

SE840F/X, SE832AF Open Source Wireless Sensors

OpenSource with Market Ready Enclosure

SE840F/X sensors support Bluetooth 5, Thread, or Zigbee radio protocols. They are in market ready enclosure and pre-certified. OpenSource codes are available to expedite your firmware development.

SE832AF-210 BLE 5 Sensor

SE832AF integrates BT832AF Bluetooth 5 module with AMS ENS210 temperature and humidity sensor. It is a low power, low cost, long range sensor.m



SE840F-210 BLE 5, Thread, Zigbee Sensor

SE840F integrates a long-range module BT840F with AMS ENS210 humidity and temperature sensor.

SE840X-210 BLE 5, Thread, Zigbee Sensor

Using BT840X with +22.9 dBm TX, BLG832X can



penetrate multiple walls or be used in wide area mesh

Wireless Sensor Summaries

	SE840F-210	SE840X-210	SE832AF-210
BLE module	BT840F	BT840X	BT832AF
Radio protocols	Bluetooth, Thread, Zigbee	Bluetooth, Thread, Zigbee	Bluetooth
Temperature, humidity sensors	AMS ENS210	AMS ENS210	AMS ENS210
Power supply	2AAA, not included	AC adapter, included	2AAA, not included
FCC			
Industrial Canada			
QDID	108621	108621	97989

applications. Range between 2 BT840X is more than 4500 meters at 125 Kbps.

An AC adapter is included. SE840X is a perfect device to be used as a long range relay in mesh network.

Miscellaneous

- Sensor size: 60x60x22 mm.
- Includes a wall mount bracket.

Hardware for Programming

The following hardwares are required for programming:

- A Tag Connect cable **TC2050-IDC-NL-050-ALL**
- A Nordic nRF52840DK
- A Nordic nRF52DK can be used to program SE832AF.

Programming services are available for production quantities.

Nordic nRF52 Development Environment

Nordic nRF52 development environment is used to develop BT832AF, BT840F/X codes. Open source codes are available

<http://www.fanstel.com/download-opensource/>

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1. Introduction

SE840F Series wireless sensors Fanstel long range wireless module BT840F, BT840X, or BT832AF and an AMS ENS210 temperature and humidity sensors. All products are referred as SE840F Series in this user's manual.

SE840F integrates BT840F (nRF52840) module with 2300 meter range at 125 Kbps. SE840X integrates BT840X (nRF52840 + SKY66112 PA) with >4500 meter range at 125 Kbps.

SE832AF uses long range lost cost module, BT832AF. It supports Bluetooth 5 radio protocol but not Thread or Zigbee.

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2. Hardware Description

The same host board design is used for all wireless sensors and development kits.

You can load codes into SE840F/X and SE832AF by using a Tag Connect cable **TC2050-IDC-NL-050-AL**.

SE840F, SE840X, and SE832AF use the same enclosure and host PCB. The only difference is Bluetooth 5 module installed. Sensor can be desk mounted. A wall mount bracket is included for wall mounting.

Additional external hardware features:

- A battery compartment for 2 AAA batteries. Batteries are not included.
- Two user definable LED indicators, red and blue.
- A micro USB connector for powering sensor.
- A push button for OTA DFU.
- SE840X includes a micro USB AC adapter.

Size of gateway is 60x60x22mm.

SE832AF-210

SE832AF-210 contains an nRF52810 BLE 5 module BT832AF and an AMS ENS210 temperature and humidity sensor. It can be powered by 2 AAA batteries (not included). A wall mount bracket is included.



SE840F-210

SE840F-210 contains an nRF52840 BLE 5, Thread, Zigbee module BT840F and an AMS ENS210 temperature and humidity sensor. It can be powered by 2 AAA batteries (not included). A wall mount bracket is included.



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SE840X-210

SE840X-210 contains an nRF52840 with power amplifier BLE 5, Thread, Zigbee module BT840X and an AMS ENS210 temperature and humidity sensor. It can be powered by an AC adapter (included). A wall mount bracket is included. Development Kit Hardware

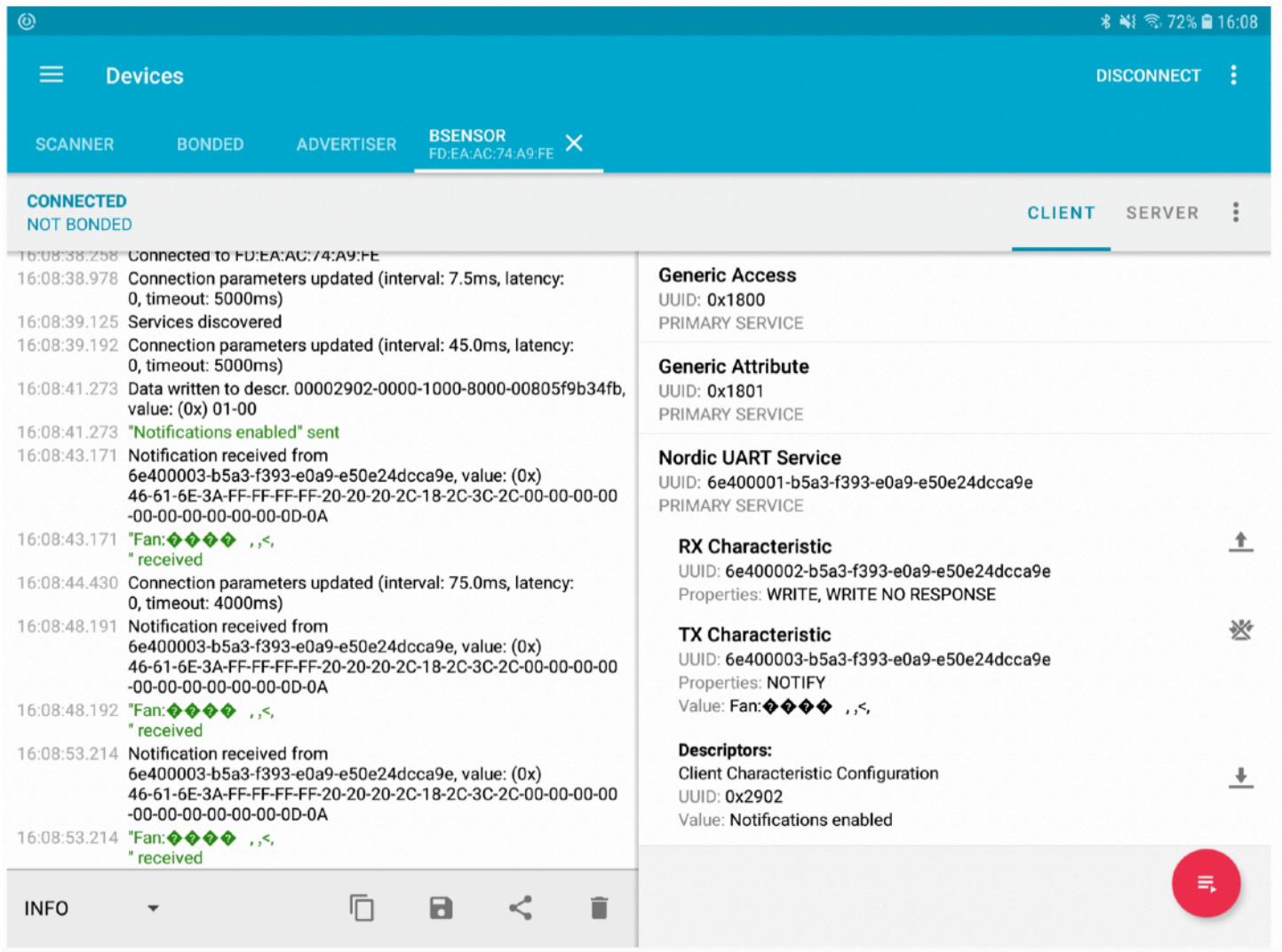


3. Firmware Development and Testing

Preloaded Firmware

SE840F-210 included temperature and humidity sensor ENS210. The device is preloaded with ENS210 driver. After powering up, the device advertises name "Bsensor".

- Use nRF Connect APP with the device.
- The APP will receive sensor data every 5 seconds in HEX format.
- The following screenshot shows temperature is 24 degrees(byte 12, 0X18 = 24) and humidity is 60 (byte 14, 0X3C = 60).



The screenshot displays the nRF Connect mobile application interface. At the top, there is a blue header with a menu icon, the word "Devices", and a "DISCONNECT" button. Below the header, there are tabs for "SCANNER", "BONDED", "ADVERTISER", and "BSENSOR" (selected). The "BSENSOR" tab shows the device's MAC address: "FD:EA:AC:74:A9:FE".

The main area is divided into two sections. On the left, there is a log of connection events. On the right, there are details for the selected service.

Log of Connection Events:

- 16:08:38.258 Connected to FD:EA:AC:74:A9:FE
- 16:08:38.978 Connection parameters updated (interval: 7.5ms, latency: 0, timeout: 5000ms)
- 16:08:39.125 Services discovered
- 16:08:39.192 Connection parameters updated (interval: 45.0ms, latency: 0, timeout: 5000ms)
- 16:08:41.273 Data written to descr. 00002902-0000-1000-8000-00805f9b34fb, value: (0x) 01-00
- 16:08:41.273 "Notifications enabled" sent
- 16:08:43.171 Notification received from 6e400003-b5a3-f393-e0a9-e50e24dcca9e, value: (0x) 46-61-6E-3A-FF-FF-FF-FF-20-20-20-2C-18-2C-3C-2C-00-00-00-00-00-00-0D-0A
- 16:08:43.171 "Fan:♦♦♦♦ ,,<, " received
- 16:08:44.430 Connection parameters updated (interval: 75.0ms, latency: 0, timeout: 4000ms)
- 16:08:48.191 Notification received from 6e400003-b5a3-f393-e0a9-e50e24dcca9e, value: (0x) 46-61-6E-3A-FF-FF-FF-FF-20-20-20-2C-18-2C-3C-2C-00-00-00-00-00-00-0D-0A
- 16:08:48.192 "Fan:♦♦♦♦ ,,<, " received
- 16:08:53.214 Notification received from 6e400003-b5a3-f393-e0a9-e50e24dcca9e, value: (0x) 46-61-6E-3A-FF-FF-FF-FF-20-20-20-2C-18-2C-3C-2C-00-00-00-00-00-00-0D-0A
- 16:08:53.214 "Fan:♦♦♦♦ ,,<, " received

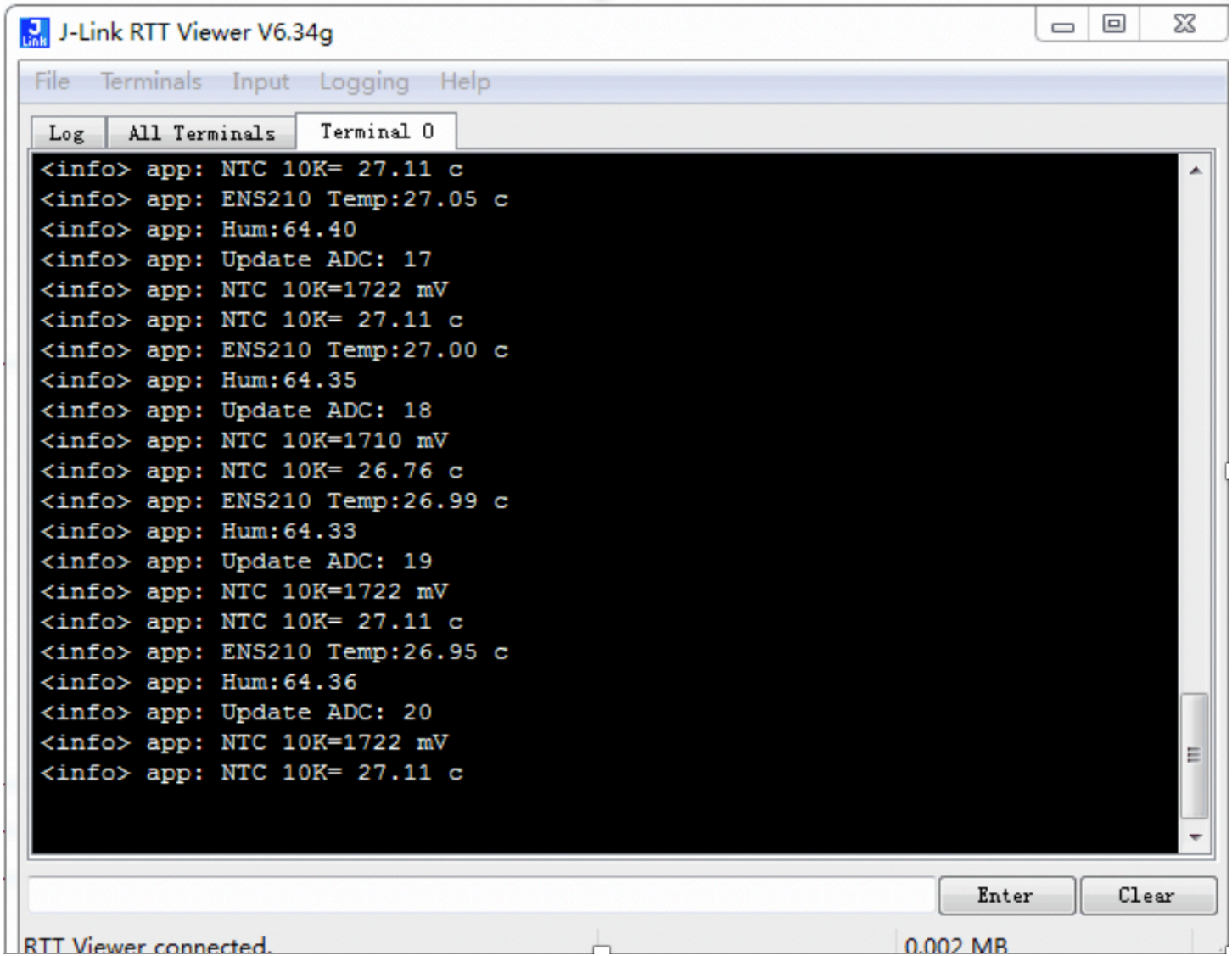
Service Details:

- Generic Access**
UUID: 0x1800
PRIMARY SERVICE
- Generic Attribute**
UUID: 0x1801
PRIMARY SERVICE
- Nordic UART Service**
UUID: 6e400001-b5a3-f393-e0a9-e50e24dcca9e
PRIMARY SERVICE
- RX Characteristic**
UUID: 6e400002-b5a3-f393-e0a9-e50e24dcca9e
Properties: WRITE, WRITE NO RESPONSE
- TX Characteristic**
UUID: 6e400003-b5a3-f393-e0a9-e50e24dcca9e
Properties: NOTIFY
Value: Fan:♦♦♦♦ ,,<,
- Descriptors:**
Client Characteristic Configuration
UUID: 0x2902
Value: Notifications enabled

At the bottom of the screen, there is an "INFO" button and a red circular button with a menu icon.

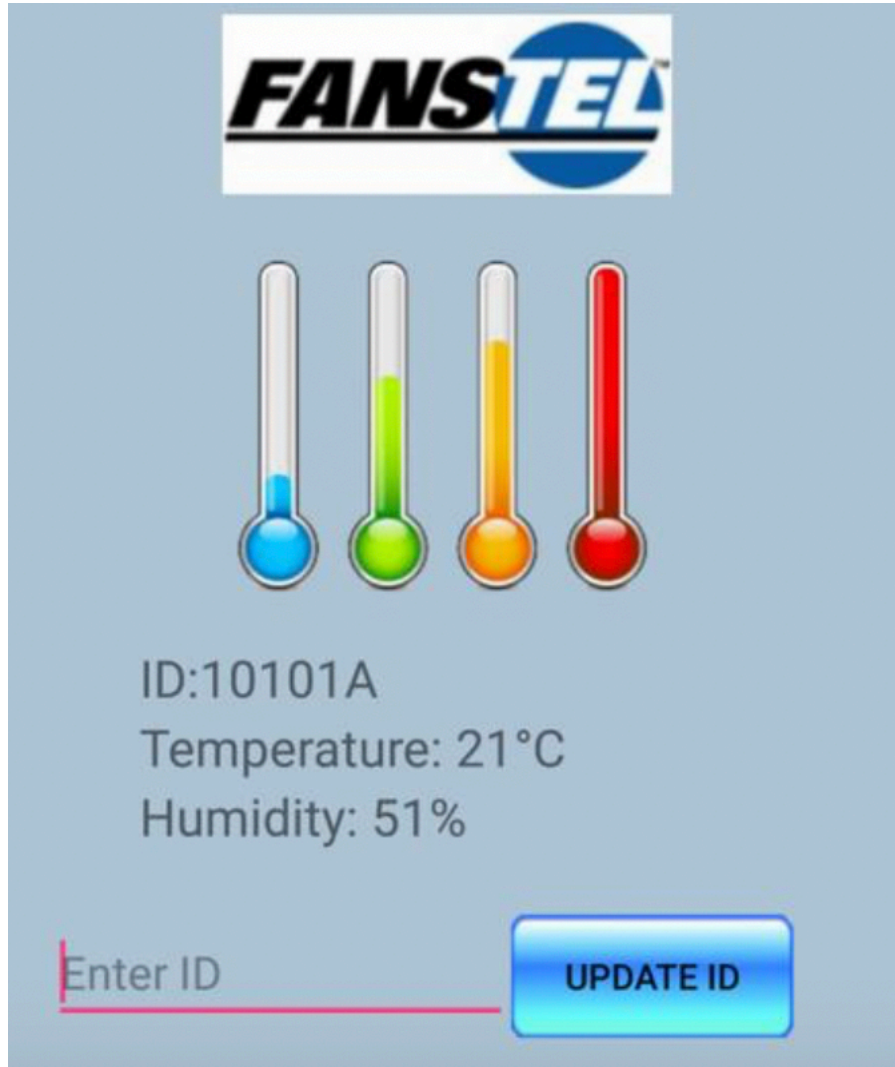
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SE840F-210 supports thermistor thermometer. Thermistor data are not sent out via the BLE. User can check the data by RTT viewer.



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When the sensor connected the Fanstel gateway BLG840F or BWG832F, BWG840F. The gateway will upload the raw data to Fanstel MQTT server. You can use your Android phone to check the data.



Please download the gateway user guide if you need the detail of sequences for setup gateway.

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Nordic Development Environment

Nordic Semiconductor provides a complete range of hardware and software development tools for the nRF52 Series devices. nRF52 DK board is recommended for firmware development. Document and Software development tools can be downloaded by the following links.

Get start with Nordic chip and all online documents.

http://infocenter.nordicsemi.com/index.jsp?topic=/com.nordic.infocenter.nrf52/dita/nrf52/development/nrf52_dev_kit.html&cp=1_1

Nordic SDK with many example projects.

https://developer.nordicsemi.com/nRF5_SDK/

Nordic development zone. You can search or ask a question there.

<https://devzone.nordicsemi.com/tutorials/b/getting-started/posts/development-with-gcc-and-eclipse>

Programming the Nordic chip

Download and install Nrf5x-Command-Line Tools

<https://www.nordicsemi.com/eng/nordic/Products/nRF52840/nRF5x-Command-Line-Tools-Win32/58850>

Download and install nRF Connect

https://www.nordicsemi.com/?sc_itemid={B935528E-8BFA-42D9-8BB5-83E2A5E1FF5C}

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Firmware to Control Power Amplifier in SE840X

The following codes are used to set up and control power amplifier SKY66112 in SE840X. Codes can be downloaded from:

<https://www.fanstel.com/download-document>

Header files

```
#ifndef PA_LNA_H__
#define PA_LNA_H__

#include "ble.h"
#include "app_error.h"
#include "nrf_drv_gpiote.h"
#include "nrf_drv_ppi.h"

void pa_lna_init(uint32_t gpio_pa_pin, uint32_t gpio_lna_pin);

#endif
```

Main program.

```
#include "pa_lna.h"

#define APP_PA_LAN

#ifdef APP_PA_LAN
#define APP_PA_PIN    17
#define APP_LNA_PIN   19
#define APP_CHL_PIN8
#define APP_CPS_PIN   6

int main(void)
{
    ....
#ifdef APP_PA_LAN
    nrf_gpio_cfg_output(APP_CPS_PIN);
    nrf_gpio_cfg_output(APP_CHL_PIN);
    nrf_gpio_pin_set(APP_CHL_PIN);
    nrf_gpio_pin_clear(APP_CPS_PIN); //enable
    pa_lna_init(APP_PA_PIN,APP_LNA_PIN);
```

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```
#endif
```

```
....
```

```
}
```

SKY66112 control codes.

```
#include <stdint.h>
```

```
#include <string.h>
```

```
#include "pa_lna.h"
```

```
#include "ble.h"
```

```
#include "app_error.h"
```

```
#include "nrf_drv_gpiote.h"
```

```
#include "nrf_drv_ppi.h"
```

```
void pa_lna_init(uint32_t gpio_pa_pin, uint32_t gpio_lna_pin)
```

```
{
```

```
    ble_opt_t opt;
```

```
    uint32_t gpiote_ch = NULL;
```

```
    ret_code_t err_code;
```

```
    memset(&opt, 0, sizeof(ble_opt_t));
```

```
    err_code = nrf_drv_gpiote_init();
```

```
    if(err_code != NRF_ERROR_INVALID_STATE)
```

```
        APP_ERROR_CHECK(err_code);
```

```
    err_code = nrf_drv_ppi_init();
```

```
    //if(err_code != MODULE_ALREADY_INITIALIZED)
```

```
        APP_ERROR_CHECK(err_code);
```

```
    nrf_ppi_channel_t ppi_set_ch;
```

```
    nrf_ppi_channel_t ppi_clr_ch;
```

```
    err_code = nrf_drv_ppi_channel_alloc(&ppi_set_ch);
```

```
    APP_ERROR_CHECK(err_code);
```

```
    err_code = nrf_drv_ppi_channel_alloc(&ppi_clr_ch);
```

```
    APP_ERROR_CHECK(err_code);
```

```
    nrf_drv_gpiote_out_config_t config = GPIOTE_CONFIG_OUT_TASK_TOGGLE(false);
```

```
    if((gpio_pa_pin == NULL) && (gpio_lna_pin == NULL))
```

```
    {
```

```
        err_code = NRF_ERROR_INVALID_PARAM;
```

```
        APP_ERROR_CHECK(err_code);
```

```
    }
```

```
    if(gpio_pa_pin != NULL)
```

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```
{
  if(gpiote_ch == NULL)
  {
    err_code = nrf_drv_gpiote_out_init(gpio_pa_pin, &config);
    APP_ERROR_CHECK(err_code);

    gpiote_ch = nrf_drv_gpiote_out_task_addr_get(gpio_pa_pin);
  }

  // PA config
  opt.common_opt.pa_lna.pa_cfg.active_high = 1; // Set the pin to be active high
  opt.common_opt.pa_lna.pa_cfg.enable     = 1; // Enable toggling
  opt.common_opt.pa_lna.pa_cfg.gpio_pin   = gpio_pa_pin; // The GPIO pin to toggle tx
}

if(gpio_lna_pin != NULL)
{
  if(gpiote_ch == NULL)
  {
    err_code = nrf_drv_gpiote_out_init(gpio_lna_pin, &config);
    APP_ERROR_CHECK(err_code);

    gpiote_ch = nrf_drv_gpiote_out_task_addr_get(gpio_lna_pin);
  }

  // LNA config
  opt.common_opt.pa_lna.lna_cfg.active_high = 1; // Set the pin to be active high
  opt.common_opt.pa_lna.lna_cfg.enable     = 1; // Enable toggling
  opt.common_opt.pa_lna.lna_cfg.gpio_pin   = gpio_lna_pin; // The GPIO pin to toggle rx
}

// Common PA/LNA config
opt.common_opt.pa_lna.gpiote_ch_id = (gpiote_ch - NRF_GPIOTE_BASE) >> 2; // GPIOTE channel used for
radio pin toggling
opt.common_opt.pa_lna.ppi_ch_id_clr = ppi_clr_ch; // PPI channel used for radio pin clearing
opt.common_opt.pa_lna.ppi_ch_id_set = ppi_set_ch; // PPI channel used for radio pin setting

err_code = sd_ble_opt_set(BLE_COMMON_OPT_PA_LNA, &opt);
APP_ERROR_CHECK(err_code);
}
```

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Revision History

- June 2019, Ver. 0.50: Initial draft release
- Nov. 2020, Ver. 0.90: Draft revision

SE840F/X, SE832AF Open Source Wireless Sensors

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