unexpected behaviors like bus faults. This item was listed as a fixed issue by mistake in 2.13.10 release. The issue actually presents in 2.13.12 and older versions. |
| 1203914 | Fix an issue in the Bluetooth link layer that caused the scanner to skip a scanning interval in case of a radio error. |

Fixed in release 2.13.12

| ID # | Description |
|---------|--|
| 1181688 | Fix an issue in the Bluetooth Link Layer that caused advertising intervals to be skipped when handling radio errors. |

Fixed in release 2.13.11

| ID # | Description |
|--------|---|
| 840102 | Fix a crash when the stack does not properly handle received data during the disconnection of a Bluetooth connection. |

Fixed in release 2.13.10

| ID # | Description |
|--------|---|
| 696220 | Fix an internal data structure initialization which may cause issues on another protocol in a dynamic multiprotocol application. |
| 698320 | Fix a memory access issue in certain out-of-memory situations that may cause unexpected behaviors like bus faults. Retrospective update: This item was listed as a fixed issue by mistake in 2.13.10 release. The issue actually presents in 2.13.12 and older versions. |

Fixed in release 2.13.9

| ID # | Description |
|--------|---|
| 646773 | Fix project generation errors on the BGM210P032JIA2. |
| 647345 | Fix the calculation of the default Bluetooth stack buffer size to ensure the size is big enough when the maximum connection configuration value is 0. |
| 659229 | The signing key for BGBuild and BGTool has been updated for macOS. |
| 663012 | Fix the SoC DTM example application on the BG22C112. |
| 671146 | Fix an issue on EFR32[B M]G2x parts where the current consumption would be higher than expected after radio activity. |

Fixed in release 2.13.9.alpha

| ID # | Description |
|--------|--|
| 617470 | Fix an issue that could cause a Bluetooth connection to drop with "unspecified error" code. |
| 628649 | Fix an issue that could cause <code>gecko_cmd_sync_open()</code> to persistently return an error code indicating wrong state if a synchronization to periodic advertising failed to synchronize. |
| 645453 | Fix an issue on EFR32BG22 where receiving after a transmit from EM2 sleep based on RAIL state transitions would result in dropped packets. |
| 648010 | Fixed an issue that causes double compensation on the TX power. |

Fixed in release 2.13.8.0

| ID # | Description |
|--------|--|
| 485550 | Fix an issue in Bluetooth stack that may cause advertising to fail to restart after autonomously disconnecting an unbonded connection that was established from the advertiser. This use case is valid only when the stack is set to accept bonded connections only. |
| 580317 | Support DTM test setup commands 0x05 - 0x09 of the Bluetooth specification v5.2 in soc-dtm application. |

| ID # | Description |
|--------|---|
| 628933 | Fail the pairing if received random and confirmation values match to the ones sent by this device in the pairing process. This change is a security enhancement. |
| 630357 | When privacy mode has been enabled and advertisers' addresses are managed by the Bluetooth stack, update the advertiser-resolvable random address each time advertising is started. This change is a privacy enhancement. |
| 633251 | Fix an issue with ATT_FIND_BY_TYPE_VALUE_REQ in GATT Server if the service being searched is empty. |
| 636280 | Set DCDC to bypass mode in OTA mode with Aploader on EFR32[B M]G22. |
| 638420 | The stack returns the invalid_parameter error if bonding handle value 0xff (-1) is given to sl_bt_sm_delete_bonding(). Additionally, trying to delete non-existing bonding now returns the no_bonding error. |

Fixed in release 2.13.7.0

| ID # | Description |
|--------|---|
| 494793 | Fix transmit power when operating with EFR32[B M]G21 Medium Power PA. |
| 495892 | Fix an issue which causes stack to hang if there is an empty service in the GATT database. |
| 521854 | Fix a rare case where device would send advertisements on a wrong PHY. |
| 622747 | Bluetooth stack now returns connection-limit-exceeded error code when application starts a connectable advertising while maximum number of connections has already reached. Memory-capacity-exceeded error was returned prior this fix. |

Fixed in release 2.13.6.0

| ID # | Description |
|--------|---|
| 480185 | Added configuration option for setting RF path antenna selection for OTA mode. This option is only applicable to EFR32[B M]G21. |
| 481530 | Fix populating the whitelist in Bluetooth security manager after device reset. |
| 484822 | Fix "SOC - Range Test RAIL-DMP BLE and IEEE802.15.4" application being stuck at start-up screen. |
| 485074 | The soc-empty project targeted at EFR32[B M]G22 parts now correctly initializes DC-DC. |

Fixed in release 2.13.4.0

| ID # | Description |
|--------|--|
| 467342 | Fix OTA DFU update on BGM210P032. |
| 469935 | <p>Fix the issue that the thermometer RTOS example does not enter to deep sleep. The root cause is that the application's idle hook uses OSIdleEnterHook(void), which is not called by the kernel if HW interrupt wakes up the device and no tasks are triggered by the interrupt. The fix is to use OSIdleContextHook(void). In this function, use a loop to set the stack to sleep, e.g.,</p> <pre> void SleepAndSyncProtimer(); void OSIdleContextHook(void) { while (1) { /* Put MCU in the lowest sleep mode available, usually EM2 */ SleepAndSyncProtimer(); } } </pre> <p>See thermometer RTOS example from the Bluetooth SDK.</p> |
| 472920 | Improve extended advertising packet reception during connections with very short intervals. |
| 475785 | Fix an issue in Bluetooth RTOS adaptation that may cause incorrect conversion from sleeptimer frequency to OS frequency. |
| 477676 | Improve the performance of Bluetooth connections using very short intervals on EFR32[B M]G22. |

Fixed in release 2.13.3.0

| ID # | Description |
|--------|--|
| 457174 | Bluetooth applications are able to use RTCC on EFR32[B M]G13 and EFR32[B M]G21 again. To use RTCC, configure sleep timer to use PRORTC (#define SL_SLEEPTIMER_PERIPHERAL SL_SLEEPTIMER_PERIPHERAL_PRORTC). |
| 466477 | Improve scanning robustness. |
| 463724 | Network Analyzer now correctly decodes a connection request packet opened on the LE Coded PHY. |
| 464918 | Fix a performance issue which may cause advertising to fail if the application is compiled without optimization (-O0). |
| 467371 | Fix an issue that may cause the stack to use an invalid Bluetooth device address stored in PS key after the application is migrated from an old version of the SDK. This fix checks if an address is stored in PS, and removes the PS key if the address is invalid. |
| 467479 | Prevent from erasing the next flash page after storage slot in OTA if the upgrade firmware is too big to fit storage slot. |
| 468416 | Function gecko_sleep_for_ms() now returns the sleep time in milliseconds. Previously a tick count value is returned. |

Fixed in release 2.13.2.0

| ID # | Description |
|--------|--|
| 431452 | TX power is now set to correct values correlating to the requests. Previously, when the requested TX Power was above 0 dBm, the actual transmit power may have deviated randomly. |
| 444469 | Fix an issue that may cause the application to be unable to disconnect a Bluetooth connection when writing large amounts of data to characteristic values using the write-without-response command. |
| 446074 | Fixed an issue that causes the stack to be unable to establish new connections after multiple connection drops. |
| 453828 | Fix an issue that causes the application to be unable to confirm a characteristic indication in a low memory situation when writing large amounts of data to characteristic values using the write-without-response command. |
| 454960 | Fix the tick rate RTOS_TICK_HZ in rtos_bluetooth.c to the correct value (1000). |
| 458216 | Fix an issue in gecko_sleep_for_ms() which limits the sleep time to no more than 131 seconds. |
| 461654 | BGAPI soft timers now work correctly regardless of the value SL_SLEEPTIMER_FREQ_DIVIDER is configured to in sleep timer. |

Fixed in release 2.13.1.0

| ID # | Description |
|--------|--|
| 448020 | In system_set_tx_power command, the stack now sets and returns the nearest possible value if the requested value is out of range. |
| 450903 | Fix the issue when application compiles mbedTLS into source that uses AES with padding, mbedTLS context objects in Bluetooth stack may be corrupted and cause hard faults. |
| 450922 | Use of GPCRC in Bluetooth stack is now thread safe. |
| 452831 | Fix an issue in Apploader that causes application OTA update to fail if the data length in the first data packet is not multiple of four. |
| 455666 | Fix a compatibility issue in Apploader with bootloader v1.10 on EFR32[B M]G21. This issue causes OTA update to fail and the device to stay in OTA mode indefinitely. |

Fixed in release 2.13.0.0

| ID # | Description |
|--------|---|
| 234520 | In cmd_gatt_read_characteristic_value_by_uuid command, if multiple characteristic values are received, an evt_gatt_characteristic_value event is generated for each value. Previously only one event is generated for this case. |
| 281984 | First advertisement packet is now sent with the right timing in dynamic multi-protocol use cases. |
| 335894 | Documentation fix to the lolen field in a BGAPI command header binary. The field specifies the minimal number of bytes the parameters take. It does not include the array data length if the command has an array type parameter. |
| 347844 | Event evt_user_message_to_host can now be sent during user command handling in NCP target application. |
| 358171 | Fix a random advertising hang issue which was observed when the application optimization build option was disabled or the device was exposed to low temperature. |
| 408097 | Extended advertising now works in dynamic multi-protocol use cases. |

| ID # | Description |
|--------|---|
| 415583 | The stack now returns out of memory error if the application sends a characteristic notification to all connections in low memory situation. Previously wrong state error was returned. |
| 420866 | Improves robustness when streaming large data packets to and from a device which does not support data length extension. |
| 421731 | When sending a characteristic value notification to all connections using <code>cmd_gatt_server_send_characteristic_notification</code> command, the stack now returns success if devices are connected but none has enabled the notification. Previously wrong state error was returned. |
| 425187 | SL_BT_ prefix is added into the include guard in <code>bg_version.h</code> . |
| 425532 | Fix whitelisting when an extended advertising packet does not contain an auxiliary pointer. |
| 430225 | Fix CTUNE control using PS key on EFR32[B M]G2x devices. |
| 430752 | Fix an issue that the stack may lose a periodic advertising synchronization because the scanner uses highest priority for secondary tasks. This was solved by lowering the priority. |
| 434406 | Remove the use of variable length array in the stack. |
| 436243 | Fix a HW initialization issue in the soc-dtm example that causes incorrect timeout for incoming data. |
| 441445 | Fix an advertisement data update race condition which causes no advertisement is sent out. |
| 445627 | Repeated bonding attempts handling is now connection specific. After first failed attempt there is cool down period of 1 s. After second attempt this is doubled to 2 s then to 4 s etc. The maximum wait time is 64 s. |
| 450515 | Fix an issue that causes BGTool does not run on Linux. |

4 Known Issues in the Current Release

Issues in bold were added since the previous release.

| ID # | Description | Workaround |
|--------|---|--|
| 243009 | With certain events, GCC breakpoints cannot be set. | Change optimization level to none in project settings |
| 337467 | MGM12P has poor signal strength when doing OTA with Uploader. | None |
| 360313 | Default RAIL assertion (RAILCb_AssertFailed) enters an infinite loop causing the stack not responsive. | Override RAIL assertion function in application space following these instructions . |
| 361592 | The sync_data event does not report TX power. | None |
| 368798 | Example soc-thunderboard_sense_2 does not print float values correctly in GCC project. | In project C/C++ settings, enable the printf float option. |
| 396308 | In NCP, BGAPI may be out of sync between the host and target when the target is reset in the middle of sending a BGAPI message to host. The out of sync issue could cause the host unable to communicate with the target. | In NCP target, add a delay to flush NCP Tx queue after a system reset command is received. |
| 456701 | Before gecko_init() is called, enabling busfaults generation on access to peripherals with clocks disabled causes a crash. | Enable busfaults generation after gecko_init(). |
| 470424 | Connection drop may happen in rare cases if multiple simultaneous connections use the same connection interval. | Try to use different connection intervals in different connections to improve the robustness. |

5 Deprecated Items

Deprecated in release 2.13.6.0

Important Notice

Starting with the next major GSDK release, the Bluetooth SDK version will be incremented to version 3.x, which is not backwards compatible with version 2.x. This means that an application written with the v2.x SDK will not work without modifications with the new v3.x SDK.

NOTE: Customers who cannot immediately move to Bluetooth SDK v3.0 are reminded that 'maintenance' support for Bluetooth SDK v2.x will be provided in accordance to the "Software Longevity Commitment" statement found at <https://www.silabs.com/products/software/longevity-commitment>.

As part of Bluetooth SDK v3.x, the Bluetooth stack API will be modified. The changes will streamline functionality across a smaller set of APIs, which will further enhance usability, improve development experience, and simplify application development. These modifications also align with API conventions across other Silicon Labs software components, including not only wireless stacks but also lower level platform components such as RAIL, emlib, and emdrv.

While many of the new API commands/events have familiar naming to ensure a smooth migration, the structure and overall interface will have slight changes:

- commands/events will be prefixed with `sl_bt` instead of `gecko_cmd`.

Example: `gecko_cmd_gatt_server_read_attribute_value` becomes `sl_bt_gatt_server_read_attribute_value`

- Command functions return only a status code, as opposed to a data structure containing data.

Example:

SDK 2.x Function

```
struct gecko_msg_gatt_server_read_attribute_value_rsp_t *gecko_cmd_gatt_server_read_attribute_value(uint16
attribute, uint16 offset);
```

```
/* Response structure */
struct gecko_msg_gatt_server_read_attribute_value_rsp_t
{
    uint16 result,
    uint8array value
}
```

SDK 3.x Function

```
sl_status sl_bt_gatt_server_read_attribute_value(uint16 attribute, uint16 offset, size_t max_value_size,
size_t *value_len, void *value);
```

- The new API uses unified `SL_STATUS` error codes that consists of common codes for platform and technology stacks as well as codes assigned in dedicated code spaces for a specific technology. Existing error codes are mapped to corresponding `sl_status` values, so no change is required if the existing application is using the error code enums currently defined in `bg_errorcodes.h`.

A full and comprehensive migration guide is available that explains all the details related to migration of applications into Silicon Labs Bluetooth SDK v3.0. See <https://www.silabs.com/documents/public/application-notes/an1255-transitioning-from-bluetooth-sdk-v2-to-v3.pdf>.

Deprecated in release 2.13.4.0

Thunderboard Sense (SLTB001) and Thunderboard React (RD-0057-0201)

Support for Thunderboard Sense (SLTB001) and Thunderboard React (RD-0057-0201) is now deprecated and will be removed in the next major SDK release.

6 Removed Items

None

7 Using This Release

This release contains the following

- Silicon Labs Bluetooth stack library
- Bluetooth sample applications

This SDK depends on Gecko Platform. The Gecko Platform code provides functionality that supports protocol plugins and APIs in the form of drivers and other lower layer features that interact directly with Silicon Labs chips and modules. Gecko Platform components include EMLIB, EMDRV, RAIL Library, NVM3, and mbedTLS. Gecko Platform release notes are available through Simplicity Studio's Launcher Perspective, under this SDK's **Release Notes** doc header.

For more information about the Bluetooth SDK see [QSG139: Getting Started with Bluetooth® Software Development](#). If you are new to Bluetooth see [UG103.14: Bluetooth LE Fundamentals](#).

7.1 Installation and Use

A registered account at Silicon Labs is required in order to download the Silicon Labs Bluetooth SDK. You can register at https://siliconlabs.force.com/apex/SL_CommunitiesSelfReg?form=short.

Stack installation instructions are covered in [QSG139: Getting Started with Bluetooth® Software Development](#).

Use the Bluetooth SDK with the Silicon Labs Simplicity Studio V4 development platform. Simplicity Studio ensures that most software and tool compatibilities are managed correctly. Install software and board firmware updates promptly when you are notified.

Documentation specific to the SDK version is installed with the SDK. Additional information can often be found in the [knowledge base articles \(KBAs\)](#). API references and other information about this and earlier releases is available on <https://docs.silabs.com/>.

7.2 Support

Development Kit customers are eligible for training and technical support. You can use the [Silicon Labs Bluetooth LE web page](#) to obtain information about all Silicon Labs Bluetooth products and services, and to sign up for product support.

You can contact Silicon Laboratories support at <http://www.silabs.com/support>.

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