



Bluetooth® SDK 3.1.1.0 GA

Gecko SDK Suite 3.1

January 27, 2021

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 5.1-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):

3.1.1.0 released January 27, 2021
3.1.0.0 released December 9, 2020



KEY FEATURES

- Angle of Arrival General Availability
- LE Power Control
- Support for CMSIS-RTOS2
- New NCP tool - Bluetooth NCP Commander

Compatibility and Use Notices

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

Compatible Compilers:

Note: The supported compilers will be upgraded to ARM GCC-10-2020-q4-update and IAR 8.50.9 in the next major release.

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 3.1.1.0

Bluetooth on-demand start

With the Bluetooth on-demand start feature, the application can start and stop the Bluetooth stack at run time. The feature is enabled by including the `bluetooth_on_demand_start` component. When this feature is enabled, the Bluetooth stack does not run until `sl_bt_system_start_bluetooth()` is called. The Bluetooth stack can be stopped with `sl_bt_system_stop_bluetooth()`. When the Bluetooth stack is not running, all BGAPI classes other than System become unavailable. The main use case of this feature is for DMP applications where Bluetooth is not needed all the time.

If this feature is not enabled, the Bluetooth stack is started automatically.

Added in release 3.1.0.0

Angle of Arrival (AoA) and Angle of Departure (AoD)

Beginning with this release, the Bluetooth stack supports Bluetooth 5.1 AoA and AoD features. The SDK provides `soc_aoa_asset_tag` and `ncp_aoa_locator` example applications for evaluating the AoA functionality. The AoD is supported only at the Bluetooth stack level and the SDK does not provide any sample application in this release. For more information see the examples, API reference, and *AN1296: Application Development with Silicon Labs' RTL Library* in the SDK.

LE Power Control

The Bluetooth stack now supports the Bluetooth 5.2 LE Power Control feature. Both procedures, Power Control Request and Power Change Indication, are supported. In order to use these procedures, the connection peer entity must support the same procedures.

At the receiver side, the user can specify so-called 'Golden RSSI range' for each PHY. Based on the configuration the receiver side requests the transmitter to adjust transmit power such that the received signal level would be within the configured range.

At the transmitter side, the user is allowed to configure the transmit power range. The transmitter shall not use a transmit power out of the configured range even if the connection peer entity sends such a request.

The power control feature can be used seamlessly with or without adaptive frequency hopping.

The Golden RSSI range and the transmit power range can be configured in the `bluetooth_feature_power_control` software component.

The global minimum and maximum TX power are also configurable in the Bluetooth stack component.

FreeRTOS Support

The Bluetooth stack can also run on FreeRTOS in this release. This is achieved by using the CMSIS-RTOS2 in the RTOS adaptation software component of the Bluetooth stack. User application can choose to run the stack either on Micrium OS or FreeRTOS. The Bluetooth SDK provides `soc_thermometer_micrium` and `soc_thermometer_freertos` examples.

Additionally, the Bluetooth stack RTOS adaptation is now in its own software component and it supports configuring the Bluetooth RTOS task priorities.

1.2 New APIs

For additional documentation and command descriptions please refer to the Bluetooth API reference in the SDK installation or the online API reference specific to the SDK version you are using. The most up-to-date version is at <https://docs.silabs.com/bluetooth/latest/>.

Added in release 3.1.0.0

Minimum and maximum TX power configuration: In the Bluetooth stack component (`sl_bluetooth_config.h`), including items `SL_BT_CONFIG_MIN_TX_POWER` and `SL_BT_CONFIG_MAX_TX_POWER`.

LE Power Control configuration: In the `bluetooth_feature_power_control` component (`sl_bt_power_control_config.h`).

Bluetooth RTOS task priority configuration: In the `Bluetooth_rtos_adaptation` component (`sl_bt_rtos_config.h`).

sl_bt_system_get_version command: Returns the firmware version information, the same as the sl_bt_evt_system_boot event returns.

sl_bt_system_set_tx_power command: Sets the global minimum and maximum radiated TX power levels for Bluetooth.

sl_bt_system_get_tx_power_setting command: Returns the global minimum and maximum radiated TX power levels for Bluetooth.

sl_bt_connection_set_power_reporting command: Enables or disables the transmit power reporting for the local device on a Bluetooth connection.

sl_bt_connection_set_remote_power_reporting command: Enables or disables the transmit power reporting for the remote device on a Bluetooth connection.

sl_bt_connection_get_tx_power command: Returns the transmit power of the local device on a Bluetooth connection.

sl_bt_connection_get_remote_tx_power command: Reads the transmit power of the remote device on a Bluetooth connection.

sl_bt_evt_connection_get_remote_tx_power_completed event: Indicates that reading remote transmit power operation has completed.

sl_bt_evt_connection_tx_power event: Reports a transmit power change of the local device on a Bluetooth connection.

sl_bt_evt_connection_remote_tx_power event: Reports a transmit power change of the remote device on a Bluetooth connection.

sl_bt_gatt_server_send_notification command: Sends a characteristic value notification to a remote GATT client.

sl_bt_gatt_server_send_indication command: Sends a characteristic value indication to a remote GATT client.

sl_bt_gatt_server_notify_all command: Sends a characteristic value notifications or indications to all connected remote GATT clients.

sl_bt_gatt_server_read_client_configuration command: Reads a remote GATT client's current value of the client characteristic configuration of a characteristic.

sl_bt_evt_gatt_server_indication_timeout event: Indicates the indication to a remote GATT client has timed out.

sl_bt_test_dtm_tx_v4 command: Supports setting the TX power level in DTM transmitter test v4 of the Bluetooth specification.

sl_bt_user_manager_event_filter command: Used for managing the API event filter over the NCP.

2 Improvements

2.1 Changed APIs

Changed in release 3.1.0.0

Behavior change in TX power setting command

The new command `sl_bt_system_set_tx_power` replaces the `sl_bt_system_set_max_tx_power` command, with the change that the set TX powers are the radiated values from the antenna, i.e., without the TX RF path gain. Previously, the TX powers in `sl_bt_system_set_max_tx_power` command had the TX RF path gain applied.

RSSI value in `sl_bt_connection_get_rssi` event

The RSSI value in this event is the median of the last seven measured RSSI values. Previously the last RSSI value was returned.

PA auto-mode

The Bluetooth stack now uses PA auto-mode for power level handling to optimizing the operation processing time.

Simultaneous scanning on LE 1M and Coded PHYs

The command `sl_bt_scanner_start()` now supports simultaneous scanning on LE 1M and Coded PHYs. The stack alternates the scanning on two PHYs by switching the PHY at every scan interval.

Bluetooth component ID and name change

The Bluetooth component 'bluetooth' is changed to 'bluetooth_feature_default'. The feature selection in this component remains unchanged.

Maximum number of advertisers in `ncp_empty` application

The maximum number of advertisers for user is increased to 4 in the `ncp_empty` application.

Separate headers for common BGAPI protocol types and generated types

Common types of the BGAPI protocol are separated into their own header file `sl_bgapi.h`, which is automatically included from `sl_bt_api.h`. No change is required in applications.

Prefix of Bluetooth API types

Bluetooth types and defines that do not have the "sl_bt_" prefix are deprecated and replaced by types and defines that include the "sl_bt_" prefix to the name. A compatibility header, `sl_bt_api_compatibility.h`, is automatically included from `sl_bt_api.h` to maintain source code compatibility to existing code until it has migrated to use the new names.

3 Fixed Issues

Fixed in release 3.1.1.0

ID #	Description
644088	The <code>aoa_locator</code> example application exposes RTL library's azimuth constraint API via an optional configuration file.
649616	Previously, in the the RF regulatory mode of the NCP commander, changing the transmit power when TX is already enabled didn't change the output power even though the API command is accepted. This has been fixed such that the TX power can be changed when the TX is enabled.
651999	Fix the issue that characteristic extended property descriptors are not generated into the GATT database when a characteristic in the GATT XML file has an extended property.
652908	Added an empty GATT database if the application does not provide one. This enables the application to exclude the GATT configurator component when the GATT server feature is not used.
653289	Add a <code>-c</code> command line option that points to a JSON configuration file. It can contain a list of accepted tags. If used, location of other tags will not be reported to the MQTT. Sample configuration file looks like this: <pre> { "tag_whitelist": ["ble-pd-aaaaaaaaaaaa", "ble-pd-bbbbbbbbbbbbbb"] }</pre>
654946	Return the correct address type in the <code>sl_bt_evt_connection_opened</code> event when the remote device uses a random resolvable address but the Bluetooth stack cannot resolve it due to no existing bonding.
655455	Fix build errors caused by missing include path in the <code>aoa_compass</code> host example.
656118	Fix the issue that <code>sl_bt_system_set_max_tx_power</code> when the requested maximum TX power is less than -30 dBm.
658852	Previously, commands <code>sl_bt_cte_receiver_enable_connectionless_cte()</code> and <code>sl_bt_cte_receiver_enable_silabs_cte()</code> returned an "invalid command parameters" error if <code>cte_count</code> value 0 was used. This has been fixed now. The only supported value is 0. Other values still return an "unsupported parameter" error.
660489	Fix an issue in the LE Power Control feature that the reported TX power level is out of range in certain minimum and maximum TX power level configurations.
666980	Fix an issue that may cause the LE power control initialization to fail due to the fixed size array reserved for supported power levels being too small in certain devices.

Fixed in release 3.1.0.0

ID #	Description
457227	Optimize the use case where an advertisement task was delayed if the scanning task was running at the same time.
485334	Fix an issue that caused the Bluetooth connection to drop when setting a breakpoint
465088	BGTool now works on MacOS 10.13 (High Sierra) and older Mac versions.
488915	The Bluetooth stack performs a version exchange before doing feature exchange to improve interoperability with devices that do not properly handle the control packets from the device in slave role.
489436	Update the slave feature request handling to improve the interoperability. Previously, the Bluetooth stack sent the slave feature request automatically when connected as the peripheral role. However, some existing master Bluetooth 4.0 implementations freeze. In order to be compliant with those master implementations, the Bluetooth stack executes the version information exchange procedure before executing the slave feature request. If the peer master is version 4.1 or newer, the slave executes the feature request procedure. For older peer implementations the slave feature request is not executed. Instead, the slave assumes the master will support the encryption feature until the master indicates otherwise.
622436	Fix the issue that timers started using Bluetooth APIs are not fired at the correct time.
628916	Fix duplicate whitelist address issue.
631755	Set Bluetooth stack component to always require HFXO.
635058	Fix an invalid packet transmission issue where the Bluetooth link layer may transmit invalid packet content if radio interrupts are delayed.
635417	Fix an issue that causes hanging during CTE reception if a corrupted packet header length was read.

ID #	Description
637232	Fix a case where the connection might be dropped with "unspecified error" code.
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	Fix an issue in the Bluetooth stack that causes the TX RF path gain to be applied twice.
649592	Update the maximum connection to 32 in the Bluetooth configuration.

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/products/software>.

ID #	Description	Workaround
337467	MGM12P has poor signal strength when doing OTA with Apploader.	None
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 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. Call command sl_bt_ota_set_rf_path() 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 sl_bt_connection_set_preferred_phy() or sl_bt_connection_set_default_preferred_phy().
656470	BGM220SC12WGA has fixed -0.5 dBm TX power.	None
669233	If the Bluetooth on-demand start feature is used, the device freezes when stopping Bluetooth during active Bluetooth connections.	Close Bluetooth connections before stopping Bluetooth.

5 Deprecated Items

Deprecated in release 3.1.0.0

BGTool

BGTool has been deprecated and it will be removed in the next major release. A new tool, Bluetooth NCP Commander, has been introduced as the replacement. It includes a modern, intuitive, web-based user interface as well as a smart console with IntelliSense and built-in API documentation.

API command `sl_bt_system_set_max_tx_power`

This command is replaced by the command `sl_bt_system_set_tx_power`, which supports setting the minimum and maximum TX powers.

API command `sl_bt_gatt_server_send_characteristic_notification`

This command is replaced by `sl_bt_gatt_server_send_notification`, `sl_bt_gatt_server_send_indication`, and `sl_bt_gatt_server_notify_all` commands.

API command `sl_bt_test_dtm_tx`

This command is replaced by `sl_bt_test_dtm_tx_v4`, which supports setting the TX power level.

6 Removed Items

Removed in release 3.1.0.0

The `sl_bt_wait_event()` function has been removed from this release. This function is the blocking mode of receiving Bluetooth events and it became incompatible with the application software architecture beginning with the v3.0 SDK. Applications can still receive events in blocking mode by calling the `sl_bt_pop_event()` function in a loop until a valid event is returned by the function.

7 Special Notices

Silicon Labs Apple® HomeKit®

Silicon Labs implementation of Apple HomeKit is not currently available in GSDK 3. Silicon Labs is committed to providing an Apple HomeKit solution and is investigating ways to add support for it in a future release. Customers developing products targeting HomeKit applications may continue development using GSDK 2.7.x releases and upgrade to GSDK 3 when HomeKit is available.

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

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 the [Simplicity Studio 5 online User's Guide](#).

Use the Bluetooth SDK v3.x with the Silicon Labs Simplicity Studio 5 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. Only use Simplicity Studio 4 with Bluetooth SDK v2.13.x and lower.

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 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>.

9 Legal

9.1 Disclaimer

Silicon Labs intends to provide customers with the latest, accurate, and in-depth documentation of all peripherals and modules available for system and software implementers using or intending to use the Silicon Labs products. Characterization data, available modules and peripherals, memory sizes and memory addresses refer to each specific device, and “Typical” parameters provided can and do vary in different applications. Application examples described herein are for illustrative purposes only. Silicon Labs reserves the right to make changes without further notice to the product information, specifications, and descriptions herein, and does not give warranties as to the accuracy or completeness of the included information. Without prior notification, Silicon Labs may update product firmware during the manufacturing process for security or reliability reasons. Such changes will not alter the specifications or the performance of the product. Silicon Labs shall have no liability for the consequences of use of the information supplied in this document. This document does not imply or expressly grant any license to design or fabricate any integrated circuits. The products are not designed or authorized to be used within any FDA Class III devices, applications for which FDA premarket approval is required, or Life Support Systems without the specific written consent of Silicon Labs. A “Life Support System” is any product or system intended to support or sustain life and/or health, which, if it fails, can be reasonably expected to result in significant personal injury or death. Silicon Labs products are not designed or authorized for military applications. Silicon Labs products shall under no circumstances be used in weapons of mass destruction including (but not limited to) nuclear, biological or chemical weapons, or missiles capable of delivering such weapons. Silicon Labs disclaims all express and implied warranties and shall not be responsible or liable for any injuries or damages related to use of a Silicon Labs product in such unauthorized applications.

9.2 Trademark Information

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