

ANT_S332_nrf52832_5.0.0 release notes

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ANT_S332_nrf52832_5.0.0

The ANT_S332_nrf52832_5.0.0 SoftDevice for the nRF52 platform is based upon the ANT_S212_nrf52832_5.0.0 (ANT) SoftDevice and S132 v5.0.0 (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 2.2.0
 - This version of the MBR is compatible with the previous versions.
- The combined MBR and SoftDevice memory requirements for this version is as follows:
 - Flash: **180kB** (0x2D000 bytes)
 - RAM: **7.98kB** (0x1F30 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)

New functionality

- **SoftDevice**
 - The RC oscillator accuracy can now be set to any of the defined NRF_CLOCK_LF_ACCURACY values, and there is no default anymore. In other words, the `nrf_clock_lf_cfg_t::accuracy` parameter now has the same functionality when used with the RCOSC clock source as with the XTAL clock source (DRGN-8666).
- **BLE**
 - The SoftDevice now supports Channel Selection algorithm #2 (DRGN-7147).
- **LL**
 - Support for transmitting and receiving on the 2 Mbps PHY has been added (DRGN-7552).
 - Support for Network Privacy Mode (DRGN-8658).
 - PA/LNA supported for LE 2M PHY (DRGN-8259).
- **L2CAP**
 - Connection-Oriented Channels in LE Credit Based Flow Control Mode (DRGN-8572).

Using 2 Mbps

The SoftDevice provides a new SV call `sd_ble_gap_phy_update()` and two new events, `BLE_GAP_EVT_PHY_UPDATE_REQUEST` and `BLE_GAP_EVT_PHY_UPDATE`, to support initiating or responding to a PHY Update procedure and to be notified about incoming peer initiated PHY Update procedures and link PHY updates. Upon receiving a `BLE_GAP_EVT_PHY_UPDATE_REQUEST`, the application needs to respond with an `sd_ble_gap_phy_update()` SV call. For more information, see API documentation.

This alpha version of the SoftDevice supports connection establishment using the 1 Mbps PHY and then changing either the transmitting PHY or the receiving PHY (asymmetric link configuration), or both (symmetric link configuration) to use the 2 Mbps PHY. The PHYs can be changed using the abovementioned SV call.

Link Layer encryption and long data packet payload (up to 251 octets) are supported on both 1 Mbps and 2 Mbps PHYs.

Using L2CAP Credit Based Flow Control Mode

The SoftDevice provides several new SV calls and events related to setting up and using L2CAP Credit Based Flow Control. For more details, refer to `ble_l2cap.h` and the L2CAP Message Sequence Charts (s132-nrf52-5.0.0-3.alpha_API/doc/html/index.html -> dragoon -> Modules -> Logical Link Control And Adaptation Protocol (L2CAP) -> Message Sequence Charts) inside the API documentation.

Changes

- **SoftDevice**
 - It is now possible to set RCOSC accuracy to 500 ppm or 250 ppm when calling `sd_softdevice_enable` and using `nrf_clock_lf_cfg_t::source=NRF_CLOCK_LF_SRC_RC`. `nrf_clock_lf_cfg_t::xtal_accuracy` can be configured to `NRF_CLOCK_LF_XTAL_ACCURACY_250_PPM` or `NRF_CLOCK_LF_XTAL_ACCURACY_500_PPM` (DRGN-8838). All other values for `xtal_accuracy` will default to 500 ppm.
 - Interrupt priority 5 is now available to the application (DRGN-8853).
 - Added definitions for timing constraints that must be taken into account when using the `NRF_RADIO_SIGNAL_CALLBACK_ACTION_EXTEND` action with the Radio Timeslot API (DRGN-8931).
- **LL**
 - The SoftDevice slave role now accepts overlapping peer-initiated Link Layer control procedures (DRGN-8623). The following LL control procedures can be executed in parallel with any other control procedure, except for themselves: LE Ping, Feature Exchange, Data Length Update, and Version Exchange. This is done for compatibility reasons.
 - The SoftDevice now has improved control procedure performance in scenarios involving multiple links (DRGN-9001).
- **GAP**
 - A flag `lesc` is added to the `ble_gap_evt_auth_status_t` struct, indicating if an authentication procedure has resulted in an LE Secure Connection (DRGN-7801).
 - In Bluetooth Specification Version 5.0 the definition of LE Security Mode 1 Level 4 has changed. LESC MITM protected encrypted link using a 128-bit strength encryption key is now required (DRGN-8759).
 - `BLE_GAP_EVT_TIMEOUT {src: BLE_GAP_TIMEOUT_SRC_SECURITY_REQUEST}` is replaced with `BLE_GAP_EVT_AUTH_STATUS {auth_status: BLE_GAP_SEC_STATUS_TIMEOUT}` (DRGN-8752).
 - `BLE_GAP_ADV_NONCON_INTERVAL_MIN` is now removed (DRGN-8611).
 - Stack will no longer return `NRF_ERROR_BUSY` when calling `sd_ble_gap_connect()`, `sd_ble_gap_scan_start()`, `sd_ble_gap_authenticate()`, or `sd_ble_gap_adv_start()` (DRGN-8843).

- Stack will now only return NRF_ERROR_BUSY on sd_ble_gap_conn_param_update() when a connection parameter update is already in progress (DRGN-8843).
- GATT**
 - The SoftDevice will no longer prevent using "Write Command" on Characteristic Descriptors (DRGN-9085). This change reverts a change done for s132_nrf52_4.0.0. Note that according to the Bluetooth Core Specification v 5.0 (Vol. 3, Part G Chapter 4.12.3), when writing Characteristic Descriptors "The Attribute Protocol Write Request is used for this sub-procedure". While the SoftDevice will no longer prevent the use of the "Write Command", it is up to the application to ensure the correct procedure is used.
- Documentation**
 - The Message Sequence Charts (MSCs) for LL Data Length Update Procedure have been corrected, extended and improved (DRGN-8722).
 - Improved documentation for sd_ble_gap_adv_start() (DRGN-8799).

Bug fixes

- SoftDevice**
 - Fixed an issue where sd_ble_enable() may corrupt up to 8 bytes above the returned app_ram_base when the SoftDevice is configured with 0 Peripheral roles and 0 Central roles (DRGN-8802).
 - Fixed an issue where the SoftDevice might assert in some cases if the application delayed pulling of SoftDevice events (DRGN-8823).
 - Fixed an issue where 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 would in some cases lead to link disconnect (DRGN-8627).
 - Fixed an issue where the SoftDevice could trigger a BusFault when forwarding a HardFault to the application (DRGN-8604).
- LL**
 - Fixed an issue where the slave would assert if a control packet was received in the same event as it sent a LL_LENGTH_RSP packet (DRGN-9036).
 - Fixed an issue where the slave could assert if it received a PAUSE_ENC_REQ followed by an LL_ENC_REQ (DRGN-9035). This sequence of packets is illegal behavior according to the Bluetooth Core Specification v 5.0, so the slave will now disconnect in this situation.
 - Fixed an issue where the slave in some cases could disconnect with wrong disconnect reason (BLE_HCI_DIFFERENT_TRANSACTION_COLLISION instead of BLE_HCI_CONN_TERMINATED_DUE_TO_MIC_FAILURE) if master misbehaves (DRGN-8998).
 - Fixed an issue where scanner/initiator would use wrong local IRK when SoftDevice is configured to use more than one local IRK (DRGN-9072).
 - Fixed an issue which could lead to a deadlock in the Channel Map Update procedure if an unexpected disconnection occurred before the instant (DRGN-9033). The deadlock would have blocked any future Channel Map Updates.

- 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 the SoftDevice could assert if scan parameters are updated after the scanner has accepted a new LE connection (DRGN-8635).
- Fixed an issue where using encryption on multiple master links at the same time could cause an assert (DRGN-8532).
- 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).
- **GAP**
 - Fixed an issue where 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() might not work as expected on connections using a configuration with configured event length of 2, 3 or 4 (DRGN-8779).
- **GATT**
 - Fixed an issue where setting gatts_conn_cfg.hvn_tx_queue_size or gattc_conn_cfg.write_cmd_tx_queue_size to 0 would lead to a SoftDevice assert during connect for the last connection that fits in memory (DRGN-9056).
- **GATTS**
 - Fixed an issue where incoming packet processing would in some cases be delayed when the BLE_EVT_USER_MEM_REQUEST event is pulled by the application (DRGN-8595).
 - Fixed an issue where the value of the attribute in BLE_GATTS_EVT_RW_AUTHORIZE_REQUEST event corresponding to the first Prepare Write Request could be corrupted if the application delays the pulling of SoftDevice events (DRGN-8595).
 - It is no longer possible to issue an HVN if the HVN queue size is set to 0 on the config API (DRGN-8353).
- **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).

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 levels higher than 6 (priority level numerical values lower than 6) as this can lead to undefined behavior.
- **GATTS**
 - To conform to the Bluetooth Core Specification v 5.0, there shall be no secondary service that is not referenced somehow by a primary service. The SoftDevice does not enforce this (DRGN-906).

Known Issues

- **SoftDevice**
 - If Connection Event Length Extension is enabled, the Radio Notification may be suppressed between connection events (DRGN-7687).
 - When the SoftDevice is enabled the IRQ priorities of SD_EVT_IRQn and RADIO_NOTIFICATION_IRQn (SWI2_IRQn and SWI1_IRQn respectively) are set to a default of 6. This differs from previous versions of the SoftDevice, as well as what is specified in the SoftDevice Specification. It is suggested to explicitly set these priorities in the application after the SoftDevice is enabled.

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).