

Release Notes

BL654 and BL654PA

Version 29.5.7.2

December 2020

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 BL654 *smartBASIC* based Bluetooth Low Energy Module in reverse chronological order.

For each version (excluding the initial 29.1.1.0) there are subsections for New Features, Bug Fixes, and Known Issues.

BL654 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+I3 when it is in command mode.

W signifies the module ID, which in the case of BL654 is 29.

X is used to indicate the underlying BLE stack version and so far the values have been:

- 1 Production release of Nordic's Softdevice version 6.0.0
- 2 Production release of Nordic's Softdevice version 6.1.0
- 3 Production release of Nordic's Softdevice version 6.1.1
- 4 Production release of Nordic's Softdevice version 7.0.1
- 5 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 29.5.7.2**
- **Version 29.4.6.6**
- **Version 29.4.6.0**
- **Version 29.3.5.0**
- **Version 29.3.3.0**
- **Version 29.2.2.0**
- **Version 29.1.1.0**

Version 29.5.7.2

December 2020

This firmware is built to work with v7.2.0 of the S140 Softdevice from Nordic Semiconductor which is BT Spec version 5.1 qualified. The firmware is for both BL654 and BL654PA modules.

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 17961)
- 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 if TX power has been limited on PALNA firmware due to a channel map from a remote device (Bug 17928)
- 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 authorisation 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 authorisation 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 17506)
- Sysinfo indexes added to return maximum BLE packet size, event length, max central connections, max peripheral connections, max combined connections (Bug 17399)
- Sysinfo indexes added to return softdevice start status code and RAM requirements (Bug 17396)
- Sysinfo\$ indexes added for device name/type at indexes 2 and 0 (Bug 16334)
- DTM configuration system overhauled to support querying of values and updating values whilst DTM mode is enabled without needing to erase filesystem (Bug 17425)
- DTM vendor command added to exit from DTM mode and erase DTM configuration which will revert back to smartBASIC mode (Bugs 17907, 17897)
- Support added for automatically discovering 128-bit UUIDs during GATT service/characteristic/descriptor discovery (Bug 9633)
- (Experimental - no support is provided for this feature) support added to have multiple connections as a peripheral device (Bug 17265)

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 GATT firmware string is now the same as 'at i 2' response (Bug 17677)
- BLE connection set aside has been replaced with event length (Bug 17443)
- BLE packet size is now automatically reduced on PALNA firmware if it is too large (Bug 17398)
- 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 17933)
- I²C has been moved from instance I²C1 to instance I²C0 (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 17364)
- XCompiler now supports larger function and object names (Bug 17363)

Resolved Issues

BL654PA

- PHY exchange not working if remote device requesting LE coded without 1M support has been fixed (Bug 17770)
- Power limitation applying to all connections when it should only apply to one after a channel map exchange has been fixed (Bug 17438)

BL654 and BL654PA

- GATT service changed feature has now been fixed (Bug 9628)
- GATT service/characteristic discovery getting stuck in a loop has now been fixed (Bug 17841)
- 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 17325)
- BLE connection timeouts being rounded up to the nearest second instead of 100ms has been fixed (Bug 17309)
- BLE event length causing softdevice initialisation 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)

Known Issues

BL654PA

- While operating in peripheral mode, a central device may change the channel mask. Transmit power will be limited to +14 dBm at this point to keep the BL654PA within regulatory limits (Bug 16823)

BL654 and BL654PA

- I²C 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)

Version 29.4.6.6

June 2020

This firmware is built to work with v7.0.1 of the S140 Softdevice from Nordic Semiconductor which is BT Spec version 5.1 qualified. The firmware is for both BL654 and BL654PA modules.

New Features

smartBASIC

- SetREGOUT0 and GetREGOUT0 functions added to set/get register value that sets VDD to power external components while the module is operating in high voltage mode. (Bug 16469)
- Hash: Added new hashing functionality. (Bug 16409)
- Crypto: Added extended AES functions for 256-bit encryption. (Bug 16409)

Changes

- Flash space available for *smartBASIC* applications is increased from 64 KB to 80 KB. (Bug 16518)
- The high bandwidth mode (and corresponding configuration key) no longer has any effect. This functionality was replaced with connection set-aside time configuration. Note that applications that set the high bandwidth configuration value will still seem to set them correctly but will not have any change on module/radio configuration. (Bug 16533)

Resolved Issues

BL654PA

- Max packet length can be set to 200 bytes on 1M and 2M PHY at +18 dBm. (Bug 16002)

BL654 and BL654PA

- *smartBASIC* function sysinfo\$(2) now returns product name as a string. (Bug 16333)
- Advert properties for LE Coded PHY are fixed so they can be scannable. (Bug 16364)
- Fixed REGOUT0 AT command so that any attempt to overwrite it returns an error message instead of corrupting the value. (Bug 16195)
- Configuration that has not been written successfully is now reset to defaults instead of continuing to run with missing settings. (Bug 16283)
- 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 16828)

Known Issues

BL654PA

- While operating in peripheral mode, a central device may change the channel mask. Transmit power will be limited to +14 dBm at this point to keep the BL654PA within regulatory limits. (Bug 16823)

Version 29.4.6.0

December 2019

This firmware is built to work with v7.0.1 of the S140 Softdevice from Nordic Semiconductor which is BT Spec version 5.1 qualified. The firmware has NOT been tested on a BL654PA module.

New Features

The following are new features in the current version. Please refer to the manual for additional information and usage.

*smart*BASIC

- Added StrEncodeXXX() and StrDecodeXXX() functions. See details in updated core user guide.
 - So that AD elements can be read/written into large adverts
- Capability to send and receive adverts up to 255 bytes long on any PHY.
- LE_CODED connections can be initiated off LE_CODED adverts hence long-range reconnection.
- Added new extended adverts functions as follows:

– BleAdvSetCreate()	– BleConnectExtended()
– BleAdvSetNewData()	– BleExtAdvRptAppendAD()
– BleAdvSetStart()	– BleExtAdvRptAddUuid16()
– BleAdvSetStop()	– BleExtAdvRptAddUuid128()
– BleScanStartEx()	– BleExtAdvRptGetSpace()
– BleExtRptMetadata()	
- 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
 - Added new function to use static pass key: BlePairingStaticPasskey()
 - Added new 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 180 KByte of RAM is now available for *smart*BASIC use instead of just 16 Kbyte.
- When scanning is aborted due to a connection initiation, event EVBLE_SCAN_ABORTED is sent to the application.

Changes

- No changes to existing functionality.

Resolved Issues

The following issues have been resolved in this release:

- Provided a fix to internal helper function that walks an advert report to check if an AD element already exists.
- Previously, BleSetTxPower() was failing before any adverts were started. This issue is fixed.
- In DTM mode, only the first 32 GPIO pins could be manipulated. With this release, all 48 can be manipulated.
- AT I 2021 and SYSINFO(2021) now works properly to return stack tide mark.
- Intermittent high current usage after floating point operation is now fixed.
- Fixed memory leak that occurred when scanning and then a connection was initiated because scanning was aborted.

Known Issues

- Writing REGOUT0 more than once corrupts the value of this register instead of returning an error. Flash should be erased and reprogrammed with 29.4.6.0 firmware image if this occurs. (Bug 16195)

Version 29.3.5.0

July 2019

This firmware is built to work with v6.1.1 of the S140 Softdevice from Nordic Semiconductor which is BT Spec version 5.0 qualified. It is a combined image that will work with standard BL654 and also with BL654PA after a one-time firmware configuration using the AT+PALNA command.

New Features

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

PA

- Unified firmware for PA/non-PA variants of the BL654
 - The command AT+PALNA is used to persistently morph the module into the PA variant
 - PA variant allows up to +18 dBm transmit power

smartBASIC:

- GpioBindEvent() can detect changes in 8 inputs, increased from 4, hence 4 new events added
- Enhanced UART api so that CTS changes can be configured to send new EVAUXCTS or EVUARTCTS events
- Added AT+CFG 120 key which allows nAutorun to be any allowable gpio and also allow setting of active state
- Added StrMove() and StrExchange() core functions to improve speed in buffer management
- Added UartIoctl() function to allow RTS/TX output drive control (e.g. open drain)
- Added AuxIoctl() function to allow RTS/TX output drive control (e.g. open drain)
- Added Floating Point capability

Changes

- **DTM:** Functionality updated to v5 from SDK v15.2.

Resolved Issues

The following issues have been resolved in this release:

- Negative temperature readings incorrectly returned by SYSINFO(2014) (Bug: 14729)
- Intermittent high doze current after floating point is used (Bug: 14664)
- Unexpected behavior when connecting while scanning (Bug: 14210)
- sampe sb apps were using AssertBL652() instead of BL654()
- Some warm reset based commands were not sending OK post reset
- When xcompiling a long-dash character (ascii 0x96) did not result in syntax error
- Missing binary operator in arithmetic expression was not detected as an error

Known Issues

The following are known issues in this release:

- Advertising extensions is only provided as an experimental feature in this release and the API may be modified and updated in future releases.
- 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).
- NFC FIELD ON event is not triggered when field sensing is disabled then enabled (Bug 13244).

Version 29.3.3.0

December 2018

This firmware is built to work with v6.1.1 of the S140 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.

- **QSPI:** Added the ability to allow BL654 to operate as a QSPI master.
- **BLE:** Maximum number of connections increased from 8 to 16.
- **BLE:** Added ability to set channel map from smartBASIC application.
- **CRC:** added CRC16 and CRC32 error detection functions.
- nRFx-Command-Line-Tools updated to version 9.8.1.
- Moved to Softdevice v6.1.1 and SDK 15.2.0.

Changes

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

Resolved Issues

The following issues have been resolved in this release:

- **BLE** – Fixed a bug where invalid latency limit was calculated (12463)
- **UART** – Fixed a bug where standby doze (SYSTEM ON IDEL) current was not achieved (13699)

Known Issues

The following are known issues in this release:

- Advertising extensions is only provided as an experimental feature in this release and the API may be modified and updated in future releases.
- 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).
- NFC FIELD ON event is not triggered when field sensing is disabled then enabled (Bug 13244).

Version 29.2.2.0

August 2018

This firmware is built to work with v6.1.0 of the S140 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:** Advertising, scanning and connecting over CODED PHY is now supported.
- **Watchdog:** Exposed Watchdog timer functionality through smartBASIC API.
- **SPI Slave:** Added SPI Slave API to allow the BL654 to operate as an SPI Slave peripheral.
- **UART:** Added new API to allow the second UART peripheral to be used.
- **Flash:** Added new high-level API for accessing external flash.
- Moved to Softdevice v6.1.0.

Resolved Issues

The following issues have been resolved in this release:

- **DTM** – Added missing Tx power values (2dBm, 5dBm, 6dBm, 7dBm and 8dBm).
- **DTM** – Fixed sensitivity issues on engineering B and C silicon.
- **BLE** – Fixed an issue where a connection timeout event was being thrown instead of a scanning timeout event (13196).
- **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:

- Advertising extensions is only provided as an experimental feature in this release and the API may be modified and updated in future releases.
- 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).

Version 29.1.1.0

May 2018

This firmware is built to work with v6.0.0 of the S140 Softdevice from Nordic Semiconductor which is BT Spec version 5.0 qualified.

Known Issues

The following are known issues in this release:

- CODED PHY functionality is not Bluetooth qualified in this release. This feature is available for development and testing purposes only.
- Advertising in CODED PHY is not supported and will be provided in future versions of the firmware.
- 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).

Further Information

Further information relating to the BL654 and its firmware is available from the Ezurio website at <https://www.ezurio.com/wireless-modules/bluetooth-modules/bluetooth-5-modules/bl654-series-bluetooth-module-nfc>