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.

These release notes cover SDK version(s):

5.1.0.0 GA released February 1, 2023
5.0.0.0 GA released December 14, 2022

Compatibility and Use Notices

For information about security updates and notices, see the Security chapter of the Gecko Platform Release notes installed with this SDK or on the TECH DOCS tab on https://www.silabs.com/developers/bluetooth-low-energy. Silicon Labs also strongly recommends that you subscribe to Security Advisories for up-to-date information. For instructions as well as notes on using Secure Vault features, or if you are new to the Silicon Labs Bluetooth SDK, see Using This Release.

Compatible Compilers:

IAR Embedded Workbench for ARM (IAR-EWARM) version 9.20.4.

- 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 10.3-2021.10, provided with Simplicity Studio.
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1 New Items

1.1 New Features

Added in release 5.1.0.0

Bluetooth AppLoader OTA DFU Configurations

The Bluetooth AppLoader OTA DFU software component has configuration options now. When a custom device address is used, by default the address is read from the MFG_CUSTOM_EUI_64 token in the User Data page. This default behavior can be overridden by implementing the bootloader_apploader_get_custom_device_address() function.

Added in release 5.0.0.0

External bonding database

The external bonding database is provided in this release as an optional feature component. When the feature is used, the application stores the persistent data of Bluetooth bondings. The Bluetooth stack sends BGAPI events to the application to store bonding data and to request the application to pass bonding data when needed.

Three-Wire UART transport layer support

Three-Wire UART transport layer support for HCI is available in this release.

Per-PHY Power Limit Configuration

A new per-PHY power limit configuration is available for specifying the maximum output power when TX power is limited by power spectral density.

New AFH configuration for enabling high power

New SL_BT_CONFIG_AFH_ENABLE_HIGH_POWER configuration option is added to the bluetooth_feature_afh component. Customers who want the device to behave as FHS, that is to use high power, in regions where AFH is not mandatory can enable this option only, and disable the SL_BT_CONFIG_AFH_ENABLE_AT_BOOT configuration.

New configurations in Bluetooth Controller

The Bluetooth Controller component has two new configurations:

- SL_BT_CONTROLLER_COMPLETED_PACKETS_THRESHOLD for defining the number of transmitted air interface ACL packets to trigger the Number Of Completed Packets HCI event
- SL_BT_CONTROLLER_COMPLETED_PACKETS_EVENTS_TIMEOUT for defining the maximum number of connection events since the previous Number Of Completed Packets HCI event to trigger reporting of any unreported completed ACL packets.

Read Version over HCI

UC component bt_hci_version is added for HCI vendor specific read version command.

MQTT mock component

MQTT mock component is available for the bt_aoa_host_locator example application for testing purposes.

AoD receiver NCP example

The AoD receiver NCP example is available for Simplicity Studio Direction Finding tools.

Object Transfer Service

The Object Transfer Service (OTS) is available for applications to use the object transfer feature.

CTE transmitter SoC example

The CTE transmitter SoC example for Angle of Departure (AoD)
New Applications for TrustZone-compatible devices

bt_soc_csr_generator and bt_soc_cbap applications are now available for all TrustZone-compatible devices.

1.2 New APIs

Added in release 5.0.0.0

**sl bt_gap_set_identity_address command**: Set the Bluetooth identity address for central and peripheral roles.

**sl bt_external_bondingdb_set_data command**: Pass bonding data of a connection from the external bonding database to the stack.

**sl bt_evt_external_bondingdb_data_request event**: The Bluetooth stack requests the bonding data of a connection from the external bonding database.

**sl bt_evt_external_bondingdb_data event**: Indicates that updated bonding data of a connection is available.

**sl bt_evt_external_bondingdb_data_ready event**: The stack has received all the necessary bonding data from the application.

**sl bt_evt_system_resource_exhausted event**: Indicates the system is running out of resources during the use of the Bluetooth stack.

**New flag in sl bt_system_linklayer_configure command**: A new configuration flag is added for enabling reporting all SCA_RSP packets even if those are not the responses to the scan request initiated by the local device.

**New version constants in header sl bt_version.h**: `SL_BT_VERSION_MAJOR`, `SL_BT_VERSION_MINOR`, `SL_BT_VERSION_PATCH`, `SL_BT_VERSION_BUILD`, and `SL_BT_VERSION_HASH`

**VS_SiliconLabs_Set_Max_Low_Tx_Power (0xfc1b)**: New vendor-specific HCI command for the per-PHY power limit configuration feature.
2 Improvements

2.1 Changed Items

**Changed in release 5.0.0.0**

Stack behavioral change in case of external bonding database

Following functionality or API behavioral changes when the external bonding database feature is used:

- `sl_bt_store_bonding_configuration` command must be called to define the list size before adding devices to the accept list.
- The `sl_bt_get_bonding_handles`, `sl_bt_get_bonding_details`, and `find_bonding_by_address` commands are unavailable.

Bluetooth RTOS adaptation

The Bluetooth RTOS adaptation (bluetooth_rtos_adaptation) kernel object uses dynamic memory allocation for improving adaptability, beginning with this release. The heap usage in applications using this component is increased by roughly 4900 bytes as a result of this change.

Bluetooth API for NCP host

The host-side NCP Bluetooth API in `sl_bt_ncp_host.c` now accepts NULL pointers to output parameters. If an application does not need an output value that is merely informational, the application can pass a NULL pointer to that output parameter and avoid allocating storage for the output.

**bootloader-apploader**

The `bootloader-apploader` component can be used for both `bt_soc_csr_generator` and `bt_soc_cbap`. Previously, the `bootloader_bgapi_uart_bootloader` was used with `bt_soc_csr_generator`.

**bt_soc_throughput_display example app**

The `bt_soc_throughput_display` example app is no longer supported on BRD4169x boards.

2.2 Changed APIs

None
## 3 Fixed Issues

### Fixed in release 5.1.0.0

<table>
<thead>
<tr>
<th>ID #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1036645</td>
<td>Fix an issue in BLE CPC NCP that prevents a client application from reconnecting after the first disconnection.</td>
</tr>
<tr>
<td>1084216</td>
<td>Fix an issue in the HCI Three-wire UART that causes a deadlock when the acknowledge timeout of the controller is greater than the resending timeout of the host.</td>
</tr>
</tbody>
</table>

### Fixed in release 5.0.0.0

<table>
<thead>
<tr>
<th>ID #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1019590</td>
<td>Fix an issue that the sl_bt_system_get_counters() function will always return 0 for GRANT denied counts when using the rail_util_coex component with Bluetooth.</td>
</tr>
<tr>
<td>1020072</td>
<td>Fix the issue where the coex REQUEST is held asserted for a longer duration than normal when a connection event pre-empts a lower-priority passive scan event that is at or near completion.</td>
</tr>
<tr>
<td>1039172</td>
<td>Fix multiple HCI packet handling in CPC-HCI bridge that causes a GATT discovery failure.</td>
</tr>
<tr>
<td>1039636</td>
<td>Fix an issue in the Bluetooth controller that overrides the low-power amplifier configuration to the high-power amplifier if the application selects the low-power amplifier. This issue causes an increase in transmission current. The fix is available since the Bluetooth SDK 4.2.0.0.</td>
</tr>
<tr>
<td>1040323</td>
<td>The mandatory ADI field has been added to the AUX_ADV_IND PDUs.</td>
</tr>
<tr>
<td>1042501</td>
<td>Fix an issue in AppLoader causing using static random address in Series-2 devices to fail.</td>
</tr>
<tr>
<td>1043031</td>
<td>Fix an issue with RAIL’s PA auto mode that would result in selecting an unsupported RAIL_TxPowerMode_t on chip OPNs that are missing the higher power PAs.</td>
</tr>
<tr>
<td>1057377</td>
<td>Fix an issue that the Apploader hits an assertion causing the OTA DFU to be unable to proceed on [M</td>
</tr>
<tr>
<td>1057775</td>
<td>Add BGM240P/BGM240S support in Bluetooth sample applications.</td>
</tr>
<tr>
<td>1058017</td>
<td>Fix for the bt_aoa_host_locator example to use less CPU on the host side.</td>
</tr>
<tr>
<td>1060118</td>
<td>Fix an issue that causes efr32[M</td>
</tr>
<tr>
<td>1063497</td>
<td>Fix an issue in the bt_ncp_host that it is unable to send data to the device. This issue was introduced in Bluetooth SDK 4.2.0.</td>
</tr>
<tr>
<td>1067967</td>
<td>Fix an issue that causes sl_bt_evt_sync_opened and sl_bt_evt_sync_transfer_received events to report a wrong adv_phy value if the periodic advertising train uses the coded PHY.</td>
</tr>
<tr>
<td>1068798</td>
<td>Fix an issue that causes sl_bt_connection_get_tx_power() and sl_bt_connection_get_remote_tx_power() to return an error when they are called with phy value sl bt_gap_phy_coding_500k_coded.</td>
</tr>
<tr>
<td>1069081</td>
<td>Fix the vendor specific deinit command not working properly when called over HCI.</td>
</tr>
<tr>
<td>1069305</td>
<td>The stack now adds the device name to scan response data packet as needed when handling the command sl_bt_legacyAdvertiser_generate_data() for generating advertising data for legacy advertising PDUs.</td>
</tr>
<tr>
<td>1069609</td>
<td>Fix an issue that makes it impossible to set scan parameters via command sl_bt_cmdScanner_setParameters() when the component bluetooth_feature_scanner is used, but neither the bluetooth_feature_legacy_scanner nor bluetooth_feature_extended_scanner is.</td>
</tr>
<tr>
<td>1078436</td>
<td>Fix the issue in Bluetooth SDK versions 4.0.0, 4.1.0, 4.2.0, and 4.2.1, where devices previously bonded with using Bluetooth SDK versions 3.3.2 or earlier appear to be not bonded.</td>
</tr>
</tbody>
</table>
## Known Issues in the Current Release

Issues in bold were added since the previous release. If you have missed a release, recent release notes are available on [https://www.silabs.com/developers/bluetooth-low-energy](https://www.silabs.com/developers/bluetooth-low-energy) in the Tech Docs tab.

<table>
<thead>
<tr>
<th>ID #</th>
<th>Description</th>
<th>Workaround</th>
</tr>
</thead>
<tbody>
<tr>
<td>361592</td>
<td>The sync_data event does not report TX power.</td>
<td>None</td>
</tr>
<tr>
<td>368403</td>
<td>If setting CTE interval to 1, a CTE request should be sent in every connection interval. But it is sent only in every second connection interval.</td>
<td>None</td>
</tr>
<tr>
<td>641122</td>
<td>The Bluetooth stack component does not provide a configuration for RF antenna path.</td>
<td>This is an issue specifically for BGM210P. One workaround is to manually update the configuration in sl_bluetooth_config.h in text edit mode. If the OTA with Apploader is used, include the bluetooth_feature OTA config component in application project. Command sl_bt_ota_set_rf_path() to set the RF path for OTA mode.</td>
</tr>
<tr>
<td>650079</td>
<td>LE 2M PHY on EFR32[B</td>
<td>M]G12 and EFR32[B</td>
</tr>
<tr>
<td>682198</td>
<td>The Bluetooth stack has an interoperability issue on the 2M PHY with a Windows PC.</td>
<td>No workaround exists. For application development and testing, the disconnection can be avoided by disabling 2M PHY with sl_bt_connection_set_preferred_phy() or sl_bt_connection_set_default_preferred_phy().</td>
</tr>
<tr>
<td>730692</td>
<td>4-7% packet error rate is observed on EFR32M</td>
<td>BG13 devices when RSSI is between -25 and -10 dBm. The PER is nominal (as per the datasheet) both above and below this range.</td>
</tr>
<tr>
<td>756253</td>
<td>The RSSI value on a Bluetooth connection returned by the Bluetooth API is incorrect on EFR32M</td>
<td>B1, EFR32M</td>
</tr>
<tr>
<td>845506</td>
<td>When the Bluetooth_feature_afh component for AFH is included, the feature initialization always enables AFH.</td>
<td>To include the component but not to enable AFH at device boot, change the parameter value from 1 to 0 in the function call of sl_btctrl_init_afh() in sl_bt_stack_init.c.</td>
</tr>
<tr>
<td>1031031</td>
<td>Changing the configuration in the bt_aoa_host_locator application results in crash in the application.</td>
<td>None</td>
</tr>
</tbody>
</table>
5 Deprecated Items

Deprecated in release 5.0.0.0

sl_bt_scanner_set_mode

sl_bt_scanner_set_timing

Deprecated version constants in sl_bt_version.h

- BG_VERSION_MAJOR, replaced by SL_BT_VERSION_MAJOR
- BG_VERSION_MINOR, replaced by SL_BT_VERSION_MINOR
- BG_VERSION_PATCH, replaced by SL_BT_VERSION_PATCH
- BG_VERSION_BUILD, replaced by SL_BT_VERSION_BUILD
- BG_VERSION_HASH, replaced by SL_BT_VERSION_HASH
6 Removed Items

Removed from release 5.0.0.0

BGAPI command sl_bt_dfu_reset
## 7 Multiprotocol Gateway and RCP

### 7.1 New Items

**Added in release 5.1.0.0**

Zigbee now supports coex EZSP commands.

**Added in release 5.0.0.0**

Added Dynamic Multiprotocol BLE and Zigbee NCP project (zigbee_ncp-ble_ncp-xxx.slcp). Released as experimental quality.

Added 802.15.4 concurrent listening for EFR32MG24 CMP RCP. This is the ability to run Zigbee and OpenThread simultaneously on different channels using a single RCP (rcp-802154-xxx.slcp and rcp-802154-blehci-xxx.slcp). Released as experimental quality.

Added Zigbee support for 32-bit x86 architecture.

Added support for BLE to de-init in multiprotocol use cases, freeing up memory resources for use by other protocol stacks.

The Stack API Trace now can be enabled for Zigbee by setting the debug-level to 4 or 5 in the zigbeed.conf file.

Zigbee stack version as well as build date and time are now printed in the logs.

### 7.2 Improvements

None

### 7.3 Fixed Issues

#### Fixed in release 5.1.0.0

<table>
<thead>
<tr>
<th>ID #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1036645</td>
<td>Solved a bug in BLE CPC NCP which prevented a client app from reconnecting after the first disconnection.</td>
</tr>
<tr>
<td>1068435</td>
<td>Fixed Green Power bidirectional commissioning timing issue. Certification test case GPP 5.4.1.23 passes.</td>
</tr>
<tr>
<td>1074593</td>
<td>Fixed issue in which Just-in-time (JIT) messages to sleepy end devices were not sent correctly by Zigbee + RCP.</td>
</tr>
<tr>
<td>1076235</td>
<td>Fixed issue where ot-cli failed to run in the multiprotocol docker container.</td>
</tr>
<tr>
<td>1080517</td>
<td>Z3GatewayCPC now automatically handles a reset of the NCP (CPC secondary).</td>
</tr>
<tr>
<td>1085498</td>
<td>Fixed an issue where Zigbee was not sending rejoin responses to sleepy end devices indirectly.</td>
</tr>
<tr>
<td>1090915</td>
<td>Fixed issue where multiple 0x38 errors appeared when attempting to either open a Zigbee endpoint on the Z3GatewayCPC OR to set EZSP parameters without resetting the CPC NCP.</td>
</tr>
</tbody>
</table>

#### Fixed in release 5.0.0.0

<table>
<thead>
<tr>
<th>ID #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>828785</td>
<td>Fixed a bug in cpc-hci-bridge that caused an HCI packet to be dropped if BlueZ sent two at once.</td>
</tr>
<tr>
<td>834191</td>
<td>Improved the CPU utilization of the cpc-hci-bridge helper application.</td>
</tr>
<tr>
<td>1025713</td>
<td>Increased max length of Zigbee device path to 4096.</td>
</tr>
<tr>
<td>1036622</td>
<td>Fixed a problem using cmake to build ot-cli using the multi-PAN RCP.</td>
</tr>
<tr>
<td>1040127</td>
<td>CPC security was failing to initialize for the rcp_uart-802154 and rcp_spi-802154 projects on MG13 and MG14 series parts. To work around this issue, mbedtls_entropy_adc has been added as entropy source for these parts. That might prevent the ADC from being used in combination with CPC security.</td>
</tr>
<tr>
<td>1066422</td>
<td>Fixed an intermittent buffer leak in Zigbee.</td>
</tr>
<tr>
<td>1068429</td>
<td>Fixed a race condition that could cause the CMP RCP to assert.</td>
</tr>
</tbody>
</table>
### 7.4 Known Issues in the Current Release

Issues in bold were added since the previous release. If you have missed a release, recent release notes are available on [https://www.silabs.com/developers/gecko-software-development-kit](https://www.silabs.com/developers/gecko-software-development-kit).

<table>
<thead>
<tr>
<th>ID #</th>
<th>Description</th>
<th>Workaround</th>
</tr>
</thead>
<tbody>
<tr>
<td>811732</td>
<td>Custom token support is not available when using Zigbee.</td>
<td>Support is planned in a future release.</td>
</tr>
<tr>
<td>937562</td>
<td>Bluetoothctl <code>advertise on</code> command fails with rcp-uart-802154-blehci app on Raspberry Pi OS 11.</td>
<td>Use btmgmt app instead of bluetoothctl.</td>
</tr>
<tr>
<td>1031607</td>
<td>The rcp-uart-802154.slp project is running low on RAM on an MG1 part. Adding components may reduce the heap size below what is needed to support ECDH binding in CPC.</td>
<td>A workaround is to disable CPC security via the SL_CPC_SECURITY_ENABLED configuration.</td>
</tr>
<tr>
<td>1069362</td>
<td>The DMP NCP (Zigbee + BLE NCP) does not fit in RAM on the MG13 series parts.</td>
<td>This will be addressed in a future release.</td>
</tr>
<tr>
<td>1074205</td>
<td>The CMP RCP does not support two networks on the same PAN id.</td>
<td>Use different PAN ids for each network. Support is planned in a future release.</td>
</tr>
</tbody>
</table>

### 7.5 Deprecated Items

None

### 7.6 Removed Items

None
8 Using This Release

This release contains the following

- Silicon Labs Bluetooth stack library
- Bluetooth sample applications

For more information about the Bluetooth SDK see QSG169: Bluetooth® SDK v3.x Quick Start Guide. If you are new to Bluetooth see UG103.14: Bluetooth LE Fundamentals.

8.1 Installation and Use

The Bluetooth SDK is provided as part of the Gecko SDK (GSDK), the suite of Silicon Labs SDKs. To quickly get started with the GSDK, install Simplicity Studio 5, which will set up your development environment and walk you through GSDK installation. Simplicity Studio 5 includes everything needed for IoT product development with Silicon Labs devices, including a resource and project launcher, software configuration tools, full IDE with GNU toolchain, and analysis tools. Installation instructions are provided in the online Simplicity Studio 5 User's Guide.

Alternatively, Gecko SDK may be installed manually by downloading or cloning the latest from GitHub. See https://github.com/SiliconLabs/gecko_sdk for more information.

Simplicity Studio installs the GSDK by default in:

- (Windows): C:\Users\<NAME>\SimplicityStudio\SDKs\gecko_sdk
- (MacOS): /Users/<NAME>/SimplicityStudio/SDKs/gecko_sdk

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/.

8.2 Security Information

Secure Vault Integration

When deployed to Secure Vault High devices, sensitive keys such as the Long Term Key (LTK) are protected using the Secure Vault Key Management functionality. The table below shows the protected keys and their storage protection characteristics.

<table>
<thead>
<tr>
<th>Wrapped Key</th>
<th>Exportable / Non-Exportable</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Long Term Key (LTK)</td>
<td>Non-Exportable</td>
<td></td>
</tr>
<tr>
<td>Local Long Term Key (legacy only)</td>
<td>Non-Exportable</td>
<td></td>
</tr>
<tr>
<td>Remote Identity Resolving Key (IRK)</td>
<td>Exportable</td>
<td>Must be Exportable for future compatibility reasons</td>
</tr>
<tr>
<td>Local Identity Resolving Key</td>
<td>Exportable</td>
<td>Must be Exportable because the key is shared with other devices.</td>
</tr>
</tbody>
</table>

Wrapped keys that are marked as “Non-Exportable” can be used but cannot be viewed or shared at runtime.

Wrapped keys that are marked as “Exportable” can be used or shared at runtime but remain encrypted while stored in flash.

For more information on Secure Vault Key Management functionality, see AN1271: Secure Key Storage.
Security Advisories

To subscribe to Security Advisories, log in to the Silicon Labs customer portal, then select Account Home. Click HOME to go to the portal home page and then click the Manage Notifications tile. Make sure that 'Software/Security Advisory Notices & Product Change Notices (PCNs)' is checked, and that you are subscribed at minimum for your platform and protocol. Click Save to save any changes.

8.3 Support

Development Kit customers are eligible for training and technical support. 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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