

# Release Notes

## BL652

Version 28.11.8.0

Feb 2021

Release notes are a summary of new and enhanced features, resolved issues, and known issues that are not resolved in this firmware version. This release note describes the changes and enhancements to the firmware of the BL652 *smartBASIC* based Bluetooth Low Energy Module in reverse chronological order.

For each version (excluding the initial 28.6.1.2) there are subsections for 'New Features', 'Bug Fixes' and 'Known Issues'.

BL652 firmware version numbers consist of four numbers in the format **W.X.Y.Z** which can be read back from the module by submitting the command AT I 3 when it is in command mode.

**W** signifies the module ID, which in the case of BL652 is 28.

**X** is used to indicate the underlying BLE stack version and so far, the values are:

6	Production release of Nordic's Softdevice version 3.0.0
7	Production release of Nordic's Softdevice version 5.0.0
8	Production release of Nordic's Softdevice version 5.1.0
9	Production release of Nordic's Softdevice version 6.1.0
10	Production release of Nordic's Softdevice version 7.0.1
11	Production release of Nordic's Softdevice version 7.2.0

**Y** is the release version, i.e. the major build number

**Z** is a sub-build number. When it is 0 or an even number it signifies that the firmware image is a production image that has been fully regression tested. An odd number indicates an engineering image.

## VERSION 28.11.8.0 (FEBRUARY 2021)

This firmware is built to work with v7.2.0 of the S132 Softdevice from Nordic Semiconductor which is BT Spec version 5.1 qualified.

### New Features

#### *smartBASIC*

- New flags have been added to the bond manager to indicate if a bond requires signing or is a high-strength LESC connection (Bug 18401)
- New event added if a device with a private address attempts to bond/pair and overwrite an existing bond (Bug 17959)
- New event added for central devices to process security request events from remote peripheral devices (Bug 17947)
- New event added for BLE passkey event, note that BLE\_EVBLEMSGID\_AUTH\_KEY\_REQUEST in EVBLEMSG should no longer be used (Bug 17267)
- New events added for pairing confirmation and authorization failure cases (Bug 17444)
- New function added for getting current advertising address (Bug 17328)
- New function added for getting current transmit power of a connection (Bug 17387)
- New function added for getting channel map of a connection (Bug 17436)
- New function added to retrieve BLE last authorization details (Bug 17608)
- New function added to retrieve BLE pairing information (Bug 17595)
- New function added to specify which keys to exchange with a BLE pairing request (Bug 17241)

- New functions added for scanning bond database with resolved addresses (Bugs 17405, 17451)
- Sysinfo index added to return NFC ID (Bug 18337)
- Sysinfo indexes added to return maximum BLE packet size, event length, max central connections, max peripheral connections, max combined connections (Bug 18337)
- Sysinfo indexes added to return softdevice start status code and RAM requirements (Bug 18337)
- Sysinfo\$ indexes added for device name/type at indexes 2 and 0 (Bug 18337)
- DTM configuration system overhauled to support querying of values and updating values whilst DTM mode is enabled without needing to erase filesystem (Bug 18435)
- DTM vendor command added to exit from DTM mode and erase DTM configuration which will revert back to smartBASIC mode (Bugs 17907, 18435)
- Support added for automatically discovering 128-bit UUIDs during GATT service/characteristic/descriptor discovery (Bug 9633)
- Checksum feature added (Bug 18491)
- Hash: Added new hashing functionality. (Bug 16409)
- Crypto: Added extended AES functions for 256-bit encryption. (Bug 16409)

## Changes

- BLE adverts no longer have trailing NULL byte character (Bug 17465)
- BLE bonding no longer saves bonds if the remote device does not support bondable mode (Bug 17167)
- BLE connection set aside has been replaced with event length (Bug 17443)
- Peripheral devices can use BLE Pair function to trigger a security request on remote peripheral device (Bug 17921)
- UART firmware upgrade no longer erases unused data section (Bug 17479)
- Oberon crypto library has been updated to version 3.0.6 (Bug 17935)
- I<sup>2</sup>C has been moved from instance I<sup>2</sup>C1 to instance I<sup>2</sup>C0 (Bug 17447)
- SPI has been moved from instance SPI0 to instance SPI2 (Bug 17448)
- Softdevice event length will be automatically reduced if there is insufficient memory to support the requested options (Bug 17397)
- Flash erase/write functions now retry upon a failure and the power consumption of these operations has been reduced (Bug 17372)
- Bootloader power consumption reduced (Bug 17673)
- XCompiler now supports lines up to 4096 characters in length (Bug 18476)
- XCompiler now supports larger function and object names (Bug 17363)
- TxPower level can now be set to +3dBm (Bug 18436)
- ESB feature removed due to memory limitations (Bug 18335)

## Resolved Issues

- GATT service changed feature has now been fixed (Bug 18391)
- GATT service/characteristic discovery getting stuck in a loop has now been fixed (Bug 18348)
- Issue with some functions not working when connected to multiple devices and one of the devices disconnects has been fixed (Bug 17691)
- VSP not working once a device disconnects and reconnects with a full transmit buffer has been fixed (Bug 17806)
- VSP power being incorrectly limited to 4dBm has now been fixed (Bug 17760)
- PHY exchange issue when switching to LE coded mode when peripheral side cannot support it due to limited event length causing a disconnect has been fixed (Bug 17639)
- Bootloader module lockup caused by reading non-mapped address has been fixed, note that a JLink flash is required to update the bootloader, UART upgrade of the bootloader is not supported (Bug 17012)
- Bond erase going through bonds one-by-one instead of all at once has been fixed (Bug 17342)
- Passcode event is no longer triggered for numeric comparison event (Bug 17259)
- BLE transmission buffers can now be configured (Bug 18336)
- BLE connection timeouts being rounded up to the nearest second instead of 100ms has been fixed (Bug 18403)
- BLE event length causing softdevice initialization failure when set outside value values has been fixed (Bug 17326)
- SPI slave attempting to append received data to ring buffer even when no data was received has been fixed (Bug 17446)
- SPI slave interfering with I2C has been fixed by separating them into different peripherals (Bug 17449)

- The 32-KHz clock source is no longer set to the external crystal during module startup unless this configuration option is specifically set. (Bug 16499)
- A memory leak caused when using extended advertising sets has been fixed. (Bug 16833)
- BleConnect now reads configuration which has been set using BleConnectConfig. (Bug 16842)
- DTM no longer toggles SIO\_3 and SIO\_4. (Bug 16830)

## Known Issues

- I<sup>2</sup>C might return low level error on some modules when it is used too fast or if there is a pull-up resistor missing or the device does not respond – this appears to be a Nordic Semiconductor silicon issue (Bug 9790)
- Erasing bonds, creating new bonds, changing NV records or any other flash erase/write operation when connected via BLE with many connections or a connection with a low interval may fail due to insufficient time available for flash write/erase cycle and to maintain BLE radio communication (Bug 17340)
- DTM requires “AT+DTMCFG 19 1” to be sent before DTM mode is entered to prevent radio transmission failure (Bug 18203)
- Configuration that has not been written successfully is now reset to defaults instead of continuing to run with missing settings. (Bug 16283)
- EVNFC\_FIELD\_ON is not triggered when field sensing is enabled, disabled and then re-enabled and NFC reading may not work (Bug 16663).
- High current consumption (280 µA+) when using SPI in combination with BINDEVENT functions (Bug 15944, [Nordic Errata 91](#))

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## VERSION 28.10.7.2 (MAY 2020)

This firmware is built to work with v7.0.1 of the S132 Softdevice from Nordic Semiconductor which is BT Spec version 5.1 qualified.

## New Features

No new features have been added with this firmware release.

## Resolved Issues

The following issues have been resolved in this release:

- Auto-accepting PHY changes will no longer attempt to use unsupported PHYs (Bug: 16653)
- Fixed Sysinfo\$(2) not returning the branch name (Bug: 16658)
- Crystal auto-detect code configuration value is now read correctly and only runs when enabled (Bug: 16500 and 16263)
- Configuration system will now recover if a power loss occurs before setup phase is complete (Bug: 16661)

## Known Issues

The following are known issues in this release:

- During a BLE connection, when a GATT service is changed in a GATT server, the GATT client does not receive an event notifying it of the change (Bug 9628).
- For the GATT server, the long writes feature on authorizable characters is not yet implemented and will be added in future releases (Bug 11193).
- Possible fault occurring whilst exercising SPI bus and BLE advertising (Bug 16406)
- EVNFC\_FIELD\_ON is not triggered when field sensing is enabled, disabled and then re-enabled and NFC reading may not work (Bug 16663).

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## VERSION 28.10.7.0 (FEBRUARY 2020)

This firmware is built to work with v7.0.1 of the S132 Softdevice from Nordic Semiconductor which is BT Spec version 5.1 qualified.

## New Features

The following are new features in the current version, please refer to the manual for usage.

- **smartBASIC:**
  - Capability to send and receive adverts up to 255 bytes long on any PHY.
  - Added new extended adverts functions as follows:
    - BleAdvSetCreate()
    - BleAdvSetNewData()
    - BleAdvSetStart()
    - BleAdvSetStop()
    - BleScanStartEx()
    - BleExtRptMetadata()
    - BleConnectExtended()
    - BleExtAdvRptAppendAD()
    - BleExtAdvRptAddUuid16()
    - BleExtAdvRptAddUuid128()
    - BleExtAdvRptGetSpace()
  - Added the following new events related to extended adverts (see user guide for details):-
    - EVBLE\_EXTADV\_END
    - EVBLE\_EXTADV\_RPT
    - EVBLE\_EXTSCN\_RPT
    - EVBLE\_EXTADV\_RPT\_INCOMPLETE
    - While scanning a whitelist can be specified
  - It is now possible to initiate a 2MPHY connection via extended adverts
  - Added new function to use static pass key: BlePairingStaticPasskey()
  - Added new config key 217 to specify max advert sets. Currently limited to just one.
  - Added new config key 218 to specify reserved max time for packet transmissions in a connection interval
  - Up to 28-KByte of RAM is now available for *smartBASIC* use instead of just 20 Kbyte
  - Softdevice now allocated 0x9000 bytes instead of 0xB000
  - When scanning is aborted due to a connection initiation, event EVBLE\_SCAN\_ABORTED is sent to the application.
  - Added AT I 2085 and 2086 which returns status of BLE stack startup
  - Added SYSINFO(2085) and SYSINFO(2086) which returns status of BLE stack startup

## Changes

- The File System is now 82 K instead of 64 K to accommodate large apps with debug prints.

## Resolved Issues

The following issues are resolved in this release:

- Fix to internal helper function that walks an advert report to check if an AD element already exists.
- Intermittent high current usage after floating point operation now fixed.
- Memory leak fixed when scanning and then a connection is initiated because scanning is aborted.
- Function EccCalcSharedSecret() now validates that input parameters are the right length.
- Bug Fix – One-byte SPI read was producing 16 clock cycles instead of 8.
- Bug Fix – Arithmetic overflow when a timeout greater than 2<sup>24</sup> was specified.
- AT I 2024 and SYSINFO(2024) return correct values for negative Celsius temperatures.

## Known Issues

The following are known issues in this release:

- During a BLE connection, when a GATT service is changed in a GATT server, the GATT client does not receive an event notifying it of the change (9628).
- For the GATT server, the long writes feature on authorizable characters is not yet implemented and will be added in future releases (11193).

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## VERSION 28.9.6.0 (NOVEMBER 2018)

This firmware is built to work with v6.1.0 of the S132 Softdevice from Nordic Semiconductor which is BT Spec version 5.0 qualified.

## New Features

The following are new features in the current version; please refer to the manual for usage.

- **ESB** – Added Nordic's proprietary Enhanced ShockBurst (ESB) protocol.
- **BLE** – Added ability to set channel map from smartBASIC application.
- Added utilities for extracting firmware + filesystem hex and ufw files.
- nRFx-Command-Line-Tools updated to version 9.8.1.

## Changes

- **VSP** – VSP via indicate feature is no longer supported.

## Resolved Issues

The following issues have been resolved in this release:

- **VSP** – Fixed a bug where data may be dropped when built-in VSP is used and ATT\_MTU is increased (12784).

## Known Issues

The following are known issues in this release:

- During a BLE connection, when a GATT service is changed in a GATT server, the GATT client does not receive an event notifying it of the change (9628).

- For the GATT server, the long writes feature on authorizable characters is not yet implemented and will be added in future releases (11193).

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## VERSION 28.9.5.0 (SEPTEMBER 2018)

This firmware is built to work with v6.1.0 of the S132 Softdevice from Nordic Semiconductor which is BT Spec version 5.0 qualified.

### New Features

The following are new features in the current version; please refer to the manual for usage.

- **LESC** – Added fix for Bluetooth vulnerability VU#304725 where public keys weren't validated during LESEC pairing.
- **BLE** – Added the ability to advertise and perform a connection over 2MPHY modulation.
- **Watchdog** – Exposed watchdog timer functionality through smartBASIC API.
- Moved to Softdevice v6.1.0 and SDK15.0.0.

### Resolved Issues

The following issues have been resolved in this release:

- **SPI** – Fixed bug where SPI operation would hang if the bus is not correctly configured (13287).

### Known Issues

The following are known issues in this release:

- During a BLE connection, when a GATT service is changed in a GATT server, the GATT client does not receive an event notifying it of the change (9628).
- For the GATT server, the long writes feature on authorizable characters is not yet implemented and will be added in future releases (11193).

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## VERSION 28.8.4.0 (JUNE 2018)

This firmware is built to work with v5.1.0 of the S132 Softdevice from Nordic Semiconductor which is BT Spec version 5.0 qualified.

### New Features

The following are new features in the current version; please refer to the manual for usage.

- **FLOAT** – Added the ability to declare and use float type variables and float functionality.
- **VSP** – Added the ability to configure the hardware VSP device name.
- **SPI Slave** – Added SPI Slave API to allow the BL652 to operate as an SPI Slave peripheral.
- Moved to softdevice v5.1.0 and SDK v14.2.0.

### Resolved Issues

The following issues have been resolved in this release:

- Bluetooth connection with BT5 phones (e.g. iPhone X, Samsung Galaxy S8) no longer fails when using hardware VSP (12637 & 12647).
- UART no longer locks up when two devices exchange data at different baud rates (9688).
- Fixed GPIO power consumption rise after GPIO is used as a frequency output (12531).
- RTS no longer asserts too soon after power up or reset (9625).

## Known Issues

The following are known issues in this release:

- During a BLE connection, when a GATT service is changed in a GATT server, the GATT client does not receive an event notifying it of the change (9628).
- For the GATT server, the long writes feature on authorizable characters is not yet implemented and will be added in future releases (11193).

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## VERSION 28.7.3.0 (OCTOBER 2017)

This firmware is built to work with v5.0.0 of the S132 Softdevice from Nordic Semiconductor which is BT Spec version 5.0 qualified.

## New Features

The following are new features in the current version; please refer to the manual for usage.

- **2M PHY** – Added the Bluetooth 5 feature to switch to the higher 2M PHY modulation.
- **BLE Connections** – Increased number of outgoing connections (central links) from 7 to 8.
- **Cryptography** – Added cryptographic functions for generating public/private keypair and computing shared key.
- **Authentication** – Added function for generating authenticated hash using supplied data and key.
- **Filesystem** – increased the filesystem size for smartBASIC applications from 48K to 64K.
- **Security** – Added to the ability to enable readback protection.
- Moved to softdevice v5.0.0 and SDK v14.

## Changes

The following changes have occurred to this version of the firmware.

- **L2CAP** – L2CAP functionality has been removed from the firmware and new API will be added in future releases.
- **BleMaxPacketLengthSet** – The function BleMaxPacketLengthSet has been replaced with the config key 216. To set the maximum packet length, the command 'AT+CFG 216 nNewMaxPacketLength' should be issued followed by a reset (e.g. using 'ATZ') for the new value to take effect.

## Resolved Issues

The following issues have been resolved in this release:

- Using SPI open with an invalid flag now returns the correct error response.
- The CTS and RTS pins can now be used as normal GPIO pins when the UART is opened with no handshaking.
- Connecting to certain Samsung Android devices can cause an NRF\_FAULT.

## Known Issues

The following are known issues in this release:

- During a BLE connection, when a GATT service is changed in a GATT server, the GATT client does not receive an event notifying it of the change (9628).
- For the GATT server, the long writes feature on authorizable characters is not yet implemented and will be added in future releases (11193).
- RTS is asserted too soon after on power up on reset. To overcome this, wait 200ms after CTS is asserted before sending data via the UART (9625).

## VERSION 28.6.2.0 (MAY 2017)

This firmware is built to work with v3.0.0 of the S132 Softdevice from Nordic Semiconductor which is BT Spec version 4.2 qualified.

### New Features

The following are new features in the current version; please refer to the manual for usage.

- **LE Ping** – Added the ability to use authenticated payload timeout to monitor the integrity of an encrypted link.
- **Bandwidth Configuration** – Added the option to achieve high bandwidth on first connection. This allows up to six packets to be sent per connection interval, therefore improving the BLE throughput.
- **Data in notifications and write events** – Added new events that allow BLE data to be thrown in the events therefore significantly enhancing the throughput.
- **BleVspInfo** – The length of the VSP Rx/Tx characteristics can now be returned using BleVspInfo(5).
- **Gatt Server Write** – Added a new function that allows the user to write data at a certain offset.

### Resolved Issues

The following issues have been resolved in this release:

- The unexpected behavior of UartWrite() at 921600 baud rate has now been resolved (10415).
- When a characteristic that requires authentication is written to using 'write without response' procedure, an event is now thrown to the application (EVAUTHVALEX) allowing the user to choose to accept or reject the data (11050).
- Added EVBLE\_PASSKEY event so that during passkey pairing, the connection handle is included as part of the event, therefore enabling the application to identify the device performing the pairing (11145).
- Added a function to get the maximum packet length supported by the device - BleMaxPacketLengthGet (10599).
- If slave prefers LESC pairing and master only supports legacy, the pairing fails instead of reverting back to legacy pairing (11164).

### Known Issues

The following are known issues in this release:

- During a BLE connection, when a GATT service is changed in a GATT server, the GATT client does not receive an event notifying it of the change (9628).
- For the GATT server, the long writes feature on authorizable characters is not yet implemented and will be added in future releases (11193).
- When two devices are bonded, erasing the bond on one device can sometimes cause a disconnection (9663).

## VERSION 28.6.1.4 (DECEMBER 2016)

This firmware is built to work with v3.0.0 of the S132 Softdevice from Nordic Semiconductor which is BT Spec version 4.2 compliant.

### New Features

The following are new features in the current version; please refer to the manual for usage.

- **Packet Length Extension** – Added the ability to set the maximum packet length up to 251 bytes.
- **Attribute MTU** – Added the ability to increase the maximum transmission unit for attributes, i.e. allowing GATT operations to be performed on attributes larger than 20 bytes.
- **Maximum Attribute Length** – Added ability to increase the attribute data size up to 244 bytes.
- **Long Writes** – Added support for Long Writes on both the GATT client and the GATT server.

## Resolved Issues

The following issues have been resolved in this release:

- The central device can now get an event with the connection parameter update request from the peripheral instead of being forced into accepting the peripheral's parameters.
- The Device Information service now contains the BL652 device name instead of the BL600.

## Known Issues

The following are known issues in this release:

- During a BLE connection, when a GATT service is changed in a GATT server, the GATT client does not receive an event notifying it of the change (9628).
- Unexpected behavior occurs with the UartWrite() function at 921600 baud rate when writing large amounts of data, causing data loss. As a work around the PRINT smartBASIC function can be used instead (10415).
- BleMaxPacketLengthGet() is not implemented and will be added in future releases when the softdevice supports it. If BleMaxPacketLengthSet() succeeds then that value can be saved in the smartBASIC application and used as a reference for the maximum packet length (10599).
- For the GATT server, the long writes feature on authorizable characters is not yet implemented and will be added in future releases (11193).
- When two devices are bonded, erasing the bond on one device can sometimes cause a disconnection (9663).

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## VERSION 28.6.1.2 (AUGUST 2016)

This firmware is built to work with v3.0.0 of the S132 Softdevice from Nordic Semiconductor which is BT Spec version 4.2 compliant.

## Known Issues

The following are known issues in this release:

- During a BLE connection, when a GATT service is changed in a GATT server, the GATT client does not receive an event notifying it of the change (9628).
- When adding the Device Information service to a GATT table using BleSvcRegDevInfo(), the Firmware Revision String contains the value BL600:v28.6.1.2 when it should be BL652:v28.6.1.2.

## Further Information

Further information relating to the BL652 and its firmware is available from the Laird website at <http://www.lairdtech.com/products/bl652-ble-module>