



Bluetooth[®] LE SDK 6.3.0.0 GA

Gecko SDK Suite 4.3

March 13, 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 5.4-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):

- 6.3.0.0 GA released March 13, 2024
- 6.2.0.0 GA released October 9, 2023
- 6.1.0.0 GA released July 26, 2023
- 6.0.0.0 GA released June 7, 2023



KEY FEATURES

Bluetooth

- Bluetooth 5.4 support including Periodic Advertisements with Responses (PAwR) and Encrypted Advertisement Data (EAD) features
- Electronic Shelf Label (ESL) Service / Profile support - both Tag and Access Point (AP) roles
- Object Transfer Service / Profile support
- Periodic Advertisement Sync Transfer (PAST) support
- LE Privacy 1.2

Multiprotocol

- Zigbee/OpenThread Concurrent Multiprotocol SoC sample app
- CPC GPIO expander module
- Zigbeed enhancements

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 larBuild.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 6.2.0.0

Bluetooth Connection Statistics

New feature component `bluetooth_feature_connection_statistics` provides the functionality to collect connection-specific statistics and report them to applications upon request. The statistics are also reported upon connection closing.

ESL AP

Multiconnection: Support is added to ESL AP script for opening and maintaining multiple parallel connections to Tags.

Encryption: Encrypted NCP communication is added and is made the default choice between ESL Core C library and ESL AP NCP.

Simple Communication Interface

Robust configuration option is added to the component to make the UART communication more resistant to garbage on the line at boot.

Added in release 6.1.0.0

User-Controlled TX Power of a Bluetooth Connection

New feature component `bluetooth-feature-user-power-control` is added to support changing the TX power of a Bluetooth connection. In RCP mode. Use the vendor command `0xfc30` to set the TX power of a connection. In NCP and SoC modes, use the `sl_bt_connection_set_tx_power` command. This feature is mutually exclusive with the standard Bluetooth LE Power Control feature (`bluetooth-feature-power-control`).

Testing Network Co-Processor (NCP) Communication

New host example is added for testing Network Co-Processor (NCP) communication between host and EFR32 target. It demonstrates the communication between an NCP host and NCP target using BGAPI user messages, responses and events. It can be used as a starting point for creating custom commands or for testing purposes.

Network Co-Processor (NCP) User Command

New component is added for handling BGAPI User Commands. It demonstrates the communication between an NCP host and NCP target using BGAPI user messages, responses and events. It can be used as a starting point for creating custom commands or for testing purposes.

ESL AP

- **Core C library – Multiconnection:** Support is added for opening and maintaining multiple parallel connections to Tags in the ESL Core C library. Note that multiconnection support is not yet available in ESL AP Python script!
- **Application Python script – command line:** ESL AP command line auto-complete and command history functionality is added for convenience.

ESL Tag

- **e-paper driver:** ESL Tag e-paper display driver is published (experimental quality).

ESL Tag and ESL AP NCP

ESL HW support is extended to xG13 chip family, tripled the number of supported radio boards. ESL Tag and ESL AP NCP pre-built binaries are provided in Simplicity Studio for convenience.

Added in release 6.0.0.0

Controller-Based Privacy

Controller-based privacy is now supported. The controller is able to perform address resolving for up to 8 devices. Include component `'bluetooth_feature_resolving_list'` to use controller address resolving. The host stack continues to perform address resolving for resolvable private addresses that were not resolved by the controller, or to support the use case where the controller address resolving feature is not used.

Filter Accept List

The Filter Accept List is enhanced by the support of address resolving in the controller. Use component 'bluetooth_feature_accept_list' for the enhanced feature.

Connection Data Length Update

The stack supports data length update on Bluetooth connections. The component 'bluetooth_feature_connection' has a new configuration SL_BT_CONFIG_CONNECTION_DATA_LENGTH for setting default data length and run-time APIs are provided for using the feature.

Resource Usage Report

User applications can query the resource usage in the Bluetooth stack at run time with the 'bluetooth_feature_resource_report' component.

Transmission Queue Reports on Bluetooth Connections

The 'bluetooth_feature_resource_report' component supports tracking and reporting the number of packets and bytes queued for transmission on a specific connection.

Transmission Events for GATT Characteristic Notifications

The Bluetooth host stack now supports getting an event when the transmission of a GATT notification has completed on a connection. This functionality is provided by the 'bluetooth_feature_resource_report' component when the application specifically enables connection TX queue reporting using the commands in that class.

Accurate Bluetooth Address Types in BGAPI

It is possible now to select API semantics that use accurate Bluetooth address types with the 'bluetooth_feature_use_accurate_api_address_types' component. In the default Bluetooth stack configuration, most BGAPI commands and events use coarse address typing that only differentiates between public (value 0) and any random (value 1) address types. This component changes how the Bluetooth stack interprets and reports Bluetooth address types. When this component is included, Bluetooth commands and events that include an address type will systematically use the sl_bt_gap_address_type_t enumeration to indicate the accurate type.

Periodic Advertising with Responses (PAwR)

The Bluetooth stack now supports advertising with and synchronizing to Periodic Advertising with Responses (PAwR). The Bluetooth stack has new components 'bluetooth_feature_pawr_advertiser' for advertising with PAwR, 'bluetooth_feature_sync_scanner' for scanning for synchronization, and 'bluetooth_feature_periodic_sync' and 'bluetooth_feature_pawr_sync' for managing the sync to periodic advertising trains of different types. The new BGAPI classes corresponding to these components supersede some functionality in the 'bluetooth_feature_sync' component. Deprecated functionality and the replacements are shown in the documentation of the affected BGAPI classes, commands, and events.

PAwR-Aware Connection Scheduling Algorithm

The component 'bluetooth_feature_connection_pawr_scheduling' provides a connection scheduling algorithm that has been designed for use especially with applications that use several concurrent connections while advertising using PAwR. The algorithm tries to distribute the connections such a way that they are distracted as little as possible by the PAwR train.

Support for Electronic Shelf Label (ESL) Service and Profile

The 'ESL Tag Core' software component implements the ESL tag role of the [Electronic Shelf Label Profile](#) and is fully compliant with the Bluetooth ESL specification.

The Access Point role is also implemented by the bt_host_esl_ap host sample app for NCP hosts, and is also fully compliant with the Bluetooth ESL specification.

Support for Object Transfer Service (OTS) and Profile

Object Transfer Service and Profile is implemented by the 'Object Client' and 'Object Server' software components in accordance with the [Object Transfer Profile](#) specification. This enables transferring binary large objects via a BLE connections.

Vendor HCI Command for Fetching Connection Parameters

Vendor HCI command 0xfc2a is added for fetching the current parameters of a Bluetooth connection.

1.2 New APIs

Added in release 6.2.0.0

sl_bt_connection_read_statistics command: Read the statistic values collected on a specified connection.

sl_bt_evt_connection_statistics event: Provide the connection statistic values when the application includes the component `bluetooth_feature_connection_statistics`.

Vendor HCI command 0xfc321 and event 0xef: Read the statistic values collected on a specified connection in the RCP mode.

sl_bt_evt_system_stopped event: Indicate that stopping the Bluetooth stack using the command `sl_bt_system_stop_bluetooth` has completed.

sl_bt_system_forcefully_stop_bluetooth command: Stop the Bluetooth stack immediately without performing the ACL. This is a termination procedure for connections that were open. This command is available only when the application includes the Bluetooth on-demand start component.

Added in release 6.1.0.0

sl_bt_connection_set_tx_power command: Set the transmit power of a connection.

Added in release 6.0.0.0

sl_bt_accept_list_add_device_by_bonding command: Add a device to the Filter Accept List based on its bonding handle.

sl_bt_accept_list_add_device_by_address command: Add a device to the Filter Accept List based on its identity address.

sl_bt_accept_list_remove_device_by_bonding command: Remove a device from the Filter Accept List based on its bonding handle.

sl_bt_accept_list_remove_device_by_address command: Remove a device from the Filter Accept List based on its identity address.

sl_bt_accept_list_remove_all_devices command: Remove all devices from the Filter Accept List.

sl_bt_resolving_list_add_device_by_bonding command: Add a device to the Resolving List based on its bonding handle.

sl_bt_resolving_list_add_device_by_address command: Add a device to the Resolving List based on its identity address.

sl_bt_resolving_list_remove_device_by_bonding command: Remove a device from the Resolving List based on its bonding handle.

sl_bt_resolving_list_remove_device_by_address command: Remove a device from the Resolving List based on its identity address.

sl_bt_resolving_list_remove_all_devices command: Remove all devices from the Resolving List.

sl_bt_connection_set_default_data_length command: Set the default preferred maximum TX payload length for new connections.

sl_bt_connection_set_data_length command: Update the maximum TX payload length and maximum packet TX time of a Bluetooth connection.

sl_bt_evt_connection_data_length event: Report a change to the maximum payload length or TX time in either direction of a connection.

sl_bt_connection_forcefully_close command: Forcefully close a Bluetooth connection without performing the ACL Termination procedure.

sl_bt_resource_get_status command: Get the present memory buffer usage status.

sl_bt_resource_set_report_threshold command: Set low and high thresholds of memory buffer usage reports.

sl_bt_resource_enable_connection_tx_report command: Enable tracking and reporting data packet TX status of future new connections.

sl_bt_resource_get_connection_tx_status command: Get the data packet TX status of a connection.

sl_bt_resource_disable_connection_tx_report command: Disable tracking and reporting data packet TX status of future new connections.

sl_bt_evt_resource_status event: Indicates that the memory buffer usage has crossed a threshold.

sl_bt_evt_gatt_server_notification_tx_completed event: Indicates that one or more GATT notifications have been transmitted.

- sl_bt_scanner_set_parameters_and_filter command:** Set scan parameters and the scanning filter policy for subsequent scanning operations.
- sl_bt_pawr_advertiser_start command:** Start PAwR advertising on an advertising set.
- sl_bt_pawr_advertiser_set_subevent_data command:** Set data to be sent in the subevent of an active PAwR train.
- sl_bt_pawr_advertiser_create_connection command:** Initiate a connection request to a device that is synchronized to the active PAwR train.
- sl_bt_pawr_advertiser_stop command:** Stop PAwR advertising on an advertising set.
- sl_bt_evt_pawr_advertiser_subevent_data_request event:** Triggered when the Bluetooth stack is ready to accept data for subevents of the PAwR train.
- sl_bt_evt_pawr_advertiser_subevent_tx_failed event:** Triggered if subevent data was successfully set but the attempt to transmit the subevent data has failed.
- sl_bt_evt_pawr_advertiser_response_report event:** Report the status and data of a used response slot of an active PAwR train.
- sl_bt_sync_scanner_set_sync_parameters command:** Configure synchronization parameters for synchronizing to periodic advertising trains.
- sl_bt_sync_scanner_open command:** Start establishing synchronization with the specified periodic advertiser in parallel with other advertisers given in previous invocations of this command.
- sl_bt_sync_update_sync_parameters command:** Update synchronization parameters for a periodic sync that was already established.
- sl_bt_evt_periodic_sync_opened event:** Triggered when synchronization is established to a periodic advertising train that does not have subevents or response slots.
- sl_bt_evt_periodic_sync_transfer_received event:** Triggered when synchronization transfer is received for a periodic advertising train that does not have subevents or response slots.
- sl_bt_evt_periodic_sync_report event:** Triggered when data for a periodic advertising train that does not have subevents or response slots is received and accepted by the reporting mode currently set to the train.
- sl_bt_evt_pawr_sync_opened event:** Triggered after synchronization is established to a PAwR train.
- sl_bt_evt_pawr_sync_transfer_received event:** Triggered after synchronization transfer is received for a PAwR train.
- sl_bt_pawr_sync_set_sync_subevents command:** Specify the subevents that this device will synchronize to on the specified PAwR train.
- sl_bt_evt_pawr_sync_subevent_report event:** Triggered when subevent data for PAwR train is received and accepted by the reporting mode currently set to the train.
- sl_bt_pawr_sync_set_response_data command:** Set the data to be sent in the specified response slot of a subevent of an active PAwR train.
- sl_bt_sync_update_sync_parameters command:** Update synchronization parameters for a periodic sync that was already established.
- sl_bt_gatt_discover_characteristic_descriptors command:** Discover all descriptors of a GATT characteristic in a remote GATT database.
- New option in **sl_bt_sm_configure command:** Support the new option of rejecting a pairing when the remote device uses debug keys.

2 Improvements

2.1 Changed Items

Changed in release 6.3.0.0

ID #	Description
1203109	Improved detection logic for ESLs that do not have a valid GATT configuration according to the ESL Service specification. The new logic now prevents a number of false positive detections and the resulting exclusion of valid ESLs from the network.

Changed in release 6.2.0.0

ESL AP

Various stability and performance improvements are provided. The introduction of multiconnection feature allows parallelization of Tag configuration, and hence improves system performance significantly.

Changed in release 6.1.0.0

Configurable IQ Sample Quality Analysis

IQ sample quality analysis in the AoA host examples is now enabled only in case of debug log level.

ESL AP

Various stability improvements are provided.

ESL AP Command Line Interface – Multiconnection

Changes ESL AP CLI to enable future support for multiple simultaneous connections to Tags.

OTS Image Transfer

Stability improvements are provided.

ESL Core Library - Multiconnection

Adds support for opening and maintaining multiple parallel connections to Tags in the ESL Core C library.

Changed in release 6.0.0.0

Amazon FreeRTOS BLE HAL Component

The Amazon FreeRTOS BLE HAL component `iot_ble` has been updated to use new BGAPI classes for scanning and advertising. If a BLE HAL application uses scanning, the application must add `bluetooth_feature_legacy_scanner` to the application project. If a BLE HAL application uses advertising, the application must add `bluetooth_feature_legacy_advertiser` to the application project.

Prevent BGAPI Command Calls From Interrupt Handler Mode

The stack now checks if a BGAPI command is called in interrupt handler mode, and returns error SL_STATUS_IRQ if so.

2.2 Changed APIs

Changed in release 6.3.0.0

sl_bt_evt_system_resource_exhausted event: New parameter 'num_message_allocation_failures' is appended to the the parameter list for reporting a resource exhaustion situation that the system has run out of internal pre-allocated message items, and that the creation of an internal message has failed.

Changed in release 6.1.0.0

sl_bt_evt_l2cap_command_rejected event: New parameter 'cid' is appended to the parameter list for specifying the local channel identifier.

sl_simple_timer_start renamed to **app_timer_start**.

sl_simple_timer_stop renamed to **app_timer_stop**.

esl_image_chunk_received callback: New parameter 'offset' is added.

Changed in release 6.0.0.0

sl_bt_evt_connection_parameters event: This is no longer used for communicating the TX data length change on the connection. Data length update comes from new event 'sl_bt_evt_connection_data_length'.

sl_bt_evt_l2cap_le_channel_open_request event: New parameter 'remote_cid' is appended to the event parameter list for specifying the corresponding channel identifiers of the peer device.

sl_bt_evt_l2cap_le_channel_open_response event: New parameter 'remote_cid' is appended to the event parameter list for specifying the corresponding channel identifiers of the peer device.

sl_bt_sm_configure command: Option "Allow connections only from bonded devices" is not supported when the application includes the 'bluetooth_feature_external_bonding_database' feature.

Connection handle returned from sl_bt_connection_open command and sl_bt_evt_connection_opened event: The stack now uses a handle value assignment schematic such that a newly assigned handle contains an additional sequence number. This change is to solve possible handle collisions in race conditions when connections are opened and closed very frequently.

2.3 Intended Behavior

When configuring the HFXO frequency in SL_DEVICE_INIT_HFXO_FREQ, make sure to set the SL_DEVICE_INIT_DPLL_FREQ to twice the HFXO frequency in sl_device_init_dpll_config.h for proper function of Bluetooth.

3 Fixed Issues

Fixed in release 6.3.0.0

ID #	Description
1170640	Fix a race condition in GATT Client that the ATT MTU exchange could be prevented if the user application calls a GATT Client command that in turn starts a GATT procedure with the remote GATT Server under the context of <code>sl_bt_evt_connection_opened</code> event handling in SoC mode.
1197438	Fix an issue in setting flow control in NCP Host test example.
1205317	The Silabs vendor specific 0x1F opcode for the ESL experimental PAwR interval skip function has been added to the ESL AP readme document.
1205333	Eliminated the need to manually change the type of UART flow control after creating the ESL AP NCP project for numerous supported boards.
1206647	Fix a bug in the Bluetooth link layer that was caused by incorrect handling of an error if the transmission of the connection indication packet by the central failed.
1209154	Fixed a bug that could prevent the ESL demo mode from working more than once in an AP session. The AP Python sample code now does not allow changing the mode while the EFR Connect application is connected in demo mode, while it is now possible to query the current state of the demo via the CLI interface.
1212515	Fix an issue in the RCP mode that made the <code>LE_Set_Periodic_Advertising_Subevent_Data</code> HCI command erroneously fail when data for multiple subevents was set at the same time with certain lengths. Fix another issue in the RCP mode that allowed indefinitely reserving an unusable connection handle when the Host did not wait for the Connection Complete HCI event before calling another <code>LE_Create_Connection</code> command.
1212633	Fix <code>iop_create_bl_files.sh</code> script failure on MacOS.
1214140	BLE ESL examples now support BRD4402B and BRD4403B boards.
1215158	PAwR subevent data requesting-setting procedure now follows the core specification strictly. Data provided by the host will be sent in the given order, and data arriving too late will not be sent in the forthcoming periodic advertising interval.
1218018	Optimize connection establishments in a DMP configuration. Previously, packets were not processed fast enough in certain cases, resulting in connection loss.
1218112	Fix a race condition between the connection termination and channel map update procedure that could cause a double buffer free.
1222271	Fix an issue in the Bluetooth link layer where PAwR would hang the task scheduler while trying to send a connection request just after another task got executed.
1223155	Fix a memory access violation in the host stack when processing the <code>HCI_LE_Read_Remote_Features_Complete</code> event if the connection handle in the event is invalid.
1225207	Fixed issue: NULL dereferencing can occur in ESL C lib which leads ESL AP to crash in while configuring large networks.
1233996	Fix a GATT compliance issue when the GATT client feature component does not present in the application. The issue was that the Bluetooth stack responds to an <code>ATT_HANDLE_VALUE_IND</code> with an error when the remote GATT server sends an unsolicited GATT Indication. This is now fixed so that the Bluetooth stack will respond with an <code>ATT_HANDLE_VALUE_IND</code> with <code>ATT_HANDLE_VALUE_CFM</code> . This issue does not exist when the GATT client feature component presents in the application.
1243489	Fix potential memory leaks in ESL key library implementation.
1245534	Fix an issue in Bluetooth host stack for the Privacy feature that can cause bonding to fail if the remote device changes its resolvable private address (RPA) and the RPA is resolved again before bonding is completed.
1252462	Fixed issue with scanner where coded extended advertisement packets are not received after forming connection with uncoded PHY.
1256359	Reduce memory usages in ATT message processing. Now an ATT request, response, or status update message is delivered to the BGAPI layer without additional memory allocations.
1254794	Fixed a corrupted packet being sent when starting encryption while concurrently streaming data in a noisy environment.
1262944	Fixed an issue that caused the adaptive frequency hopping component not to follow the cooldown parameter configuration accurately.

Fixed in release 6.2.0.0

ID #	Description
1145112	The even-connection-scheduling feature now distributes connections evenly over common connection interval with any number of connections (up to 32 connections). In addition, the PAwR-aware connection scheduling is fixed at the same time.
1164422	Validation of the AUX_SYNC_SUBEVENT_RSP PDU has been improved to catch invalid data fields.
1170496	Now the RX data length of the connection remains unchanged when setting the TX data length with command <code>sl_bt_connection_set_data_length()</code> . The Bluetooth stack sets the default RX data length of a connection to maximum. The RX data length can be configured by the peer device during the feature exchange and connection procedures.
1174893	Fix an issue that was affecting the Bluetooth RCP application, where the response to HCI LE Periodic Advertising Parameters v2 command was missing the advertising handle.
1179646	Improved tolerance of ESL Tag example to air transmission interference.
1190534	Fix an issue that would cause connection creation over Periodic Advertising with Responses (PAwR) to fail if the synchronized device had a static random identity address but the application did not include Bluetooth scanner component.
1190989	Fix an issue where ESL Tag becomes inaccessible after timeout in Unsynchronized state.
1191503	Add Get-Coex-Parameters vendor-specific command to Bluetooth HCI Coex plugin.

Fixed in release 6.1.0.0

ID #	Description
1063952 1169496	Fix an issue in the Bluetooth link layer that may cause a multiprotocol application using the BLE advertisements to crash after running for a long time.
1114654	Update the NCP user commands of the <code>bt_ncp</code> example and add new host example <code>bt_host_ncp_test</code> that can be used together to test and verify the communication between the host and target devices.
1131599	The config file template now provides an example of how to disable angle filtering, required for the AoA positioning example, which must use unfiltered angle reports from the locators.
1131945	Fix an issue in the AppLoader that the TX power is too low on EFR32[M B]G1x devices.
1144105	Fix an issue that the first connection packet was not received by the peripheral if the peripheral was advertising using LE Coded PHY with S2 coding.
1145112	Even connection scheduling is fixed to distribute connections evenly over common connection interval with any number of connections (up to 32 connections).
1151844	Fix various issues in ESL Access Point CLI and logging.
1152274	Fix a dependency in the link-layer that causes unnecessary extended advertising functions compiled into the application even the application only uses the legacy advertising component. This issue results in increased code size.
1154896	Provide extended board support for Bluetooth NCP ESL AP and Bluetooth SoC ESL Tag examples.
1157633	Fix an issue in the GATT server that the client characteristic notification status may be out of sync if the remote GATT client device has lost the bonding with the local device. In this fix, when the remote GATT client device has lost bonding keys and the local device has enabled bonding confirmations to allow re-bonding, the GATT server will erase client-supported features and client characteristic notification settings of the GATT client if a re-bonding happens on an unencrypted connection between the GATT client and local devices. If re-bonding happens when the connection has already been encrypted, the settings are not erased.
1164860	Fix a bug that causes the Bluetooth link layer to transmit invalid Tx and Rx maximum times in the <code>LLCP_LENGTH_REQ</code> and <code>LLCP_LENGTH_RSP</code> packets to the remote device.
1159523	Fix an issue where the ESL access point running on Linux could not connect to ESL Tags.

Fixed in release 6.0.0.0

ID #	Description
731981	Document UG434 is updated to only describe the priorities of interrupts used by the Link Layer and radio. Other interrupts, e.g., the USART interrupt, that are not used by the Bluetooth stack are no longer listed. Check the priority settings in the corresponding component to determine whether it uses the default priorities or has its own setting.
1074048	Fix an issue in Apploader that the address and address type are sent in wrong order in the advertising data packet. This issue results in the address type becoming part of the address and the most significant byte of the address becoming the address type.
1084247	Fix a memory leak if a connection update is received from the remote device at the same time as the connection is being closed by the local device.
1099142	Fix a pairing failure when the remote device address is a resolvable private address that has been resolved in link layer.
1104191	Fix a peripheral connection performance issue with simultaneous scanning.
1105786 1132177	Fix the extended connection backoff procedure behavior. Now, when the Link Layer fails multiple times to receive a AUX_CONNECT_RSP after a AUX_CONNECT_REQ is sent, an increasingly random number of connectable extended advertisements are skipped before attempting to connect again.
1118901	Update the documentation of the sl_bt_evt_connection_tx_power event to explicitly list the situations in which this event may get triggered.
1124748	Fix a possible MIC failure case when encrypting a connection with the bluetooth_feature_external_bonding_database component.
1124749	Fix an issue that could cause the Bluetooth stack to enter a live-lock situation where no progress is made if buffer resources are exhausted when the stack is generating critical events that require a retry in out-of-memory situations.
1124749	Update the documentation of the sl_bt_external_signal API that, if the Platform Core Interrupt API has been configured to use the CORE_ATOMIC_METHOD_BASEPRI as the implementation method of atomic sections, this function must not be called from an interrupt handler with a priority higher than CORE_ATOMIC_BASE_PRIORITY_LEVEL.
1132204	Improve that ATT PDU validation in the GATT server for the case that it receives more data than defined in the data length field of the L2CAP packet. The GATT server will discard such invalid packet.
1132430	Clarify that the transmission specified in the sl_bt_test_dtm_tx_v4 command is restricted by the global TX power setting that could be set using the sl_bt_system_set_tx_power command.
1135759	The sl_bt_system_linklayer_configure command now returns error codes properly. Previously it returned SL_STATUS_OK always even when the low level returns an error.
1135862	Improve the ATT response length validation to prevent the stack from being corrupted if the ATT response contains a too large invalid length value.
1135899	Fix an issue that the GATT client operation under command sl_bt_gatt_discover_primary_services goes into an infinite loop until the GATT operation timeout occurs if the end group handle in the response from GATT server is 0.
1137820	Fix an issue that the GATT client continues reading the value infinitely until the GATT operation timeout occurs if the GATT server always claims that it has more data to read for an attribute. This has been fixed such that the GATT client will stop the operation when the data offset is bigger than the attribute's maximum length.
1142135	Fix a memory leak when debug keys (set with command with sl_bt_sm_set_debug_mode) are used for pairing. The issue does not exist when pairing with normal keys.
1143357	Fix an issue of possible duplicate handle assignment in the stack in race conditions when a new connection is opened in the time period between the stack generating a sl_bt_evt_connection_opened event and the user application receiving the event for a disconnected connection.
1143531	Fix an issue that the EDIV and random values were always set to all zero, potentially causing encryption to fail when reconnecting to a peripheral that has been paired with legacy pairing.
1143589	Improve the channel identifier validation in L2CAP COC disconnection requests and responses to comply with the specification.
1145778	Fix an issue in the stack that the LTK key is stored incorrectly in RAM after doing the bonding. This issue may cause encryption failure if the key is refreshed later on that same connection. This issue does not affect persistent bonding data.

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/bluetooth-low-energy> in the Tech Docs tab.

ID #	Description	Workaround
361592	The sync_data event does not report TX power.	None
368403	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.	None
641122	The Bluetooth stack component does not provide a configuration for RF antenna path.	This is an issue specifically for BGM210P. One workaround is to manually update the configuration in <code>sl_bluetooth_config.h</code> in text edit mode. If the OTA with Apploader is used, include the <code>bluetooth_feature_ota_config</code> component in application project. Call command <code>sl_bt_ota_set_rf_path()</code> to set the RF path for OTA mode.
650079	LE 2M PHY on EFR32[B M]G12 and EFR32[B M]G13 doesn't work with smartphones using the Mediatek Helio chip due to an interoperability issue.	No workaround exists. For application development and testing, the disconnection can be avoided by disabling 2M PHY with <code>sl_bt_connection_set_preferred_phy()</code> or <code>sl_bt_connection_set_default_preferred_phy()</code> .
682198	The Bluetooth stack has an interoperability issue on the 2M PHY with a Windows PC.	No workaround exists. For application development and testing, the disconnection can be avoided by disabling 2M PHY with <code>sl_bt_connection_set_preferred_phy()</code> or <code>sl_bt_connection_set_default_preferred_phy()</code> .
730692	4-7% packet error rate is observed on EFR32M BG13 devices when RSSI is between -25 and -10 dBm. The PER is nominal (as per the datasheet) both above and below this range.	None
756253	The RSSI value on a Bluetooth connection returned by the Bluetooth API is incorrect on EFR32M B1, EFR32M B12, EFR32M B13, and EFR32M B21 devices. On EFR32M B21 devices. It is about 8~10 dBm higher than the actual value, according to a measurement.	Install the "RAIL Utility, RSSI" component in the application project. This component provides a default RSSI offset for the chip that is applied at the RAIL level and can help to achieve more accurate RSSI measurements.
845506	When the <code>Bluetooth_feature_afh</code> component for AFH is included, the feature initialization always enables AFH.	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 <code>sl_btctrl_init_afh()</code> in <code>sl_bt_stack_init.c</code> .
1031031	Changing the configuration in the <code>bt_aoa_host_locator</code> application results in the application crashing.	None

5 Deprecated Items

Deprecated in release 6.0.0.0

Component `bluetooth_feature_whitelisting`

Command `sl_bt_gap_enable_whitelisting`

Command `sl_bt_sync_set_parameters`

Command `sl_bt_sync_open`

Command `sl_bt_evt_sync_opened`

Command `sl_bt_evt_sync_transfer`

Command `sl_bt_evt_sync_data`

Command `sl_bt_sm_add_to_whitelist`

The `txsize` field in command `sl_bt_evt_connection_parameters`

6 Removed Items

Removed from release 6.0.0.0

Component bluetooth_feature_dfu

Component bluetooth_apploader_migration_util

Component bluetooth_feature_default

7 Multiprotocol Gateway and RCP

7.1 New Items

Added in release 6.0.0.0

Added a new application `z3-light_ot-ftd_soc` that demonstrates Zigbee and OpenThread Concurrent Multiprotocol functionality. It features a router on the Zigbee side and a Full Thread Device (FTD) on the OpenThread side. See the project description or `app/framework/scenarios/z3/z3-light_ot-ftd_soc/readme.html` for details.

First GA-quality release of CPC GPIO Expander module. The Co-Processor Communication (CPC) General Purpose Input/Output (GPIO) Expander is a software component designed to enable a Host device to utilize a Secondary device's GPIOs as if they were its own. With the CPC GPIO Expander, the Host device can seamlessly integrate with the Secondary device and make use of its GPIO capabilities. See <https://github.com/SiliconLabs/cpc-gpio-expander/README.md> for documentation.

Added antenna diversity and coex EZSP command support to Zigbeed.

Added better assert reporting to Zigbeed.

Added `bt_host_empty` application (option: `-B` for the `run.sh` script) to the multiprotocol docker container.

Zigbeed now includes an implementation of `emberGetRestoredEui64()` which loads the `CREATOR_STACK_RESTORED_EUI64` token from the `host_token.nvm` file.

The multiprotocol container now sets the size of syslog to 100 MB by default. Users are able to change the size by modifying the `"/etc/logrotate.d/rsyslog"` and `"/etc/rsyslog.d/50-default.conf"` files and restarting the rsyslog service inside the container.

7.2 Improvements

Changed in release 6.1.0.0

`Radio_url` can now take a list of IIDs. This is to control IIDs a host can accept spinel frames from other than its own IID. RCP uses IID zero for the received broadcast packet to deliver a spinel frame to all the connected hosts/endpoints. An example of the new `radio_url` is `'spinel+cpc://cpcd_0?iid=1&iid-list=0'`.

CLI commands used by `z3-light_ot-ftd_soc` sample application have been moved from the project into a new component called `ot_up_cli`.

Changed in release 6.0.0.0

Reduced CPC Tx and Rx queue sizes to fit the DMP NCP on the MG13 family.

Configured options on the multiprotocol RCP projects to provide ~3.3k in RAM savings, particularly for the MG1 part. This was accomplished by

- Reducing
 - The number of user CPC endpoints to 0
 - Tx CPC queue size to 15 from 20
 - Rx buffer count to 15
- Disabling OpenThread RTT logs

For further savings, customers can look into reducing the Tx and Rx queue sizes further. Note that the downside to this change would be a reduction in message throughput due to added retries. Also, customers can look into reducing the NVM cache size based on need. As a last resort, customers may also choose to disable CPC security on both the RCP and the host. We do not recommend the last option.

Changed `zigbee_ble_event_handler` to print scan responses from legacy advertisements in the `DMPLight(Sed)` app.

The `rcp-xxx-802154` apps now by default support 192 μ sec turnaround time for non-enhanced acks while still using 256 μ sec turnaround time for enhanced acks required by CSL.

7.3 Fixed Issues

Fixed in release 6.3.0.0

ID #	Description
1155676	Fixed issue where the 802.15.4 RCP will discard all received unicast packets (after MAC acking) if multiple 15.4 interfaces happen to share the same 16-bit node ID.
1173178	Fixed issue where host falsely reported hundreds of packets received with mfglib in the Host-RCP setup.
1199706	Fixed an issue where data polls from forgotten end device children weren't properly setting a pending frame on the RCP to queue a Leave & Rejoin command to the former child.
1207967	Fixed an issue that the "mfglib send random" command was sending out extra packets on zigbeed.
1213058	Fixed a Zigbeed segmentation fault that could occur under heavy traffic conditions.
1213701	Fixed an issue caused by a missed MAC ack that can lead to application layer transactions between the child and some other device (including its parent) failing due to lack of APS Ack or app-layer response, most notably the disruption and unexpected termination of ZCL OTA Upgrades targeting the child device.
1214359	Fixed another Zigbeed segmentation fault that could occur under heavy traffic conditions.
1216470	Fixed an issue that after relaying a broadcast for address mask 0xFFFF, a Zigbee RCP acting as a parent device would leave the pending data flag set for each child, resulting in each child staying awake expecting data after each poll, requiring some other pending data transaction to each end device to eventually clear this state.
1231021	Avoid an assert by recovering the RCP rather than passing unhandled transmit errors to the sub mac.
1244459	Fixed issue where MAC-retried Indirect transmissions via RCP can result in source match table entry for child being removed despite messages pending.
1256028	Fixed an issue where concurrent listening feature was not properly disabled in previous patch releases, resulting in crashes on xG24 and xG21.

Fixed in release 6.2.0.0

ID #	Description
1090921	An issue has been fixed that caused Z3GatewayCpc not being able to form the zigbee network in a noisy environment.
1190859	An EZSP issue when sending mfglib packets CMP RCP setup has been fixed.

Fixed in release 6.1.0.0

ID #	Description
1113498 1135805	Resolved several issues that caused intermittent failures in zigbeed when attempting to join 100 or more Zigbee devices to the network.
1153055	An issue has been fixed that caused failure on the host if a communication error occurred when reading the NCP version.
1171451	An argument parsing issue has been fixed in the CLI command ping_ipaddr of the ot_up_cli component.

Fixed in release 6.0.0.0

ID #	Description
1078323	Resolved issue where Z3GatewayCPC asserts when there is a communication failure with the NCP during address table initialization. We will now try to reconnect to the NCP upon failure.
1080517	Z3GatewayCPC now automatically handles a reset of the NCP (CPC secondary).
1117789	Fixed an issue where modifying OPENTHREAD_CONFIG_PLATFORM_RADIO_SPINEL_RX_FRAME_BUFFER_SIZE caused a linker error when building Zigbeed.
1118077	In the CMP RCP, Spinel messages were being dropped under heavy traffic load due to CPC not keeping up with the incoming packets. Fixed this by bundling all Spinel messages ready to be sent over CPC into one payload on the RCP and unbundling them on the host. This dramatically improves the efficiency of CPC so that it can keep up with the incoming radio traffic.

ID #	Description
1129821	Fixed null pointer dereference in Zigbeed in an out-of-buffer scenario while receiving packets.
1139990	Fixed an assert in the OpenThread Spinel code that could be triggered when joining many Zigbee devices simultaneously.
1144268	Fixed an issue where excessive radio traffic can cause the Zigbee-BLE NCP to get into a state where it continually executes the NCP and CPC initialization.
1147517	Fixed an issue with Z3GatewayCPC on startup that could cause the reset handling of the secondary to not work correctly.

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>.

ID #	Description	Workaround
811732	Custom token support is not available when using Zigbeed.	Support is planned in a future release.
937562	Bluetoothctl 'advertise on' command fails with rcp-uart-802154-blehci app on Raspberry Pi OS 11.	Use btmgmt app instead of bluetoothctl.
1022972	Coex not working on ZB NCP + OT RCP.	Fixed in GSDK 4.4.2.
1074205	The CMP RCP does not support two networks on the same PAN id.	Use different PAN ids for each network. Support is planned in a future release.
1122723	In a busy environment the CLI can become unresponsive in the z3-light_ot-ftd_soc app.	This app is released as experimental quality and the issue will be fixed in a future release.
1124140	z3-light_ot-ftd_soc sample app is not able to form the Zigbee network if the OT network is up already.	Start the Zigbee network first and the OT network after.
1129032	Experimental concurrent listening feature on xG24 devices is disabled in this release.	The feature is supported in GSDK 4.4.0.
1143857	Antenna Diversity is not available on the CMP RCP for xG21 and xG24 parts, since the antenna diversity hardware is used for concurrent listening.	Intended behavior.
1221299	RSSI readings are less sensitive for RCP firmware when compared to the NCP setup.	Will be addressed in a future release.

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 <https://docs.silabs.com/bluetooth/latest/>. 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\\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.

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

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.

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<input type="checkbox"/> Modems and DAAs	<input type="checkbox"/> Voice
<input type="checkbox"/> Microcontrollers	<input type="checkbox"/> Wireless
<input type="checkbox"/> 8-bit MCUs <input checked="" type="checkbox"/> 32-bit MCUs	<input type="checkbox"/> Bluetooth Classic <input type="checkbox"/> Bluetooth Low Energy <input checked="" type="checkbox"/> Proprietary
<input type="checkbox"/> Timing	<input type="checkbox"/> Wi-Fi
<input type="checkbox"/> Clocks	<input type="checkbox"/> ZigBee and Thread
<input type="checkbox"/> Buffers	<input type="checkbox"/> Z-Wave
<input type="checkbox"/> Oscillators	
<input type="checkbox"/> CDR and PHY	

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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