s310_nrf51422 release notes

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Introduction to the s310_nrf51422 release notes

These release notes describe the changes in the s310_nrf51422 from version to version.

The release notes are intended to list all relevant changes in a given version. They are kept brief, to make it easy to get the overview. More details regarding changes and new features may be found in the s310_nrf51422 migration document (normally available for major releases only).

Issue numbers in parentheses are for internal use, and should be disregarded by the customer.

s310_nrf51422_3.0.0

The main features of this release enable you to:

- set the size of the GATT Server Attribute Table when initializing the BLE stack.
- notify the application when the SoftDevice receives scan requests.
- disable RF channels for advertising.
- change CPU availability during radio events.
- change DC/DC converter configuration.
- PPI channel allocations have been added to take advantage of the nRF51 series IC revision 3.

Notes:

- This is a major release which has changed the Application Programmer Interface (API), requiring applications to be recompiled.
- This SoftDevice version is not production tested on all IC revisions, and is **not compatible with nRF51 IC revision 1**. Users of the SoftDevice **must verify the compatibility of their SoftDevice/IC combination** for development and for production. Compatibility information is found in the nRF51 Series Compatibility Matrix, which can be downloaded from www.nordicsemi.com.

SoftDevice properties

- The SoftDevice Specification corresponding to this release is the S310 SoftDevice Specification v3.0.0.
- This version of the SoftDevice contains the Master Boot Record (MBR) version 1.0.1.
- The combined MBR and SoftDevice memory requirements for this version are as follows:
  - Flash: **116 kB** (`0x1D000` bytes).
  - RAM: **8.5 kB** (`0x2200` bytes) (default value - dependent upon configured size of the GATT Server Attribute Table).

New functionality

- SoftDevice
  - The application can now configure the amount of memory reserved for the GATT Server Attribute Table when initializing the BLE stack (DRGN-3744). Configuration is optional. By default, the RAM reserved for the Attribute Table will be `0x700` bytes. This is the same default allocation as in the v7.1.0.
- GAP
  - The application can now configure the SoftDevice to deliver events when scan request packets are received (DRGN-2880, NRFFOETT-281).
  - The application can now selectively disable RF channels used for advertising (DRGN-2598, NRFFOETT-179).

Changes

- SoftDevice
    - The default behavior is now that the application can use the CPU while the radio is active. In previous versions of the S110, the CPU execution was blocked by the SoftDevice during radio activity. Note that this new default setting is incompatible with running this SoftDevice on nRF51 series IC revision 2 (devices affected by PAN #44 "CCM may exceed real time requirements" and PAN #45 "AAR may exceed real time requirements" described in the nRF51822-PAN). If you plan to run v8.x on devices affected by these PANs, you will need to enable mutual exclusion between the radio and the application by means of the `sd_ble_opt_set()` SV call and the `BLE_COMMON_OPT_RADIO_CPU_MUTEX` option (DRGN-4511). (For IC revision information, see the nRF51 Series Compatibility Matrix, downloadable from the Nordic Semiconductor web page.)
    - The DC/DC converter usage has been simplified by deprecating the `AUTO` option. The DC/DC converter is now supported when running the SoftDevice on nRF51 series IC revision 3 (DRGN-2420, DRGN-4622). (For IC revision information, see the nRF51 Series Compatibility Matrix, downloadable from the Nordic Semiconductor web page.)
    - Six previously reserved PPI channels have been freed and may be used by the application (DRGN-5082).
    - A set of new macros have been introduced to access the SoftDevice info structure directly from hex or bin SoftDevice images (DRGN-4642).
- GAP
    - RSSI events can now be controlled by the application by setting a report frequency and threshold (DRGN-3598).
    - The SoftDevice can now accept an LTK distributed by a Central during bonding (DRGN-4998).
    - The `BLE_GAP_EVT_CONNECTED` event now includes the device's own address which allows the application to find out which address was used to establish a particular connection. This can be useful when using privacy features (DRGN-5016).
    - The GAP advertising timeout source macro has been renamed.
    - The `ble_gap_opt_t` instance inside `ble_opt_t` has been renamed from `gap` to `gap_opt` (DRGN-4511).
    - The GAP security interface has been redesigned and improved. Please refer to the migration document for further information.
- GATTS
    - `sd_ble_gatts_value_set()` and `sd_ble_gatts_value_get()` now take a connection handle as an input parameter (DRGN-4988).
    - The system attribute data (CCCDs) can now be separately retrieved and restored for user and system attributes (DRGN-5112).
- ANT
    - Updated ANT version string to BAJ5.00B00
    - Updated sd_ant_enable() API description in interface header file
    - Allow re-enabling Softdevice to reset default ANT scalable configuration
    - Increased maximum ANT event queue size to support increased channels
    - ANT scalable channel feature
        - ANT stack, by default, only supports 1 ANT channel (encryption supported) and transmit burst queue size of 64 bytes. If additional channels are required, *sd_ant_enable()* must be used to specify maximum number of channels, number of encrypted channels, transmit burst queue size and supply application RAM block. Call after the Softdevice is enabled and before configuring/running ANT channels. For more information on usage see migration document. *(s310_nrf51422_3.0.0_migration_document.pdf)*
    - Major revision change: Re-compilation of application is required.

Bug fixes

- SoftDevice
  - Fixed an issue where the SoftDevice current consumption could remain high (1 mA) after disabling the SoftDevice when running on RC LFCLOCK (DRGN-5472, NRFFOETT-968).
- GAP
  - Fixed an assert that could happen if the peer sent two consecutive pairing requests (DRGN-5081).
  - Fixed an assert that could happen if the peer sent an out of sequence key distribution packet and a new pairing request (DRGN-5503).
- GATTS
  - When adding an attribute with `vloc == VLOC_USER` the SoftDevice now correctly initializes its initial length to the one provided in the `init_len` parameter (DRGN-5216, NRFFOETT-936).
  - The `sd_ble_gatts_value_set()` SV call now accepts pointers to values residing in flash memory (DRGN-4609).
  - When adding a writable attribute with `vloc == VLOC_USER` the SoftDevice will now make sure that the pointer provided refers to a value stored in RAM (DRGN-4406).
  - The `sd_ble_gatts_sys_attr_get()` call now returns an error if no system attributes exist in the GATT Server Attribute Table (DRGN-5310).
  - Fixed an issue where the `conn_handle` member of the `ble_gatts_evt_t` structure for a `BLE_GATTS_EVT_SYS_ATTR_MISSING` event did not contain a valid connection handle (DRGN-4501, DRGN-4617).
- GATTC
  - The `sd_ble_gattc_char_value_by_uuid_read()` SV call can no longer return `NRF_ERROR_INTERNAL` if an invalid UUID type is provided (DRGN-4715).
- LL
  - Fixed an assert that could be triggered if the local clock and/or peer clock accuracy are lower (less accurate) than declared (DRGN-5153, NRFFOETT-987).
  - Fixed an issue where disconnection with reason `0x3E` could be received during connection parameter update (DRGN-4862).
- L2CAP
  - Fixed an issue where the wrong LL PDU length was used for data over the air when an L2CAP command reject packet was sent (DRGN-5480).
- ANT
  - Fixed RX find match issue caused by incorrect MAX_ANT_CHANNELS. Maximum scalable channel configuration (MAX_ANT_CHANNELS) is now 15.
  - Added error checking on attempts to send transmission on background searching channel.
  - Addressed bug in fast channel start with pending close channel.

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.
  - On nRF51 series IC revision 2 and earlier, DC/DC converter operation controlled by the SoftDevice may interfere with radio function. As a result, `nrf_power_dcdc_mode` should not be modified by the application. The mode must not be set to `NRF_POWER_DCDC_MODE_AUTOMATIC` or `NRF_POWER_DCDC_MODE_ON` at any time (DRGN-2420).
- 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 Radio Notifications are configured while the SoftDevice is not in an idle state, the SoftDevice may in some situations assert (DRGN-5556, NRFFOETT-986). The workaround is to only configure Radio Notifications when the SoftDevice is in an idle state with no protocol stack or other SoftDevice activity in progress, as described in the API and in the S110 SoftDevice Specification v2.0.

s310_nrf51422_2.0.1

The only changes in this bugfix release are updates to the documentation - the release notes and the migration document. The SoftDevice hex file and the API header files are unchanged from the previous version.

New functionality

- No new functionality

Changes

- No changes

Bugfixes

- No bugfixes

Limitations

- **ANT**
  - ANT CW Test mode API might not always correctly generate the TX Carrier at the desired frequency.
    The suggested workaround is:
    - Request the HFCLK via the sd_clock_hfclk_request() API
    - Wait for HFCLK to be running by waiting for NRF_EVT_HFCLKSTARTED event by polling sd_evt_get() OR use nrf_delay_us() for ~2000us
    - Run sd_ant_cw_test_mode_init()
    - Run sd_ant_cw_test_mode()

Known Issues

- No known issues.

s310_nrf51422_2.0.0

This release adds several new features, among them support for over-the-air Device Firmware Update, support for running other protocol stacks concurrently with the BLE and ANT protocol stacks, and support for concurrent broadcasting while in an active BLE connection. The release also contains a number of changes and bugfixes. The feature set of this release corresponds to the combined feature sets of the s110_nrf51822_7.1.0 BLE SoftDevice and s210_nrf51422_4.0.1 ANT SoftDevice. The release is qualified to the Bluetooth specification version 4.1. The corresponding SoftDevice Specification is the *S310 nRF51422 SoftDevice Specification v2.0*.

Notes:

- This is a major release which has changed the Application Programmer Interface (API), requiring applications to be recompiled.
- This version of the SoftDevice contains the Master Boot Record (MBR) version 1.0.0.

New functionality

- **SoftDevice**
    - o The SoftDevice now supports concurrent multiprotocol operation using the Concurrent Multiprotocol Timeslot API. This enables the application to run a separate radio protocol (or reserve time slots) from application space concurrently with the SoftDevice BLE and ANT protocol stacks (DRGN-1010, DRGN-4074, DRGN-3456, DRGN-3176, FORT-828).
    - o The SoftDevice now contains a Master Boot Record (MBR) which enables Device Firmware Update (DFU) of the SoftDevice (in addition to the application and bootloader) over the air. The MBR API enables copying and comparing regions in flash memory and interrupt forwarding (DRGN-2282, DRGN-3738, FORT-822).
    - o `RCOSC` calibration can now be configured to be temperature dependent (FORT-790).
    - o The Flash API is now also available when the SoftDevice is disabled (FORT-836).
    - o The SoftDevice can now be configured to forward interrupts to one of several applications using the new `sd_softdevice_vector_table_base_set()` API call (FORT-815, NRFFOETT-688).
- **BLE**
    - o Common
        - ▪ An Options API has been introduced to allow the application to set and get advanced configuration options for the SoftDevice (DRGN-1183).
        - ▪ Using the Options API `sd_ble_opt_set()`, it is now possible for the application to use the CPU while the radio is active. By default in this version, and in previous versions of the SoftDevice, the CPU execution is blocked by the stack during radio activity. Note that this option cannot be used when running the SoftDevice on nRF51422 devices affected by PAN no. 44 "CCM may exceed real time requirements" and PAN no. 45 "AAR may exceed real time requirements" described in the nRF51422-PAN (DRGN-4511, DRGN-4815).
        - ▪ The application can choose not to include the Service Changed characteristic within the GATT server by using the parameters in the new `sd_ble_enable()` API call (DRGN-2879, NRFFOETT-215).
    - o GAP
        - ▪ Added support for Low Duty Cycle Directed Advertising (DRGN-1760).
        - ▪ The SoftDevice now supports broadcasting while in an active connection (DRGN-810, DRGN-4008).
        - ▪ Privacy 1.1: The SoftDevice is now able to generate and refresh resolvable and non-resolvable private addresses while advertising or broadcasting. The application may set a custom IRK and an address cycle interval, but also retains the option to set addresses explicitly (DRGN-4310, NRFFOETT-579).
        - ▪ The application can now provide its own display passkey during a pairing procedure that uses the passkey entry algorithm (DRGN-4169, NRFFOETT-716).
- **ANT**
    - o RSSI proximity can now be configured and used in the ANT RX scanning channel.
    - o Added support to allow wildcard channel ID uplink transmissions on an ANT RX scanning channel.
    - o Asynchronous TX channels are now capable of running asynchronously in the presence of other running ANT channels.
    - o Channels opened with channel fast initiation option now start as soon as possible in the presence of other running ANT channels.
    - o Improved RX scanning channel coexistence with application flash write and application radio timeslot scheduling.

o Added continuous modulated transmission test mode.

Changes

- **SoftDevice**
  - The size of the SoftDevice has been changed to 116 kB.
  - The SoftDevice hex file no longer contains the SoftDevice size in the UICR.CLENR0 register. This means that the SoftDevice is no longer protected by default. The updated versions of the tools (nRFgo Studio, nrfjprog) will write the SoftDevice size to the UICR.CLENR0 by default, thereby restoring default protection. Having protection enabled will not allow Device Firmware Update to a SoftDevice of a larger size than the original. Therefore, the tools make it optional to not set the UICR.CLENR0 register.
  - The FWID is no longer stored in the UICR. Updated versions of the tools (nRFgo Studio, nrfjprog) compatible with this change are available as downloads from the Nordic Semiconductor web page.
  - The `sd_softdevice_forward_to_application()` call has been replaced with `sd_softdevice_vector_table_base_set()` which takes the forwarding address as an argument (FORT-815, NRFFOETT-688).
  - SVC number changes.
  - The Radio Disable API supported in S310 version 1.0.0 is replaced by the Concurrent Multiprotocol Timeslot API.
  - Flash API operation behavior is changed. Flash write/erase retries are now based on a combination of timeout values and a fixed number of retries. Total operation timeout is a combination of low priority timeout (30 ms) and normal priority timeout (100 ms). If the initial low priority flash operation could not be scheduled within low priority timeout or within 3 scheduling tries, the operation's priority is raised to normal. If then the operation could not be scheduled within the normal priority timeout, the flash operation is treated as being timed out.
- **BLE**
  - Common
    - A new API call, `sd_ble_enable()` has been added. This must be called to initialize and enable the BLE stack after invoking `sd_softdevice_enable()` and previous to any BLE activity (DRGN-2879, NRFFOETT-215).
  - LL
    - The maximum RX listening time after sending a packet is increased from 152 us to 156 us to ensure that packets are successfully received from PC central protocol stacks that have been observed to send packets later than the T_IFS time of 150+/-2 us (DRGN-4719).
  - GAP
    - The `sd_ble_gap_address_set()` API call now takes an additional argument to support Privacy 1.1 (DRGN-4310, NRFFOETT-579).
    - New advertising data types introduced by the Bluetooth specification have been added (DRGN-4311).
    - The default appearance in the GAP service is now set to be `0x0000` (DRGN-3741).
    - The link will no longer be automatically disconnected if a pairing or bonding procedure fails (DRGN-3122, DRGN-4837).
  - GATTS
    - Characteristic User Description descriptors may now be stored in application flash (if read only) or application RAM (DRGN-3745, NRFFOETT-624).
    - The application can now call `sd_ble_gatts_value_set()` with `p_value` set to `NULL` to update the length of `VLOC_USER` attributes (DRGN-3748, NRFFOETT-670).

- **ANT**
  - The `sd_ant_prox_search_set()` API call now takes an additional parameter to specify custom (non-ANT indexed) proximity values. See the API documentation (included in the nRF51 SDK documentation, and also as comments in the API header files) for more information on usage.
  - The `sd_ant_cw_test_mode()` API call requires an additional parameter to specify test mode operation (original TX carrier test mode or new continuous modulated transmission test mode).
  - Return values that were previously not documented, have been added to `ant_interface.h` for one or more APIs.

Bugfixes

- **BLE**
  - Common
    - Fixed an issue affecting nRF51 chips with more than 16 kB of RAM that could cause an assert at `sd_ble_enable()` or cause SVC calls to return NRF_ERROR_INVALID_ADDRESS when a pointer to RAM above 16 kB was supplied (DRGN-4927, NRFFOETT-900).
    - Fixed an issue where sending data after the link had been disconnected might lead to reduced maximum throughput for the next connection (DRGN-4519).
  - LL
    - Fixed an issue where stopping advertising after a flash operation is triggered and then starting advertising again could lead to undefined behavior (DRGN-3785, DRGN-3788, DRGN-4151).
    - Fixed an issue that could cause the CPU to be active on each possible connection event (ignoring slave latency) if a peripheral connection and a broadcaster were active (DRGN-4832).
    - Fixed an issue that may occur when slave latency is used. After every 65536 connection events, queued data may not be sent at the next connection event, but after slave latency has expired (DRGN-4943).
  - GAP
    - Fixed an issue where the Identity Address Information sent to the peer during a pairing procedure was not initialized (DRGN-4521). The application no longer needs to manually initialize this field.
    - Fixed an issue where the key exchange bitmaps in the `ble_gap_evt_auth_status_t` event structure could be set incorrectly when re-bonding with an already bonded device (DRGN-3888).
    - Fixed an issue where the `offset` member in the `ble_gattc_evt_write_rsp_t` event structure was not set to 0 in case of a Write Response (DRGN-4402).
    - Fixed an issue where re-authenticating before the key distribution phase of the previous authentication procedure had finished could cause an assert (DRGN-3710, NRFFOETT-592).
  - GATTS
    - Fixed an issue where the previous value of the CCCD would be returned on a new connection (NRFFOETT-663, DRGN-3746).
- **ANT**
  - Fixed an issue where radio override settings in FICR may not get applied for NRF_1MBIT mode when running ANT.
  - Fixed an issue where specifying optional frequency hopping (FH) field in ANT advanced burst transfer parent configuration never puts the transfer parent in FH mode.
  - Added missing radio coexistence configuration capability in ANT capabilities message.

- Fixed an issue which causes ANT RX synchronous channel potentially to drop to search if it receives a non-synchronous ANT transmission packet (e.g. mid burst packets) that matches its ID. An example case where this issue could occur is in a Shared Channel network setup. Burst transfers from a slave channel to a master channel could cause all other slave channels (tracking the same master channel) to drop to search when it is not expected to.

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).
  - If Radio Notifications are enabled and configured with INT_ON_ACTIVE or INT_ON_BOTH and flash write, flash erase or concurrent multiprotocol timeslots are initiated through the SoftDevice API concurrently with ANT traffic, the radio notification distance should be set to 800 µs.
  - DC/DC converter operation controlled by the SoftDevice may interfere with radio function. As a result, nrf_power_dcdc_mode should not be modified by the application. The mode must not be set to NRF_POWER_DCDC_MODE_AUTOMATIC or NRF_POWER_DCDC_MODE_ON at any time. (DRGN-2420)
- **BLE**
  - Common
    - Synthesized low frequency clock source is not tested or intended for use with BLE stack.
  - GATTS
    - To conform to the Bluetooth specification there shall not be a secondary service that is not referenced by a primary service. The SoftDevice does not enforce this (DRGN-906).

Known Issues

- **BLE**
  - GATTS
    - The `conn_handle` member of the `ble_gatts_evt_t` structure for a `BLE_GATTS_EVT_SYS_ATTR_MISSING` event does not contain a valid connection handle (DRGN-4501). The application should store the connection handle upon connection establishment and use the stored value in subsequent `sd_ble_gatts_sys_attr_set()` calls.
    - Pointers to attribute values using the `VLOC_USER` modifier are not checked to be in a valid range (DRGN-4406). The application must provide a pointer to a valid area in RAM to avoid a Hard Fault during the processing of attribute operations.

s310_nrf51422_1.0.0

This is the initial production release of the s310_nrf51422 SoftDevice.

The s310_nrf51422 is a multiprotocol SoftDevice, containing both a Bluetooth Low Energy (BLE) protocol stack and an ANT protocol stack. These two protocol stacks can execute concurrently. The featureset of

the s310_nrf51422_1.0.0 corresponds to the combined featuresets of the s110_nrf51822_6.0.0 BLE SoftDevice and the s210_nrf51422_3.0.0 ANT SoftDevice.

Bugfixes

(This is the first production release of s310_nrf51422.)

Changes

(This is the first production release of s310_nrf51422.)

New functionality

(This is the first production release of s310_nrf51422.)

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).
  - If Radio Notifications are enabled, radio disable periods initiated through the SoftDevice API will be notified to the application as Radio Events (FORT-809)
  - If Radio Notifications are enabled and configured with INT_ON_ACTIVE or INT_ON_BOTH and flash write, flash erase or radio disable periods are initiated through the SoftDevice API concurrently with ANT traffic, the radio notification distance should be set to 800 µs.
- 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).
- SoftDevice
  - Synthesized low frequency clock source is not tested or intended for use with BLE stack.
  - DCDC converter operation controlled by the SoftDevice may interfere with radio function. As a result, nrf_power_dcdc_mode should not be modified by the application. The mode must not be set to NRF_POWER_DCDC_MODE_AUTOMATIC or NRF_POWER_DCDC_MODE_ON at any time. (DRGN-2420)

Known Issues

- SoftDevice
  - Stopping advertising (either by calling sd_ble_gap_adv_stop() or by a timeout) and then starting advertising again immediately may lead to undefined behaviour. The workaround is to wait 50 ms or more from advertising is stopped until starting advertising again. (DRGN-3785)