

ANT_S332_nrf52832_4.0.2 release notes

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ANT_S332_nrf52832_4.0.2

The ANT_S332_nrf52832_4.0.2 SoftDevice for the nRF52 platform is based upon the ANT_S212_nrf52832_4.0.2 (ANT) SoftDevice and S132 v4.0.2 (BLE) SoftDevice combined.

SoftDevice Properties

- The SoftDevice Specification for the S332 is available on the [ANT website](#)
- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.1.0
 - The changes from the previous version are header file modifications only.
- The combined MBR and SoftDevice memory requirements for this version is as follows:
 - Flash: **168kB** (0x29000 bytes)
 - RAM: **7.73kB** (0x1E30 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)

New functionality

- **SoftDevice**
 - The SoftDevice now supports sleep clock accuracy values less than 20 ppm as a peripheral (DRGN-8158).
- **ANT**
 - A new API function, `sd_ant_channel_open_with_offset`, has been added to allow the start time of the channel to be configured. When used, the channel will start at a specified offset from the time of the API call instead of a fixed offset relative to existing channels. This can be used to manage spacing between multiple master channels on the same device in use cases where channel diversity is required for high traffic environments.
 - A new API function, `sd_ant_channel_radio_crc_mode_set`, has been added that allows the CRC to be configured to three bytes instead of the default two. This change reduces the chance of receiving invalid packets in noisy environments. This mode is incompatible with existing devices using the default two byte CRC mode.
 - ANT channels can now run at a faster rate. This can also improve performance in some multi-channel use cases.

| | V 2.0.1 | V 4.0.2 |
|------------------------|---------|---------|
| Master Channel | 224 Hz | 270 Hz |
| Master Tx Only Channel | 442 Hz | 1129 Hz |

- **BLE**
 - Support for 20 links in total with freely selectable role (Central/Peripheral) for each link (DRGN-7102, DRGN-7152, DRGN-7848).
 - The BLE bandwidth configuration and application packet concept has been replaced with per link configurable:
 - Event length (DRGN-7858)
 - Write without response queue size (DRGN-7488, DRGN-7858)
 - Handle Value Notification queue size (DRGN-7487, DRGN-7858)
 - The GPIO pin to toggle can now be the same for PA and LNA (DRGN-8354).
- **LL**
 - The SoftDevice can be configured to disable and enable slave latency (DRGN-8305). This allows the application to override the slave latency set by the master.
 - The SoftDevice can be configured to not disconnect if the peer initiates parallel version and feature exchange procedures (DRGN-8306).
- **GAP**
 - The event length (i.e. the time set aside on every connection interval) can now be configured per link by the application (DRGN-7858).
 - The application is given control of the Data Length Update Procedure. The application can initiate the Data Length Update Procedure and has to respond when initiated by the peer (DRGN-8297).
- **GATT**
 - The maximum ATT_MTU can now be configured per link by the application (DRGN-7858).
- **GATTC**
 - The application packet concept has been replaced with a dedicated transmission queue for Write without responses. Also, the `BLE_EVT_TX_COMPLETE` event has been replaced with `BLE_GATTC_EVT_WRITE_CMD_TX_COMPLETE`. Write without response queue size can now be configured per link by the application (DRGN-7488, DRGN-7858).
- **GATTS**
 - The application packet concept has been replaced with a dedicated transmission queue for Handle Value Notifications. Also, the `BLE_EVT_TX_COMPLETE` event has been replaced with `BLE_GATTS_EVT_HVN_TX_COMPLETE`. Handle Value Notification queue size can now be configured per link by the application (DRGN-7487, DRGN-7858).

Changes

- **SoftDevice**
 - `SWI3` is no longer reserved for use by the SoftDevice and is available for the application (DRGN-8367).
 - The `sd_power_ramon_set()`, `sd_power_ramon_clr()`, and `sd_power_ramon_get()` SoftDevice APIs have been replaced with `sd_power_ram_power_set()`, `sd_power_ram_power_clr()`, and `sd_power_ram_power_get()`, so the application now has access to the registers `RAM[x].POWER` instead of the deprecated `RAMON/RAMONB` (DRGN-8117).
- **ANT**
 - When receiving acknowledged messages, if the previous message has not been handled the ANT stack will no longer acknowledge the message and generate an event message for the application (`EVENT_RX_DATA_OVERFLOW`).
- **BLE**
 - Configuration parameters passed to `sd_ble_enable()` have been moved to the SoftDevice configuration API (DRGN-8107)
 - More pointers have been defined as `const` in the BLE API, allowing the application to put more data into flash instead of RAM, if desired (DRGN-6133).

Bug fixes

- **SoftDevice**
 - `sd_softdevice_enable()` now returns an error code if called with `fault_handler` set to `NULL` or to an invalid function pointer. If the application returns from the `fault_handler` function, the SoftDevice will do an `NVIC_SystemReset()` (DRGN-7122).
 - It is no longer required to clear `INTENSET` for `TIMER0` before the timeslot ends, if the application uses `TIMER0` inside a timeslot scheduled with the Radio Timeslot API (DRGN-7776).
 - The `SVCALL` macro can now be used with the GCC C++ compiler as well (DRGN-8028).
 - The `sd_power_pof_threshold_set` API has been fixed to support all the new levels that were introduced in nRF52 (DRGN-8348).
 - Fixed an issue where scanning or advertising with timeout greater than 256 seconds and having two host protocol timers running at the same time might lead to delayed timeouts (DRGN-7804).

- **ANT**

- Fixed an issue that caused `sd_softdevice_disable` to block for an extended period of time if there were ANT channels running.
- Fixed an issue that caused a divide by zero fault if the channel period is set to zero. The function `sd_ant_channel_period_set` will now return an error when called with a channel period of zero.
- Fixed an issue where an encryption session could be desynchronized if a second encrypted master channel is started on the same device.
- Fixed an issue where encryption negotiation would complete erroneously if acknowledged messages are sent or received on other channels.
- Fixed an issue where high duty search could cause an assert in certain scenarios.
- Fixed an issue where `sd_ant_enable()` could return success if the memory size provided was insufficient for the channel configuration in certain scenarios.

- **BLE**

- Several Doxygen documentation errors have been corrected (DRGN-7386, DRGN-7853, DRGN-8136).

- **LL**

- Fixed an issue where the controller completed a procedure when it received an `LL_UNKNOWN_RSP` without checking if it was the expected procedure that returned the error opcode (DRGN-7999).
- The SoftDevice no longer rejects `LL_LENGTH_REQ` and `LL_LENGTH_RSP` with parameters which are out of range according to Bluetooth 4.2 specification (DRGN-7872).
- Fixed an issue where bit errors in the length field of an encrypted packet caused the packet to be interpreted as longer than was sent by the peer (DRGN-7898). This issue could have manifested in the following ways:
 - SoftDevice memory buffer corruption which could lead to an assert or incorrect behavior.
 - SoftDevice may send a packet with an incorrect MIC field leading to a disconnect from the peer.
- Fixed an issue where the SoftDevice would only be able to send two packets per connection event after a Data Length Update Procedure to a LL Data Channel PDU payload size of more than 34 bytes (DRGN-8392).
- Fixed an issue where a connection parameter update from a short connection interval to a longer connection interval when using long ATT MTUs could lead to reduced bandwidth (DRGN-8427).
- Fixed an issue where using more than eight links and receiving a lot of data concurrently could lead to undefined behavior (DRGN-8433).
- Fixed an issue where using encryption on multiple master links at the same time could cause an assert (DRGN-8532).

- **GATTC**
 - It is no longer possible to issue a write command if the write command queue size is set to 0 on the config API (DRGN-8353).
- **GATTS**
 - It is no longer possible to issue an HVN if the HVN queue size is set to 0 on the config API (DRGN-8353).
- **GAP**
 - Two missing Advertising Data Types have been added:
`BLE_GAP_AD_TYPE_LESC_CONFIRMATION_VALUE (0x22)` and
`BLE_GAP_AD_TYPE_LESC_RANDOM_VALUE (0x23)` (DRGN-8101).
 - `sd_ble_gap_connect()` now always stops the scanner (DRGN-7679).
 - Fixed an issue where `sd_ble_gap_conn_param_update()` called in peripheral role in some cases may return `NRF_ERROR_BUSY` for 30 seconds after the previous procedure initiated by that call was completed (DRGN-8577).
 - Fixed an issue where the `conn_handle` parameter in the event `BLE_GAP_EVT_DATA_LENGTH_UPDATE_REQUEST` was not populated correctly (DRGN-8749).
 - Fixed an issue where the Softdevice would assert when `sd_ble_gap_device_identities_set()` was called while advertiser is running (DRGN-8634).

Limitations

- **SoftDevice**
 - If Radio Notifications are enabled, flash write and flash erase operations initiated through the SoftDevice API will be notified to the application as Radio Events (FORT-809).
 - Synthesized low frequency clock source is not tested or intended for use with the ANT or BLE stack.
 - Internal RC oscillator clock source is not tested or intended for use with the ANT stack.
 - Applications must not modify the `SEVONPEND` flag in the `SCR` register when running in priority level 2 or 3 as this can lead to undefined behavior.
- **GATTS**
 - To conform to the Bluetooth specification there shall not be a secondary service that is not referenced somehow by a primary service. The SoftDevice does not enforce this (DRGN-906, DRGN-2260).

Known Issues

- **SoftDevice**
 - If Connection Event Length Extension is enabled, the Radio Notification may be suppressed between connection events (DRGN-7687).
 - Calling `sd_ble_gap_sec_params_reply()`, `sd_ble_user_mem_reply()`, or `sd_ble_gatts_rw_authorize_reply()` more than 6 times without pulling events in between in some cases may lead to link disconnect (DRGN-8627).
 - If the SoftDevice is configured with 0 Peripheral roles and 0 Central roles, `sd_ble_enable()` may corrupt up to 8 bytes above the returned `app_ram_base`. For applications having such a configuration, set the application RAM start to 8 bytes or more above the returned `app_ram_base` (DRGN-8802).
- **GAP**
 - The `BLE_GAP_DATA_LENGTH_AUTO` value for `p_dl_params->max_tx_octets` and `p_dl_params->max_rx_octets` in `sd_ble_gap_data_length_update()` does not work as expected on connections using a configuration with configured event length of 2, 3 or 4, when maximum ATT_MTU in the same connection configuration is more than 69, 147 or 225 octets respectively. In these cases `sd_ble_gap_data_length_update()` will return error code `NRF_ERROR_RESOURCES`, and not have an effect (DRGN-8779).
- **GATTS**
 - When `BLE_EVT_USER_MEM_REQUEST` event is pulled by the application, incoming packet processing may be delayed in some cases until the application replies with the `sd_ble_user_mem_reply()` call (DRGN-8595).
 - The value of the attribute in `BLE_GATTS_EVT_RW_AUTHORIZE_REQUEST` event corresponding to the first Prepare Write Request on a link with heavy traffic may get corrupted if the application delays the pulling of SoftDevice events (DRGN-8595).

ANT_S332_nrf52832_2.0.1

The ANT_S332_nrf52832_2.0.1 SoftDevice for the nRF52 platform is based upon the ANT_S212_nrf52832_2.0.1 (ANT) SoftDevice and S132 v3.0.0 (BLE) SoftDevice combined.

SoftDevice Properties

- The SoftDevice Specification for the S332 is available on the [ANT website](#)
- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.0.0
- The combined MBR and SoftDevice memory requirements for this version is as follows:
 - Flash: **168kB** (0x29000 bytes)
 - RAM: **7.73kB** (0x1E30 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)

Compatibility

Compatible with Rev C and Rev 1

Bug fixes

- **ANT**
 - Fixed an issue where encrypted channel negotiation could fail if non-zero encryption key indexes were used.

Limitations

- **SoftDevice**
 - If Radio Notifications are enabled, flash write and flash erase operations initiated through the SoftDevice API will be notified to the application as Radio Events (FORT-809).
 - Synthesized low frequency clock source is not tested or intended for use with the BLE stack.
 - Applications must not modify the `SEVONPEND` flag in the `SCR` register when running in priority level 2 or 3 as this can lead to undefined behavior.
 - If the application uses `TIMER0` inside a timeslot (scheduled with the Radio Timeslot API), `INTENSET` for `TIMER0` must be cleared before the timeslot ends (DRGN-7776).
- **LL**
 - The peripheral role has priority over the central role when it comes to keeping the links alive.
- **GAP**
 - A broadcaster **and** a scanner cannot both be active if there are 8 connections established (DRGN-6543).
- **GATTS**
 - To conform to the Bluetooth specification there shall not be a secondary service that is not referenced somehow by a primary service. The SoftDevice does not enforce this (DRGN-906, DRGN-2260).

Known Issues

- **SoftDevice**

- If `sd_softdevice_enable()` is called with `fault_handler` set to `NULL`, to an invalid function pointer or a pointer to a returning function, the behavior will be undefined (DRGN-7122).
- If Connection Event Length Extension is enabled, the Radio Notification may be suppressed between connection events (DRGN-7687).

- **GAP**

- When `sd_ble_gap_connect()` returns an error code, the scanner may be stopped (DRGN-7679). To ensure the scanner is in a known state, `sd_ble_gap_scan_stop()` should be used to stop the scanner when `sd_ble_gap_connect()` returns an error code.

ANT_S332_nrf52832_2.0.0

The ANT_S332_nrf52832_2.0.0 SoftDevice for the nRF52 platform is based upon the ANT_S212_nrf52832_2.0.0 (ANT) SoftDevice and S132 v3.0.0 (BLE) SoftDevice combined.

SoftDevice Properties

- The SoftDevice Specification for the S332 is available on the [ANT website](#)
- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.0.0
- The combined MBR and SoftDevice memory requirements for this version is as follows:
 - Flash: **168kB** (0x29000 bytes)
 - RAM: **7.73kB** (0x1E30 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)

Compatibility

Compatible with Rev C and Rev 1

New functionality

- **ANT**
 - **High Duty Search:** High duty search uses the entire available resources of the radio to search for a master device. The effect is that latency to acquire the master device is significantly reduced to an average of ½ period assuming ideal RF conditions. This mode of operation consumes high power while in search and should only be used in applications that have considerable power resources available. This feature can be used with standard search and background scan.
 - **Time Sync:** This feature allows independent devices to synchronize the time at which an event was generated on the transmitting device in the time base of the receiving device(s). Using this method multiple devices can synchronize themselves within two clock ticks. Some examples of usage could include synchronizing data between sensors, LED blinking on devices, or movement in autonomous robotics
 - **Scalable Channels**
 - The application can now specify the size of the event queue on a per channel basis. This allows the application to define a bigger event queue in the case where there is large latency in event processing and the default size of the event queue is not large enough.
 - Encryption keys are now stored in application RAM.
 - **PA/LNA:** New API support to enable/disable switching of external Power Amplifiers and Low Noise Amplifiers using GPIO pins for ANT.

- **SoftDevice**
 - The effect of connection interval on bandwidth is reduced. If free time is available, extra packets compared to the configured bandwidth will be sent in a connection interval. (DRGN-7561)
- **LL**
 - Data length extension feature support (DRGN-7245)
 - LE Privacy feature support (DRGN-7199)
- **GAP**
 - LE ping feature support. (DRGN-7015, DRGN-7603).
- **GATT**
 - Long ATT_MTU support (DRGN-7346, DRGN-7651, DRGN-7610)

Changes

- **ANT**
 - The ANT version string has been changed to a different format. There are now three numbers and no build letters. The numbers are Major.Minor.Bugfix. Major denotes an API breaking change, Minor denotes a non-API breaking change and Bugfix is a release where only bugs were fixed.
 - The `ANT_ENABLE` structure has a new field called `usNumberOfEvents` that denotes the number of events the ANT stack should use. There is a compulsory change to the `ANT_ENABLE_GET_REQUIRED_SPACE` macro that takes the number of events as well.
 - The functions `sd_ant_coex_config_get` and `sd_ant_coex_config_set` now take an `ANT_BUFFER_PTR` struct as an argument instead of a `uint8_t` array.
- **BLE**
 - Enumeration `BLE_CONN_BW_NONE` is renamed to `BLE_CONN_BW_INVALID`
- **GAP**
 - The Tx power level configuration API has been updated to support the +3dBm power level (DRGN-7644).
- **SoftDevice**
 - New interfaces added for set, get, clear for both `GPREG` registers (`SD_POWER_GPREGRET_GET/CLEAR/SET`).

Bug fixes

- **ANT**
 - Event Filtering no longer generates event interrupts when a filtered event occurs in the stack.
- **GAP**
 - Fixed an issue where pairing with passkey entry would fail if the keypress notification was received in the same connection event as the pairing response (DRGN-7680).

Limitations

- **SoftDevice**
 - If Radio Notifications are enabled, flash write and flash erase operations initiated through the SoftDevice API will be notified to the application as Radio Events (FORT-809).
 - Synthesized low frequency clock source is not tested or intended for use with the BLE stack.
 - Applications must not modify the `SEVONPEND` flag in the `SCR` register when running in priority level 2 or 3 as this can lead to undefined behavior.
 - If the application uses `TIMER0` inside a timeslot (scheduled with the Radio Timeslot API), `INTENSET` for `TIMER0` must be cleared before the timeslot ends (DRGN-7776).
- **LL**
 - The peripheral role has priority over the central role when it comes to keeping the links alive.
- **GAP**
 - A broadcaster **and** a scanner cannot both be active if there are 8 connections established (DRGN-6543).
- **GATTS**
 - To conform to the Bluetooth specification there shall not be a secondary service that is not referenced somehow by a primary service. The SoftDevice does not enforce this (DRGN-906, DRGN-2260).

Known Issues

- **SoftDevice**

- If `sd_softdevice_enable()` is called with `fault_handler` set to `NULL`, to an invalid function pointer or a pointer to a returning function, the behavior will be undefined (DRGN-7122).
- If Connection Event Length Extension is enabled, the Radio Notification may be suppressed between connection events (DRGN-7687).

- **GAP**

- When `sd_ble_gap_connect()` returns an error code, the scanner may be stopped (DRGN-7679). To ensure the scanner is in a known state, `sd_ble_gap_scan_stop()` should be used to stop the scanner when `sd_ble_gap_connect()` returns an error code.

ANT_S332_nrf52832_1.0.2

The ANT_S332_nrf52832_1.0.2 SoftDevice for the nRF52 platform is based upon the ANT_S212_nrf52832_1.0.2 (ANT) SoftDevice and S132 v2.0.1 (BLE) SoftDevice combined.

SoftDevice Properties

- An updated SoftDevice Specification for the S332 is available on the [ANT website](#)
- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.0.0
- The combined MBR and SoftDevice memory requirements for this version is as follows:
 - Flash: **156kB** (0x27000 bytes)
 - RAM: **6.02kB** (0x1780 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)

Compatibility

Compatible with Rev C and Rev 1

New functionality

- **ANT**
 - Group Transmitter Initiation will allow a master device to choose a more optimal time to transmit in crowded environments, but may result in increased startup latency compared to standard channels. The `sd_ant_channel_search_timeout_set` call has been modified to configure Group Transmitter Initiation.

Changes

- **ANT**
 - `sd_ant_channel_rx_search_timeout_set` has been renamed to `sd_ant_channel_search_timeout_set`
- **GATTS**
 - The GATTS documentation has been updated to include additional error codes (DRGN-7252).

Bug fixes

- **ANT**
 - Under certain timing conditions a call to `sd_ant_stack_reset` would never return. There is a new error code for `sd_ant_stack_reset` for cases where the operation timed out.
- **SoftDevice**
 - Calling `sd_power_pof_threshold_set` will now configure the power-fail comparator correctly (DRGN-7280).

- Calling `sd_ecb_block_encrypt` will no longer prevent the application from entering sleep mode (DRGN-7381).
- The instantiation of `nrf_nvic_state_t` shown in a code example in `nrf_nvic.h` is now correctly zero-initialized (DRGN-7198).
- Several doxygen documentation errors have been corrected (DRGN-7134).
- **Link Layer**
 - The supervision timeout of the slave link will no longer expire due to priority issues (DRGN-7308).
 - The Link Layer will no longer trigger an invalid assertion while performing connection parameter updates under certain circumstances (DRGN-7246).
 - The SoftDevice will now timely deliver scan response reports (DRGN-7153).
- **GAP**
 - Security: The SoftDevice will no longer assert during pairing/bonding using LESC numerical comparison under certain circumstances (DRGN-7235).
 - Security: The SoftDevice will now interrupt pairing procedures where the key size is smaller than the one requested by the application (DRGN-7125).

Limitations

- **SoftDevice**
 - If Radio Notifications are enabled, flash write and flash erase operations initiated through the SoftDevice API will be notified to the application as Radio Events (FORT-809).
 - Synthesized low frequency clock source is not tested or intended for use with the BLE stack.
 - Applications must not modify the `SEVONPEND` flag in the `SCR` register when running in priority level 2 or 3 as this can lead to undefined behavior.
- **LL**
 - The peripheral role has priority over the central role when it comes to keeping the links alive.
- **GAP**
 - A broadcaster **and** a scanner cannot both be active if there are 8 connections established (DRGN-6543).
- **GATTs**
 - To conform to the Bluetooth specification there shall not be a secondary service that is not referenced somehow by a primary service. The SoftDevice does not enforce this (DRGN-906, DRGN-2260).

Known Issues

- **ANT**
 - **Under** Asynchronous ANT traffic can cause a synchronous channel on the same device to become misaligned and periodically drop connections. The probability of this increases as asynchronous ANT traffic increases.

ANT_S332_nrf52832_0.9.1.alpha

The ANT_S332_nrf52832_0.9.1.alpha SoftDevice for the nRF52 platform is based upon the ANT_S212_nrf52832_0.9.1.alpha(ANT) SoftDevice and S132 v2.0.0 (BLE) SoftDevice combined.

SoftDevice Properties

- An updated SoftDevice Specification for the S132 is available at <http://infocenter.nordicsemi.com/>
- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.0.0
- The combined MBR and SoftDevice memory requirements for this version is as follows:
 - Flash: **156kB** (0x27000 bytes) This number is subject to change before the production release.
 - RAM: **6.02kB** (0x1780 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)

Compatibility

Compatible with Rev C and Rev 1

New functionality

- **SoftDevice**
 - The configuration of the 32 kHz RCOSC calibration in `sd_softdevice_enable()` has been made more flexible (DRGN-6362). It now supports more calibration intervals, and the ability to combine temperature and time triggered calibration.
- **GAP**
 - Support for LE Secure Connections has been added, along with all required API changes to enable it. This change requires applications making use of GAP security APIs to adapt to the new interface (DRGN-3979).
- **L2CAP**
 - The `sd_ble_l2cap_*` APIs now support packets longer than 23 bytes (DRGN-6649).

Changes

- **SoftDevice**
 - The timeslot API clock source selection API has been improved (DRGN-5882).
 - The documentation for `sd_softdevice_enable()` has been corrected to no longer state idempotence (DRGN-6910).
 - The documentation for `opt_id` in `sd_ble_opt_set()` and `sd_ble_opt_get()` has been expanded (DRGN-6912).
 - The `sd_nvic_*` API calls have changed from being SV calls to being implemented as static functions in the new `nrf_nvic.h` header file (DRGN-7131).
 - The application priority enumeration has been removed. The application now has four interrupt priority levels available: levels 2, 3, 6 and 7 (DRGN-6350).
 - The `softdevice_assert.h` header file is no longer part of the SoftDevice API (DRGN-2548).

- The `nrf_svc.h` header file has been updated to be compatible with all GCC versions (DRGN-6747).
- All header files now include C++ guards (DRGN-6777).
- Type definitions for certain basic types have been removed (DRGN-5348).
- The number of PPI channels available for the application when the SoftDevice is enabled has been increased to 17 (DRGN-6131).
- **BLE**
 - The Message Sequence Charts (MSCs) have been corrected, extended and improved (DRGN-6529).
 - It is now possible for the application to queue outgoing packets and process incoming packets during the connection event. As a result of this more packets can be sent and received per connection event (DRGN-6785).
 - The documentation for bandwidth configuration of BLE connections has been rewritten to improve its readability (DRGN-6911).
 - A new error code, `NRF_ERROR_CONN_COUNT`, is now returned when invalid or unsupported connection counts are specified by the application (DRGN-6921).
 - Variable length fields in SoftDevice events are now defined as arrays of size 1 to ensure compatibility with a wider range of compilers (DRGN-6975).
 - The API to configure the bandwidth of BLE connections is now functional. The application can configure the bandwidth of BLE connections with the `BLE_OPT_CONN_BW_SET` option before the BLE connection is established (DRGN-6468). When using the configurable bandwidth option the application must have specified beforehand, at BLE stack initialization time, a set of connection bandwidth that includes the ones that it intends to use through this option. The `sd_ble_gap_connect()` and `sd_ble_gap_adv_start()` SV calls can now return `NRF_ERROR_NO_MEM` if there is not enough memory to honor the requested bandwidth configuration.
- **GATTS**
 - The `ble_gatts_attr_context_t` field has been replaced with a `ble_uuid_t` in the `ble_gatts_evt_write_t` and `ble_gatts_evt_read_t` structures (DRGN-6825).
 - The documentation for `sd_ble_gatts_service_changed()` has been extended (DRGN-6986).

Bug fixes

- **SoftDevice**
 - Removed workaround for nRF52832 Erratum-73: The SoftDevice no longer leaves `TIMER0` running at all times which resulted in 5 uA increased average current between BLE events (DRGN-6647).
 - The `sd_nvic_critical_region_enter()` SV call will now return an error when an invalid pointer is provided as an input (DRGN-6302).

- Fixed an assert that could have occurred on boot due to nRF52832 Erratum-36 (DRGN-7097).
- **BLE**
 - Fixed an issue where an application could invoke `sd_ble_*` SVCs without previously having called `sd_ble_enable()` (DRGN-6862).
 - Calling `sd_ble_uuid_vs_add()` with an UUID already present in the internal table will no longer fail with error code `NRF_ERROR_NO_MEM` (DRGN-6962).
- **GAP**
 - When trying to establish a connection as a peripheral and there is not enough memory available to honor the bandwidth configuration, the SoftDevice will return `NRF_ERROR_NO_MEM` instead of triggering a fault (DRGN-6874).
 - When disconnecting and reconnecting multiple connections, the SoftDevice will no longer return `NRF_ERROR_NO_MEM` with a valid configuration (DRGN-6875).
 - GAP will no longer trigger a fault when a connection as a peripheral is established right before the advertising timeout, or just before a call to `sd_ble_adv_stop()` (DRGN-6976).
 - GAP will no longer trigger a fault when starting a broadcaster or an observer with all configured connections established. It will instead return the new `NRF_ERROR_RESOURCES` error code (DRGN-7090).
 - Fixed an issue where the GAP API accepted channel map updates with only one channel set. This has been done to comply with the Bluetooth specification (DRGN-6743).
 - Fixed an issue where the SoftDevice did not use optimal radio configuration values for the current IC version that resulted in a loss of 3 dB of RX sensitivity (DRGN-6000, DRGN-6157).

Limitations

- **SoftDevice**
 - If Radio Notifications are enabled, flash write and flash erase operations initiated through the SoftDevice API will be notified to the application as Radio Events (FORT-809).
 - Synthesized low frequency clock source is not tested or intended for use with the BLE stack.
 - Applications must not modify the `SEVONPEND` flag in the `SCR` register when running in priority level 2 or 3 as this can lead to undefined behavior.
- **LL**
 - The peripheral role has priority over the central role when it comes to keeping the links alive.
- **GAP**
 - A broadcaster **and** a scanner cannot both be active if there are 8 connections established (DRGN-6543).

- **GATTS**
 - To conform to the Bluetooth specification there shall not be a secondary service that is not referenced somehow by a primary service. The SoftDevice does not enforce this (DRGN-906, DRGN-2260).

Known Issues

- The address in the `pc` parameter of the `nrf_fault_handler_t` callback for `NRF_FAULT_ID_APP_MEMACC` might be 2 or 4 bytes higher than the one of the actual instruction that triggered the fault (DRGN-7110).
- If `sd_softdevice_enable()` is called with `fault_handler` set to `NULL`, to an invalid function pointer or a pointer to a returning function, the behaviour will be undefined (DRGN-7122).
- During LE Secure Connections pairing, when operating in the peripheral role, the SoftDevice will not automatically fail the pairing procedure if the peer's key size is smaller than the minimum key size (`min_key_size`) set during the call to `sd_ble_gap_sec_params_reply()`. Normally the full key size (16 bytes) is used in LE Secure Connections pairing procedures, so this issue should not typically manifest itself. If the application expects to interact with a peer central using a reduced key size, it should check the peer's key size in `BLE_GAP_EVT_SEC_PARAMS_REQUEST` and reply with `sd_ble_gap_sec_params_reply(BLE_GAP_SEC_STATUS_ENC_KEY_SIZE, NULL, NULL)` if the peer's key size is too small (DRGN-7125).
- `sd_nvic_*` functions do not operate with interrupts with an IRQ number higher than 31.
- `sd_nvic_critical_region_enter()` is not functional.

ANT_S332_nrf52832_0.6.0.alpha

The ANT_S332_nrf52832_0.6.0.alpha SoftDevice for the nRF52 platform is based upon the ANT_S212_nrf52832_0.6.0.alpha(ANT) SoftDevice and S132 v2.0.0-7.alpha (BLE) SoftDevice combined.

Notes:

- This is a major release which has changed the Application Programmer Interface (API), requiring application(s) to be recompiled.

SoftDevice Properties

- There is no SoftDevice Specification corresponding to this release. The S310 SoftDevice Specification v3.0.0 and S132 SoftDevice Specification v0.5 are applicable in large parts. Both are available on the [Nordic Infocenter](#).
- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.0.0-1.alpha
- The combined MBR and SoftDevice memory requirements for this version is as follows:
 - Flash: **164kB** (0x29000 bytes) This number is subject to change before the production release.
 - RAM: **5.664kB** (0x1620 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at sd_ble_enable() time)

Compatibility

Tested on Eng Rev B.

New functionality

- **SoftDevice**
 - The `sd_ecb_block_encrypt()` SV call now puts the CPU to sleep while waiting for the encryption to complete. In addition, a new SV call, `sd_ecb_blocks_encrypt()`, has been added to perform multiple block encryptions in a single call (DRGN-6359).
- **BLE**
 - A new `BLE_COMMON_OPT_PA_LNA` option supports enable/disable switching of external Power Amplifiers and Low Noise Amplifiers using GPIO pins (DRGN-6478).
- **GATTS**
 - Write Commands (Write Without Response) are now subject to attribute authorization. The incoming data will not be written into the Attribute Table, requiring the application to do so itself by using `sd_ble_gatts_value_set()` (DRGN-2460).

Changes

- **SoftDevice**

- A new MBR (2.0.0-1) is included with this release. The size has been reduced to 4KB in code memory (DRGN-6134, DRGN-6609, DRGN-5436). In order to issue the `SD_MBR_COMMAND_COPY_BL` and `SD_MBR_COMMAND_VECTOR_TABLE_BASE_SET` commands to the bootloader `UICR.NRFFW[1]` must be set to an address corresponding to a page in the application flash space. This page will be cleared by the MBR and used to store parameters before reset. When the `UICR.NRFFW[1]` field is set the page it refers to should not be used by the application. If the `UICR.NRFFW[1]` is set to `0xFFFFFFFF` (the default) all MBR commands will return `NRF_ERROR_NO_MEM` and DFU will be unavailable.
- The CPU Cache is now turned on when enabling the SoftDevice (DRGN-6479).
- SoftDevice assert handling has been completely overhauled. The application now provides a pointer to the new `nrf_fault_handler_t` callback type that handles all types of unrecoverable errors. The file name and line number parameters to this callback have been replaced by parameters including the program counter of the instruction that triggered the error (DRGN-6587).
- The SV call handler has been optimized to reduce overhead when invoking SV calls from the application (DRGN-6692).
- **BLE**
 - The documentation for the `sd_ble_uuid_vs_add()` SV call has been extended and corrected (DRGN-6169).
- **GAP**
 - The `sd_ble_gap_tx_power_set()` SV call no longer accepts a -30dBm setting, the minimum now being -40dBm (DRGN-2702).

Bug fixes

- **SoftDevice**
 - The whole of the RAM is no longer configured not to go into low-power mode when entering either CPU idle (WFE, WFI) or SYSTEM OFF (DRGN-6635).
 - The DebugMonitor interrupts are now correctly forwarded by the MBR (DRGN-6242).
 - Fixed an issue where the application did not return from a call to `sd_ble_app_evt_wait()` when waking up from IRQ numbers above 31 (DRGN-6205).
 - Pointers addressing the Code RAM section are now permitted as parameters to the SoftDevice (DRGN-6535).
- **BLE**
 - The `p_app_ram_base` pointer passed to `sd_ble_enable()` is now NULL-checked (DRGN-6719).

- Specifying a total connection count of 0 (0 peripheral connections and 0 central connections) in `sd_ble_enable()` no longer leads to a SoftDevice assert (DRGN-6613).
- **GAP**
 - Fixed an issue which could cause peers to reject or drop connection parameter update requests sent by the local device if the signalling identifier was set to 0x00 (invalid value) (DRGN-6354).
- **GATTS**
 - The pointer checking for the system attribute access functions has been corrected. The `sd_ble_gatts_sys_attr_get()` SV call now only allows pointers to RAM and the `sd_ble_gatts_sys_attr_set()` SV call now allows pointers to both RAM and Flash memory (DRGN-6532).

Limitations

- **SoftDevice**
 - If Radio Notifications are enabled, flash write and flash erase operations initiated through the SoftDevice API will be notified to the application as Radio Events (FORT-809).
 - Synthesized low frequency clock source is not tested or intended for use with BLE stack.
- **BLE**
 - Only the bandwidth configurations `BLE_CONN_BW_MID` for connections as a central and `BLE_CONN_BW_HIGH` for connections as a peripheral are currently allowed (DRGN-6371).
- **LL**
 - The peripheral role has priority over the central role when it comes to keeping the links alive.
- **GAP**
 - The maximum amount of concurrent connections is limited to 8, with an additional broadcaster **or** scanner active. (DRGN-6543).
- **GATTS**
 - To conform to the Bluetooth specification there shall not be a secondary service that is not referenced somehow by a primary service. The SoftDevice does not enforce this (DRGN-906, DRGN-2260).

Known Issues

- **SoftDevice**
 - The SoftDevice does not use optimal Radio configuration values for the current chip version that results in a loss of 3dB of RX sensitivity. This limitation will not be present in the S132 Production version (DRGN-6000).

- Temperature based calibration of the RC low frequency clock source does not work. (DRGN-5429).
- Due to nRF52832 Errata-73, the SoftDevice leaves TIMER0 running at all times which results in 5uA increased average current between BLE events (DRGN-6647).

ANT_S332_nrf52832_0.5.0.alpha

The ANT_S332_nrf52832_0.5.0.alpha SoftDevice for the nRF52 platform is based upon the ANT_S212_nrf52832_0.5.0.alpha(ANT) SoftDevice and S132 v2.0.0-4.alpha (BLE) SoftDevice combined.

Notes:

- This is a major release which has changed the Application Programmer Interface (API), requiring application(s) to be recompiled.

SoftDevice Properties

- There is no SoftDevice Specification corresponding to this release. The S310 SoftDevice Specification v3.0.0 and S132 SoftDevice Specification v0.5 are applicable in large parts. Both are available on the [Nordic Infocenter](#).
- This version of the SoftDevice contains the Master Boot Record (MBR) version 1.1.0-2.alpha
- The combined MBR and SoftDevice memory requirements for this version is as follows:
 - Flash: **164kB** (0x29000 bytes)
 - RAM: **5.664kB** (0x1620 bytes)

Compatibility

Tested on Eng Rev B.

New functionality

ANT functionality in the ANT_S332_nrf52832_0.5.0.alpha SoftDevice for the nRF52 platform is equivalent to the content in the Nordic ANT_S332_nrf52832_0.3.0.alpha SoftDevice. BLE content is equivalent to the functionality in the Nordic S132 v2.0.0-4.alpha (BLE) SoftDevice.

- **SoftDevice**
 - A variable called `p_license_key` has been added to the `sd_softdevice_enable()` call for the SoftDevices that include ANT. If this license key is set incorrectly the SoftDevice will not enable. An evaluation key can be found in `nrf_sdm.h` which will enable the full stack, however you may use the evaluation key for non-commercial use only, under the terms described in the `license.pdf` file included in the root directory of the ANT_S332 .zip file. It is a requirement to obtain and use a commercial use license key with the S332 in any product that is sold or otherwise distributed for revenue-generating purposes. Commercial use license keys will be made available by ANT Wireless. Further information about obtaining a license key can be found here:
<https://www.thisisant.com/developer/ant/licensing>

- **BLE**
 - The application can now configure the number of connections and their roles when initializing the BLE stack (DRGN-4669).
A range of 0 to 8 connections can be specified, one of which may be of the peripheral role type.
 - The application can now configure the bandwidth requirements of connections when initializing the BLE stack (DRGN-4670).
Bandwidth configuration is optional. By default, the BLE stack will assign typical bandwidth settings to all connections depending on their role. See the Limitations section for additional information.
 - The application can now configure the number of vendor specific UUIDs when initializing the BLE stack (DRGN-6257).
UUID count configuration is optional. By default, the BLE stack will reserve memory for 10 UUIDs.
- **GATTS**
 - A new SV call, `sd_ble_gatts_attr_get()`, has been added to allow retrieval of a local attribute's UUID and metadata (DRGN-6203).
 - A new SV call, `sd_ble_gatts_initial_user_handle_get()`, has been added to allow retrieval of the first valid user attribute handle in the Attribute Table (DRGN-5152).
- **GATTC**
 - A new SV call, `sd_ble_gattc_attr_info_discover()`, has been added to allow retrieval of remote attribute information including full 128-bit UUIDs (DRGN-6195).

Changes

- **BLE**
 - The public API header files now require C99 compiler support. In particular, flexible array members must be supported to correctly parse array definitions in the SoftDevice header files (DRGN-4662).
 - The documentation has been revamped and improved with additional links between functions, events and MSCs (DRGN-6366).
 - The doxygen documentation for `ble_gap_adv_params_t` and `ble_gap_adv_ch_mask_t` has been corrected (DRGN-6363).
 - The doxygen documentation for `ble_evt_hdr_t` has been corrected (DRGN-6016).
 - `sd_ble_tx_buffer_count_get()` and `BLE_ERROR_NO_TX_BUFFERS` have been renamed to `sd_ble_tx_packet_count_get()` and `BLE_ERROR_NO_TX_PACKETS`, respectively (DRGN-4670).
In addition, `sd_ble_tx_packet_count_get()` has been updated to take a connection handle as an input parameter and to return the total number of available guaranteed application transmission packets for a particular connection.

- **GAP**
 - Distribution of the identity keys (`ble_gap_id_key_t`) has been aligned with the rest of the keys and no longer constitutes an exception (DRGN-6279).
 - The default device name has been changed from "nRF51822" to "nRF5x" (DRGN-6262).
 - The documentation for `sd_ble_gap_adv_data_set()` has been corrected (DRGN-5396).
- **GATTS**
 - The default Attribute Table size has been reduced to 0x580 bytes. (DRGN-5797).
 - The SoftDevice now allows an application to reply with the `BLE_GATT_STATUS_ATTERR_INVALID_OFFSET` and the `BLE_GATT_STATUS_ATTERR_PREPARE_QUEUE_FULL` error codes as a response to an app-handled queued write request (DRGN-5994, DRGN-6187).
 - The format used for the system attribute data is now publicly documented for application developers (DRGN-5689).
 - The documentation for `sd_ble_gatts_service_changed()` has been corrected (DRGN-6202).
- **GATTC**
 - The documentation for `sd_ble_gattc_read()` has been corrected (DRGN-5728).

Bug fixes

- **SoftDevice**
 - Fixed a problem which prevented application from enabling the Floating-Point Unit (FPU) when running from the Process Stack Pointer (PSP) (DRGN-6556).
- **GAP**
 - Fixed a memory leak that could appear when authenticating with invalid security parameters and could prevent further authentication attempts from taking place (DRGN-6227).
- **GATTS**
 - The SoftDevice will now generate a `BLE_GATTS_EVT_RW_AUTHORIZE_REQUEST` event with opcode `BLE_GATTS_OP_EXEC_WRITE_REQ_CANCEL` upon receiving an execute write request that cancels all prepared writes (DRGN-6022, DRGN-6186, NRFFOETT-1048).

Limitations

- **SoftDevice**
 - If Radio Notifications are enabled, flash write and flash erase operations initiated through the SoftDevice API will be notified to the application as Radio Events (FORT-809).
 - Synthesized low frequency clock source is not tested or intended for use with BLE stack.

- **BLE**
 - Only the bandwidth configurations `BLE_CONN_BW_MID` for connections as a central and `BLE_CONN_BW_HIGH` for connections as a peripheral are currently allowed (DRGN-6371).
- **LL**
 - The peripheral role has priority over the central role when it comes to keeping the links alive.
- **GAP**
 - The maximum amount of concurrent connections is limited to 8, with an additional broadcaster or scanner active. (DRGN-6543).
- **GATTS**
 - To conform to the Bluetooth specification there shall not be a secondary service that is not referenced somehow by a primary service. The SoftDevice does not enforce this (DRGN-906, DRGN-2260).

Known Issues

- **SoftDevice**
 - The SoftDevice does not use optimal Radio configuration values for the current chip version that results in a loss of 3dB of RX sensitivity. This limitation will not be present in the S132 Production version (DRGN-6000).
 - Temperature based calibration of the RC low frequency clock source does not work. (DRGN-5429).
- **GAP**
 - Specifying a total connection count of 0 (0 peripheral connections and 0 central connections) in `sd_ble_enable()` leads to a SoftDevice assert (DRGN-6613).

ANT_S332_nrf52832_0.3.0.alpha

The ANT_S332_nrf52832_0.3.0.alpha SoftDevice for the nRF52 platform is based upon the ANT_S212_nrf52832_0.3.0.alpha(ANT) SoftDevice and S132 v1.0.0-3.alpha (BLE) SoftDevice combined.

Notes:

- This is a major release which has changed the Application Programmer Interface (API), requiring application(s) to be recompiled.

SoftDevice Properties

- There is no SoftDevice Specification corresponding to this release. The S310 SoftDevice Specification v3.0.0 and S132 Softdevice Specification v0.5 are applicable in large parts. Both are available on the [Nordic Infocenter](#).
- This version of the SoftDevice contains the Master Boot Record (MBR) version 1.1.0
- The combined MBR and SoftDevice memory requirements for this version is as follows:
 - Flash: **164kB** (0x29000 bytes)
 - RAM: **11.52kB** (0x2D00 bytes)

Compatibility

The ANT_S332_nrf52832_0.3.0.alpha is restricted to use with nRF52832 IC rev Engineering A.

New functionality

ANT functionality in the ANT_S332_nrf52832_0.3.0.alpha SoftDevice for the nRF52 platform is equivalent to the content in the Nordic S310_nrf51422_3.0.0 SoftDevice. BLE content is equivalent to the functionality in the Nordic S132 v1.0.0-3.alpha (BLE) SoftDevice.

Changes

- API changes from **S310_nrf51422_3.0.0**
 - New event: NRF_EVT_FLASH_OPERATION_VERIFY_FAILED, only available on nRF52
 - sd_flash_protect() has been changed to be compatible both with nRF52 and with future nRF51 releases.
 - Platform-specific declarations, definitions and macros split out and placed in subfolders with the platform name (e.g. 'nrf52')

Limitations

- MBR

- The MBR in this release uses 12 kB of flash, meaning that the SoftDevice start address is 0x3000 and the SoftDevice info structure address is 0x5000. This is subject to change in future releases (DRGN-5436).
- **SoftDevice**
 - If Radio Notifications are enabled, flash write and flash erase operations initiated through the SoftDevice API will be notified to the application as Radio Events (DRGN-5197).
- **LL**
 - The peripheral role has priority over the central role when it comes to keeping the links alive.
- **GATTs**
 - To conform to the Bluetooth specification there shall not be a secondary service that is not referenced somehow by a primary service. The SoftDevice does not enforce this (DRGN-906, DRGN-2260).

Known Issues

- **SoftDevice**
 - FPU must be enabled in application.