ANT_S340_nrf52_7.0.1 release notes

Contents

ANT_S340_nrf52_7.0.1

The ANT_S340_nrf52_7.0.1 SoftDevice is the production release for the nRF52 platform. It is based upon the ANT_S212_nrf52_7.0.1 (ANT) SoftDevice and the s140_nrf52_7.0.1 (BLE) SoftDevice.

Notes

- This S340 release has changed the Application Programming Interface (API) and memory requirements from the previous S340 production release (ANT_S340_nrf52840_6.1.1). This requires applications to be recompiled.
- The release notes list changes from ANT_S340_nrf52840_6.1.1

SoftDevice Properties

- This SoftDevice variant is compatible with nRF52820, nRF52833 and nRF52840
- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.4.1 (DRGN-10680). This MBR version is compatible with previous MBR versions.
- The combined MBR and SoftDevice memory requirements for this version is as follows:
    - Flash: **200 kB** (0x31000 bytes)
    - RAM: **8 kB** (0x2000 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)
    - Call stack: The SoftDevice uses a call stack combined with the application. The worst-case stack usage for the SoftDevice is **1.75 kB** (0x700 bytes). Application writers should ensure that enough stack space is reserved to cover the worst-case SoftDevice call stack usage combined with the worst-case application call stack usage.
- The Firmware ID of this SoftDevice is 0x00CE.

New Functionality

- **GAP**
    - API to obtain the next connection event counter (DRGN-10913).
    - API for triggering a task when the SoftDevice is about to start a connection event (DRGN-10914).
    - API for inclusion configuration of the CAR and PPCP characteristics (DRGN-10874).

Changes

- **ANT**
    - PA/LNA support extended to GPIOs on Port 1
- **SoftDevice**
    - Bluetooth Core Specification v5.1 qualified (DRGN-12400).
    - The VersNr field in the LL_VERSION_IND packet now contains the value 0x0A to indicate Bluetooth Core Specification v5.1 compatibility (DRGN-12466).

    - References to Errata are added to the documentation of all the events and APIs which report RSSI and should be observed if using RSSI measurements.
    - Removed macros defining PPI channels and groups available to the application (DRGN-10382).
- **LL**
    - Bluetooth Core Specification Erratum #10818 is incorporated. The SoftDevice now allows HCI ACL data packets with 0-length payload, but does not transmit anything until receiving the next non- zero continuation fragment (DRGN-11430).
    - Bluetooth Core Specification Erratum #10750 is incorporated. The `BLE_GAP_EVT_DATA_LENGTH_UPDATE` event will now be raised to the application when switching to and from Coded PHY. On-air behavior has not changed (DRGN-11435).
- **GAP**
    - The API for configuring improved advertiser role scheduling is removed. The SoftDevice now uses the improved scheduling configuration by default (DRGN-10754).

Bug Fixes

- **ANT**
    - Fixed an issue where Slave Shared Channels would not send an uplink reply in specific cases where the shared address matched.
    - Fixed an issue where Timestamp of a received message would be invalid on initial channel acquisition.
- **SoftDevice**
    - Fixed an issue where wakeup from sleep can take longer, even if the vector table is in RAM (DRGN-12508).
    - Fixed an issue in the QoS channel survey feature where the reported RSSI value for a channel was influenced by the noise on the previously checked channel (DRGN-10441)
    - Fixed an issue where the application would be blocked when requesting an earliest possible Radio Timeslot (DRGN-10402).
- **LL**
    - Fixed an issue where the slave might disconnect if many packets were lost and there was an ongoing Connection Parameter Update (DRGN-11147).

Limitations

- **ANT**
    - The low frequency RC oscillator clock source (NRF_CLOCK_LF_SRC_RC) is not tested or intended for use with the ANT stack.
- **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.
- Flash write operations may exceed the timeout provided when performed with certain protocol operations (e.g. ANT Continuous Scan).
- Applications aiming at initiating LE connections on LE Coded PHY must have configured the length of the connection event to be sufficiently large to transmit and receive at least one pair of data channel PDUs with a payload of 27 octets. Otherwise, the SoftDevice will not be able to connect on LE Coded PHY.
- If the scanner is configured with a scan window larger than 16 seconds, the scanner will truncate the scan window to 16 seconds (DRGN-10305).

- **GATT**
  - 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).
- **LL**
  - In connections, the Link Layer payload size is limited to 27 bytes on LE Coded PHY (DRGN-8476).

Known Issues

- **SoftDevice**
  - The BLE_GAP_EVT_SEC_INFO_REQUEST event will not report the identity address of the peer to the application. This issue was also present in previous releases. A workaround is to do a mapping of the connection handle to the peer's identity address (DRGN-10340).
  - `sd_ble_gap_device_name_set()` may return `NRF_ERROR_INTERNAL` instead of `NRF_ERROR_NO_MEM` if the allocated space for the device name is too small. A workaround is to allocate enough space for the device name before calling `sd_ble_gap_device_name_set()` (DRGN-10195).
  - The MWU protection may become disabled in certain cases if the application ISR is interrupted by SoftDevice ISR (DRGN-10361).
  - A memory access fault (`NRF_FAULT_ID_APP_MEMACC`) can occur in `sd_nvic_critical_region_exit()` if a high priority SoftDevice interrupt occurs during a critical section, for example due to radio traffic (DRGN-10613). This issue was present also in previous releases. It can be fixed by editing `NRF_NVIC_SD_IRQS_1` in nrf_nvic.h so that it becomes:

```
#define NRF_NVIC_SD_IRQS_1 ((uint32_t)(1U << (MWU_IRQn - 32)))
```

- The SoftDevice will generate a resolvable address for the TargetA field in directed advertisements if the target device address is in the device identity list with a non-zero IRK, even if privacy is not enabled and the local device address is set to a public address. This issue was present also in previous releases. A workaround is to set the IRK to zero or to remove the device address from the device identity list (DRGN-10659).
- The SoftDevice may generate several events, when connected, based on peer actions, i.e. without prior action from the application. The `BLE_GAP_EVT_PHY_UPDATE_REQUEST` event, for instance, will be generated when a connected peer sends a Phy Update Request, even when an application does not include logic to change phy. There are several such events that may require action from an application if they are received. For more details check `sd_ble_enable()` API in SoftDevice.
- When running on nRF52833, using `sd_power_dcdc0_mode_set` API can lead to undefined behavior.

- **GAP**
  - If an extended advertiser is configured with limited duration, it will time out after the first primary channel packet in the last advertising event (DRGN-10367).
- **GATTC**
  - The `ble_gattc_service_t::uuid` field is incorrectly populated in the `BLE_GATTC_EVT_PRIM_SRVC_DISC_RSP` event if the `sd_ble_gattc_primary_services_discover()` or `sd_ble_gattc_read()` is called when a Primary Service Discovery by Service UUID is already ongoing (DRGN-11300). When the application has called `sd_ble_gattc_primary_services_discover()`, it should wait for the `BLE_GATTC_EVT_PRIM_SRVC_DISC_RSP` event before calling `sd_ble_gattc_primary_services_discover()` or `sd_ble_gattc_read()`.
- **LL**
  - If the application adds an all zeroes IRK with the `sd_ble_gap_device_identities_set()`, it will be treated as a valid entry in the device identity list. An all zeroes IRK is invalid and must not be added (DRGN-9083).

ANT_S340_nrf52840_6.1.1

The ANT_S340_nrf52840_6.1.1 SoftDevice is the production release for the nRF52840 platform. It is based upon the ANT_S240_nrf52832_6.1.1 (ANT) SoftDevice and the s140_nrf52_6.1.1 (BLE) SoftDevice.

Notes

- This S340 release has changed the Application Programming Interface (API) and memory requirements from the previous S340 production release (ANT_S340_nrf52840_6.0.0). This requires applications to be recompiled.
- The release notes list changes from ANT_S340_nrf52840_6.1.0
    - **Note**: ANT_S340_nRF52840_6.1.0 and ANT_S340_nRF52840_6.1.0.alpha1 are non-released SoftDevice versions. Their change notes should be used as progression information from the ANT_S340_nrf52840_6.0.0 production release.

SoftDevice Properties

- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.4.1 (DRGN-10680). This MBR version is compatible with previous MBR versions.
- The combined MBR and SoftDevice memory requirements for this version is as follows:
    - Flash: **200 kB** (0x31000 bytes)
    - RAM: **8 kB** (0x2000 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)
- The Firmware ID of this SoftDevice is 0x00B9.

Changes

- **SoftDevice**
    - The MBR 2.4.1 is a minor backward compatible configuration update of the MBR for this release. There were no bugs resolved in this update, only minor build configuration option changes (DRGN-10680).
    - Applications can improve the radio utilization for multiprotocol applications by enabling the improved advertiser role scheduling configuration through the BLE Option API. The time reserved for an advertising event will then be decreased by up to 1.3 ms (DRGN-10398).

Bug Fixes

- **SoftDevice**
    - Fixed an issue with the QoS channel survey feature, where the LNA control would only work for the first channel to be checked in the survey (DRGN-10466).
    - Fixed a problem where calling `sd_ble_gap_connect()` with `scan_phys` set to only `BLE_GAP_PHY_2MBPS` would cause an assert when starting to scan (DRGN-10654).

- Fixed an issue where NRF_TIMER0 may not be reset at the start of a radio timeslot (DRGN-10650).
- Fixed an issue in the workaround for Errata 172 that could lead to high packet error rate when receiving on LE Coded PHY in noisy environments (DRGN-10652).

- **LL**
  - Fixed an issue where the SoftDevice would sometimes delay the LL_LENGTH_RSP in a Data Length Update procedure if a PHY Update procedure was ongoing at the same time (DRGN-10853).
  - Fixed an issue where the SoftDevice could assert when receiving long packets during extended scanning (DRGN-10880).
  - Fixed an issue with the Data Length Update procedure by limiting MaxTxTime and MaxRxTime in the procedure PDUs to 2120 µs unless the link is on LE Coded PHY or is about to change to LE Coded PHY. (DRGN-10264, DRGN-10751).

Limitations

- **ANT**
  - The low frequency RC oscillator clock source (NRF_CLOCK_LF_SRC_RC) is not tested or intended for use with the ANT stack.
- **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 levels higher than 6 (priority level numerical values lower than 6) as this can lead to undefined behavior.
  - Applications aiming at initiating LE connections on LE Coded PHY must have configured the length of the connection event to be sufficiently large to transmit and receive at least one pair of data channel PDUs with a payload of 27 octets. Otherwise, the SoftDevice will not be able to connect on LE Coded PHY.
  - If the scanner is configured with a scan window larger than 16 seconds, the scanner will truncate the scan window to 16 seconds (DRGN-10305).
- **GATT**
  - 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).
- **LL**
  - In connections, the Link Layer payload size is limited to 27 bytes on LE Coded PHY (DRGN-8476).

Known Issues

- **SoftDevice**
  - `sd_ble_gap_device_name_set()` may return `NRF_ERROR_INTERNAL` instead of `NRF_ERROR_NO_MEM` if the allocated space for the device name is too small. A workaround is to allocate enough space for the device name before calling `sd_ble_gap_device_name_set()` (DRGN-10195).
  - The MWU protection may become disabled in certain cases if the application ISR is interrupted by SoftDevice ISR (DRGN-10361).
  - If the application requests an earliest possible Radio Timeslot and the timeslot is blocked, the SoftDevice will repeat the same request until it times out, thereby blocking the main context and the lower application interrupt priority levels. A workaround is to increase the timeout of the Radio Timeslot request to make it able to fit after the event that is blocking the request (DRGN-10402).
  - When using the QoS channel survey feature, the reported RSSI value for a channel is influenced by the noise on the previously checked channel (DRGN-10441).
  - The SoftDevice will generate a resolvable address for the TargetA field in directed advertisements if the target device address is in the device identity list with a non-zero IRK, even if privacy is not enabled and the local device address is set to a public address. This can make devices certified for Bluetooth versions older than 4.2 ignore the advertising packets. This issue is present in SoftDevice versions 3.0.0 and later. A workaround is to set the IRK to zero or to remove the device address from the device identity list (DRGN-10659).
- **GAP**
  - If an extended advertiser is configured with limited duration, it will time out after the first primary channel packet in the last advertising event (DRGN-10367).

ANT_S340_nrf52840_6.1.0 (non-released)

The ANT_S340_nrf52840_6.1.0 SoftDevice is targeted for the nRF52840 platform and is based upon the ANT_S240_nrf52832_6.1.0 (ANT) SoftDevice and the s140_nrf52_6.1.0 (BLE) SoftDevice.

Notes

- The features are identical to those in the ANT_S340_nrf52840_6.1.0 alpha1 release described in the following section, except the changes and bug fixes mentioned in this section. Notes for the alpha1 release should be referenced for information on available features, changes, limitations, bug fixes and known issues.

SoftDevice Properties

- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.3.0.
- The combined MBR and SoftDevice memory requirements for this version is as follows:
  - Flash: **196 kB** (0x31000 bytes)
  - RAM: **8 kB** (0x2000 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)
- The Firmware ID of this SoftDevice is 0x00B1.

New Functionality

- **ANT**
  - The configured search channel priority can now be queried using `sd_ant_search_channel_priority_get()`.

Bug Fixes

- **ANT**
  - Fixed a rare issue where bursting while using shared channels could sometimes put ANT channels into an unknown state.

ANT_S340_nrf52840_6.1.0.alpha1 (non-released)

The ANT_S340_nrf52840_6.1.0.alpha1 SoftDevice is targeted for the nRF52840 platform and is based upon the ANT_S240_nrf52832_6.1.0 (ANT) SoftDevice and the s140_nrf52_6.1.0 (BLE) SoftDevice.

Notes

- The coexistence performance of this alpha release has undergone limited testing.

SoftDevice Properties

- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.3.0.
- The combined MBR and SoftDevice memory requirements for this version is as follows:
  - Flash: **196 kB** (0x31000 bytes)
  - RAM: **8 kB** (0x2000 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)
- The Firmware ID of this SoftDevice is 0x00B1.

New Functionality

- **SoftDevice**
  - The SoftDevice variant, flash usage, reserved PPIs, and reserved interrupt priorities are now available at compile time to the application through new APIs (DRGN-9627). Qualified LE Coded PHY feature (DRGN-5702).
  - Qualified LE Advertising Extensions feature (DRGN-7504).
  - An API is added to enable the application to remove an unused UUID entry from the UUID table (DRGN-10389).
  - GPIO port 1 pins (P1.00 to P1.15) can now be used for PA/LNA on the nRF52840 (DRGN-9995).
- **GAP**
  - The scanner and initiator roles can now be configured to receive ADV_EXT_IND PDUs on both 1M and Coded PHY, using a single call to `sd_ble_gap_scan_start()` or `sd_ble_gap_connect()` (DRGN-8668).
  - Message sequence charts for Advertising Extensions are added (DRGN-9285).
  - With the new `sd_ble_gap_adv_addr_get()` API, the application can now get the Bluetooth device address that is being used by the advertiser (DRGN-10470).
- **LL**
  - It is now possible to send and receive advertising packets with up to 255 bytes of payload (DRGN-9315).
  - Privacy for Advertising Extensions is fully supported (DRGN-9340).
  - The SoftDevice is now able to receive chained advertisements (DRGN-9734).
  - The SoftDevice is now able to send chained advertisements. The advertising data fragmentation is handled autonomously by the SoftDevice (DRGN-9802).

- The scanner is now able to follow AUX pointers outside the scan window (DRGN-9886).
- The scanner and initiator roles for Advertising Extensions now implement a backoff procedure (DRGN-10271).

Changes

- **ANT**
  - Multiple slave channels can now track transmitters with the same Device ID. This behavior is enabled using the `EXT_PARAM_DUPLICATE_ID_TRACKING_ENABLED` bit at the time of channel assignment. Previous behavior is preserved otherwise.
  - All background channels can now send uplink messages. The uplink capability was previously limited to the active channel. In cases where the active channel was scanning indefinitely, uplink messages from other channels were also blocked indefinitely.
- **SoftDevice**
  - The time reserved by the SoftDevice is reduced by 297 µs when performing a flash word write, and by 4.7 ms when performing a flash page erase. This increases the probability of successfully scheduled flash operations (DRGN-9048).
  - Improved documentation for the `NRF_ERROR_INVALID_STATE` error code (DRGN-9693).
  - When the SoftDevice is acting as a peripheral, and the RC oscillator is used as the LFCLK source, the configured RC calibration period can now be increased. By default, the SoftDevice will now increase the receive window if two consecutive packets are missed and will then perform RC calibration if necessary (DRGN-9852).
  - SoftDevice s140_nrf52_6.0.0 accepted an advertising interval larger than `BLE_GAP_ADV_INTERVAL_MAX` as an experimental feature. However, this configuration could make the SoftDevice assert. Now, the SoftDevice will return `NRF_ERROR_INVALID_PARAM` if the application configures an advertising interval larger than `BLE_GAP_ADV_INTERVAL_MAX` (DRGN-10322).
  - Radio utilization for multi-protocol applications are improved significantly as the time allocated for a normal Radio Timeslot request session has decreased by up to 1 ms (DRGN-10405).
- **GATT**
  - `sd_ble_gatts_rw_authorize_reply()` now allows sending the 0xFC (Write Request Rejected) profile error code which was introduced in the Bluetooth Core Specification Supplement CSSv7 (DRGN-10373).
- **GAP**
  - The maximum value of parameters `max_tx_time_us` and `max_rx_time_us` provided to `sd_ble_gap_data_length_update()` is now raised to 2704. The previous maximum value was 2120 (DRGN-9904, DRGN-10263, DRGN-10264).
  - Setting the `ble_gap_adv_properties_t::anonymous` or `ble_gap_adv_properties_t::include_tx_power` bits when configuring a legacy advertiser is no longer permitted (DRGN-10024).

    - Using a too short duration for the advertising event when advertising is no longer accepted by the API (DRGN-10067).
    - The advertising data length limit for a connectable extended advertiser is now properly documented and limited in the API to 238 bytes (DRGN-10420).
- **LL**
    - Packet content validation is improved for the scanning of extended advertising PDUs (DRGN-9686).
    - The optional TxPower field is not included in the extended header in extended advertising PDUs (DRGN-8545).
    - Instead of disconnecting, the SoftDevice will now respond with LL_UNKNOWN_RSP when receiving control procedure PDUs with invalid lengths (DRGN-9997).

Bug Fixes

- **SoftDevice**
    - Fixed an issue where a HardFault could generate a new HardFault if the application called a NULL pointer (DRGN-9607).
    - Fixed an issue where the SoftDevice HardFault handler could hang if the application wrote to protected memory (DRGN9694).
    - Fixed an issue where the SoftDevice could assert if configured with too many L2CAP Connection-oriented Channels (DRGN-9946). Fixed an issue where the HFXO would sometimes not be released properly after RC calibration. This is in addition to the bug fix for a similar condition resolved in s140_nrf52_6.0.0 (DRGN-9920, DRGN-10166).
    - Fixed an issue where the PA/LNA GPIOs could be triggered too late. Furthermore, the PA pin is now set active 23 µs before RADIO TX start, instead of 5 µs before RADIO TX start. The LNA pin is set active 5 µs before RADIO RX start, as before (DRGN-9928).
    - Fixed documentation for `SD_EVT_IRQHandler` and `RADIO_NOTIFICATION_IRQHandler`, where the default interrupt priority was documented incorrectly (DRGN-10174).
    - Fixed an issue where waiting for an event disabled the memory protection (DRGN-10198).
    - Fixed an issue where LFRC oscillator calibration could fail (DRGN-10255).
    - Fixed an issue that could make the SoftDevice assert when scheduling events close together (DRGN-10316).
- **GAP**
    - Fixed an issue where the source of the timeout event might be set to `BLE_GAP_TIMEOUT_SRC_CONN` instead of `BLE_GAP_ TIMEOUT_SRC_SCAN` when the scanner times out (DRGN-10000).
    - Fixed an issue where the advertiser would not update its address type if `sd_ble_gap_addr_set()` or `sd_ble_gap_privacy_set()` was called after `sd_ble_gap_adv_set_configure()` and before `sd_ble_gap_adv_start()` (DRGN-10025).

- Fixed an issue where the SoftDevice incorrectly reported advertising packets from non-whitelisted devices if the `BLE_GAP_SCAN_FP_WHITELIST_NOT_RESOLVED_DIRECTED` filter policy was used (DRGN-10196).
- Fixed an issue where the scanner incorrectly reported the `data_id` field in extended advertising PDUs as zero (DRGN-10204).
- Fixed an issue where passing a zero-initialized parameter to `sd_ble_gap_connect()` could cause an assert (DRGN-10331).
- Fixed an issue where the SoftDevice could return `NRF_ERROR_INVALID_STATE` if the application called `sd_ble_gap_scan_start()` or `sd_ble_gap_connect()` right after receiving `BLE_GAP_EVT_TIMEOUT` for a previous call to `sd_ble_gap_connect()` (DRGN-10215).
- Fixed an issue where the SoftDevice could return `NRF_ERROR_INVALID_STATE` if the application called `sd_ble_gap_scan_start()` or `sd_ble_gap_connect()` right after calling `sd_ble_gap_connect_cancel()` (DRGN-10226).
- Fixed an issue that could cause an assert when an advertiser configured with invalid parameters connected to a peer (DRGN-10355).
- Fixed an issue that could cause an assert when the advertiser was stopped (DRGN-10364).

- **LL**
  - Fixed an issue where the SoftDevice might not respect the MaxTxOctets of the peer if the peer transmits on LE Coded PHY using the S=2 coding scheme (DRGN-9714).
  - Fixed an issue that would lead to high packet error rate when receiving on LE Coded PHY in noisy environments (DRGN9768).
  - Fixed an issue that could cause links to disconnect (DRGN-9844).
  - Fixed an issue where the advertiser could send advertising packets beyond the set advertising duration (DRGN-10069).
  - Fixed an issue where the slave might not listen during the entire connection parameter update (DRGN-10086).
  - Fixed an issue where the master used wrong timings while establishing a connection with Advertising Extensions (DRGN10112).
  - Fixed an issue where a privacy enabled extended advertiser would never be able to connect (DRGN-10205).
  - Fixed an issue where the SoftDevice sent ADV_EXT_IND PDUs with an incorrect AUX Offset (DRGN-10207).
  - Fixed an issue where the extended advertiser could assert if receiving longer PDUs than expected (DRGN-10232).
  - Fixed an issue that could result in lost advertising reports and advertising reports with all fields set to zero (DRGN-10393).
  - Fixed an issue where the scanner would not generate a report for information received in scanned ADV_EXT_IND and AUX_ADV_IND if the AUX_SCAN_RSP was missed (DRGN-10397).

- Fixed an issue where the SoftDevice could assert while scanning on LE Coded PHY (DRGN-9932).

Limitations

- **ANT**
  - The low frequency RC oscillator clock source (NRF_CLOCK_LF_SRC_RC) is not tested or intended for use with the ANT stack.
- **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 levels higher than 6 (priority level numerical values lower than 6) as this can lead to undefined behavior.
  - Applications aiming at initiating LE connections on LE Coded PHY must have configured the length of the connection event to be sufficiently large to transmit and receive at least one pair of data channel PDUs with a payload of 27 octets. Otherwise, the SoftDevice will not be able to connect on LE Coded PHY.
  - If the scanner is configured with a scan window larger than 16 seconds, the scanner will truncate the scan window to 16 seconds (DRGN-10305).
- **GATT**
  - 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).
- **LL**
  - In connections, the Link Layer payload size is limited to 27 bytes on LE Coded PHY (DRGN-8476).
  - This SoftDevice is not backwards compatible with the s132_nrf52_3.0.0 SoftDevice for the Data Length Update procedure (DRGN-10264).

Known Issues

- **SoftDevice**
  - `sd_ble_gap_device_name_set()` may return `NRF_ERROR_INTERNAL` instead of `NRF_ERROR_NO_MEM` if the allocated space for the device name is too small. A workaround is to allocate large enough space for the device name before calling `sd_ble_gap_device_name_set()` (DRGN-10195).
  - The memory protection provided by the MWU peripheral may be disabled. Corrupting the SoftDevice memory can cause the SoftDevice to malfunction (DRGN-10361).

    - If the application requests an earliest possible Radio Timeslot and the timeslot is blocked, the SoftDevice will repeat the same request until it times out, thereby blocking the main context and the lower application interrupt priority levels. A possible workaround is to increase the timeout of the Radio Timeslot request to make it able to fit after the event that is blocking the request (DRGN-10402).
    - When using the QoS channel survey feature, the reported RSSI value for a channel is influenced by the noise on the previously checked channel (DRGN-10441).
    - When using the QoS channel survey feature, the LNA control only works for the first channel that is checked in the survey (DRGN-10466).
- **GAP**
    - If an extended advertiser is configured with limited duration, it will time out after the first primary channel packet in the last advertising event (DRGN-10367).

ANT_S340_nrf52840_6.0.0

The ANT_S340_nrf52840_6.0.0 SoftDevice is the first production release for the nRF52840 platform. It is based upon the ANT_S212_nrf52832_5.0.0 (ANT) SoftDevice and the s140_nrf52_6.0.0 (BLE) SoftDevice.

Notes

- The features in this release are identical to those in the ANT_S340_nrf52840_6.0.0 alpha1 release described in the following section. Notes for the alpha1 release should be referenced for information on available features, changes, limitations, bug fixes and known issues.

SoftDevice Properties

- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.3.0.
- The combined MBR and SoftDevice memory requirements for this version is as follows:
    - Flash: **192 kB** (0x30000 bytes)
    - RAM: **8 kB** (0x2000 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)
- The Firmware ID of this SoftDevice is 0x00AD.

ANT_S340_nrf52840_6.0.0 alpha1

The ANT_S340_nrf52840_6.0.0 alpha1 SoftDevice is the first alpha release for the nRF52840 platform. It is based upon the ANT_S212_nrf52832_5.0.0 (ANT) SoftDevice and the s140_nrf52_6.0.0 (BLE) SoftDevice.

Notes

- This release has changed the Application Programmer Interface (API). This requires applications to be recompiled.
- LE Advertising Extensions and LE Long Range (LE Coded PHY) features are not Bluetooth Qualified in this production release. These features are suitable for development purposes but cannot be used in end products. These features are limited in functionality, may not function as specified, and may contain issues. The Qualified Design Identifier (QDID) for S140 will not include qualification of these features. In future releases of this SoftDevice, LE Advertising Extensions and LE Long Range (LE Coded PHY) will be fully qualified. At that time, a new QDID will be available which includes these features for new product listings.
- s140_nrf52_6.0.0 contains Errata workarounds that are adapted for the prototype version of the nRF52840 (revision A). The latest version compatible with nRF52840 revision A Errata was s140_nrf52840_6.0.0-6.alpha. s340_nrf52_6.0.0 should be used with nRF52840 revision B or later for production or performance measurements.

SoftDevice Properties

- This version of the SoftDevice contains the Master Boot Record (MBR) version 2.3.0.
- The combined MBR and SoftDevice memory requirements for this version is as follows:
    - Flash: **192 kB** (0x30000 bytes)
    - RAM: **8 kB** (0x2000 bytes) (minimum required memory - actual requirements are dependent upon the configuration chosen at `sd_ble_enable()` time)
- The Firmware ID of this SoftDevice is 0x00AD.

New Functionality

- **SoftDevice**
    - The SoftDevice API for advertising and scanning is updated and prepared to support future features. For more information, see the migration document (DRGN-9712).
    - The SoftDevice now has the functionality of write-protecting memory. This can be achieved by accessing the ACL peripheral configuration registers through sd_protected_register_write() (DRGN-8303).
- **GAP**
    - Channel number for RSSI measurement is now available in advertising reports (DRGN-9473).
    - Channel number for RSSI measurement is now available for connections (DRGN-9667).

    - API for channel survey (noise measurement) (DRGN-9580).
    - Support for setting channel map for the Observer role (DRGN-9518).
- **LL**
    - LE Coded PHY S=2 (500 kbps) coding scheme support for connected roles (DRGN-8474).
    - Active scanning for advertising extensions (DRGN-9735).
    - Scannable advertiser for advertising extensions (DRGN-9644).
    - Non-connectable non-scannable advertiser for advertising extensions (DRGN-9317).
    - Anonymous advertiser for advertising extensions (DRGN-9317).
    - Support for channel hopping on secondary channels for the extended advertiser (DRGN-8550).
    - Support for window widening for advertising extensions when following Aux Pointers (DRGN-9643).
    - Privacy support for extended advertising events in the advertiser role (DRGN-9235).
    - Support for Power Amplifier and Low Noise Amplifier (PA/LNA) for LE Coded PHY (DRGN-8166).

Changes

- **SoftDevice**
    - The SoftDevice now returns NRF_ERROR_BUSY from flash API functions until the event generated after a previous flash operation has been pulled (DRGN-9565).
    - The support for 9dBm TX power on nrf52840 has been removed. The maximum TX power supported is 8dBm (DRGN-9431).
    - The application now has access to both DC/DC converters of the nRF52840. See API in nrf_soc.h (DRGN-9122).
    - The application can now set the power failure comparator threshold value for high voltage using the sd_power_pof_thresholdvddh_set() API (DRGN-9123).
    - A message sequence chart for Unexpected Security Packet Reception has been added to Peripheral Security Procedures in the API documentation (DRGN-9479).
- **GATT**
    - The SoftDevice will now return NRF_ERROR_TIMEOUT instead of NRF_ERROR_BUSY from GATT API functions if a GATT procedure is blocked due to a previous procedure timeout (DRGN-9545).
    - Clarified API documentation: The length field in the parameter struct passed to sd_ble_gatts_hvx() may be written to by the SoftDevice (DRGN-9620).
- **GAP**
    - The sd_ble_gap_data_length_update() input parameter requirements have been relaxed. Previous requirements, which have now been removed, included symmetric input parameters and BLE_GAP_DATA_LENGTH_AUTO as the only valid input for max_tx_time_us and max_rx_time_us (DRGN-8499).
- **LL**
    - The documentation of the PHY Update procedure is improved (DRGN-9678).

- Bluetooth Core Specification Erratum #7408 is incorporated, meaning that it is now accepted to receive an LL_UNKNOWN_RSP during encryption procedure (DRGN-8414).
- Improved reception on LE Coded PHY in noisy environments by removing a workaround for ERRATA-164 that is only applicable to nRF52840 Engineering A (DRGN-9847).
- The SoftDevice now sends LL_REJECT_EXT_IND instead of LL_REJECT_IND if the peer has indicated support for LL_REJECT_EXT_IND (DRGN-9539).

Bug Fixes

- **SoftDevice**
  - Fixed an issue where sd_ble_gap_rssi_get() could sometimes return NRF_ERROR_SUCCESS with an invalid RSSI (DRGN-9746).
  - Fixed an issue where the HFXO would sometimes not be released properly after RC calibration (DRGN-9920).
  - Fixed an issue where the BLE_EVT_LEN_MAX(ATT_MTU) macro did not return the worst-case event length because it did not account for a corner case related to GATT primary service discovery response. This was fixed for s140_nrf52840_6.0.0-6.alpha, but was missing in the release notes (DRGN-9610).
  - Removed a limitation where Radio Notification could be suppressed between connection events when Connection Event Length Extension was enabled. This was fixed for s140_nrf52840_6.0.0-6.alpha, but was missing in the release notes (DRGN-7687).
  - Fixed an issue where flash writes would sometimes return NRF_ERROR_FORBIDDEN (DRGN-9144).
  - Fixed an issue where the LNA pin would be activated after the READY event from the radio for LE Coded PHY (DRGN-9868).
- **GATT**
  - Fixed an issue where the SoftDevice could drop a write request if it was received at the same time as a write command (DRGN-9709).
- **GAP**
  - Fixed an issue where sd_ble_gap_connect() could return NRF_SUCCESS when given invalid parameters (DRGN-9362).
  - Fixed an issue where sd_ble_gap_phy_update() would return NRF_ERROR_INTERNAL if the application preferred LE Coded PHY on a connection with short event length configuration (DRGN-9495).
  - Fixed an issue where the SoftDevice would sometimes not report the actual negotiated RX parameters in the BLE_GAP_EVT_DATA_LENGTH_UPDATE event (DRGN-9939).
  - Fixed an issue where the SoftDevice could assert if the white list and identity list were set at the same time with matching addresses (DRGN-9535).
- **LL**
  - Fixed an issue where the slave could disconnect with status code BLE_HCI_DIFFERENT_TRANSACTION_COLLISION if master sent an LL_UNKNOWN_RSP after a PHY procedure collision (DRGN-9870).

- Fixed an issue where the slave could disconnect with a status code other than HCI_STATUS_CODE_PIN_OR_KEY_MISSING when LTK was missing (DRGN-9190).
- Fixed an issue where connection establishment could fail on LE 2M PHY or LE Coded PHY (DRGN-9231).
- Host is no longer allowed to set a PHY with lower bit rate if the connection event length is too short (DRGN-9154).
- Fixed an issue where the SoftDevice as a slave might violate Bluetooth Core Specification v 5.0 timing restrictions if the master sent an LL_PHY_UPDATE_IND with Coded PHY (DRGN-9871).
- Fixed an issue that could lead to high packet error rate when receiving on LE Coded PHY (DRGN-9793).
- Fixed an issue where the SoftDevice might advertise with the RxAdd bit set to 1 for undirected advertisements. According to the Bluetooth Core Specification v 5.0, the RxAdd bit is reserved for future use for these PDU types (DRGN-9739).
- Fixed an issue where the SoftDevice could assert if the identity list was used while advertising or scanning (DRGN-9723).
- Fixed an issue that could cause an assert when generating advertising report for a directed advertising event (DRGN-9552).
- Fixed an issue where the SoftDevice had problems connecting to non-Nordic devices using the LE Extended Advertising feature (DRGN-9543).
- Fixed an issue where the SoftDevice might send an LL_LENGTH_RSP with illegal values for TX/RX octets if the event length configured for the link was either 4 or 5 and LE 2M PHY was used (DRGN-9839).
- Fixed an issue where incorrect timing calculations during the LE Data Length Update procedure could lead to an assert (DRGN-9612).
- Fixed an issue where the SoftDevice could get stuck in a deadlock where it would always NACK what the peer was sending. This could happen if LE Data Packet Length Extension was used and ble_cfg.conn_cfg.params.gap_conn_cfg.event_length was less than 5. This was fixed for s140_nrf52840_6.0.0-6.alpha, but was missing in the release notes (DRGN-9494).
- Fixed an issue where the extended advertiser did not use the proper clock accuracy when switching between primary and secondary advertising channels (DRGN-8554).

Limitations

- **ANT**
  - The low frequency RC oscillator clock source (NRF_CLOCK_LF_SRC_RC) is not tested or intended for use with the ANT stack.
- **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.

    - 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 levels higher than 6 (priority level numerical values lower than 6) as this can lead to undefined behavior.
    - Applications aiming at initiating LE connections on LE Coded PHY must have configured the length of the connection event to be sufficiently large to transmit and receive at least one pair of data channel PDUs with a payload of 27 octets. Otherwise, the SoftDevice will not be able to connect on LE Coded PHY.
    - GPIO port 1 pins (P1.00 to P1.15) can not be used for PA/LNA on nRF52840.
    - The LE Advertising Extension and LE Coded PHY implementations are incomplete and may not function as specified. These features are only suitable for development purposes, not production.
    - The main functionality that is missing is scanner privacy for advertising extensions, advertising and scanning AUX_CHAIN_IND PDUs, and advertising intervals longer than 10.24 s.
- **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.
- **LL**
    - The Link-Layer payload size is limited to 27 bytes for LE Coded PHY.

Known Issues

- **SoftDevice**
    - If the application writes to protected memory, the SoftDevice HardFault handler can hang while trying to read an invalid value from the call stack.
    - If the application calls a NULL pointer, there will be a HardFault inside the SoftDevice HardFault handler.
    - If the application configures too many L2CAP Connection-oriented Channels in total for all connections, the SoftDevice will assert during sd_ble_enable(). Less than 150 channels are supported.
    - When the scanner times out, the source of the timeout event might be set to BLE_GAP_TIMEOUT_SRC_CONN instead of BLE_GAP_TIMEOUT_SRC_SCAN(DRGN-10000).
    - If sd_ble_gap_addr_set() or sd_ble_gap_privacy_set() is called after sd_ble_gap_adv_set_configure() and before sd_ble_gap_adv_start(), the advertiser will not update its address type.

    - If the application calls sd_ble_gap_adv_set_configure() with ble_gap_adv_properties_t::type set to a legacy advertising type and either ble_gap_adv_properties_t::anonymous or ble_gap_adv_properties_t::include_tx_power is set to 1, the SoftDevice will assert.
- **LL**
    - The SoftDevice might not respect the MaxTxOctets of the peer if the peer transmits on LE Coded PHY using the S=2 coding scheme.
    - The SoftDevice can assert while scanning on LE Coded PHY.
    - The packet error rate is high when receiving on LE Coded PHY in noisy environments.