

SE6233F, Open Source LoRa-BLE 5.1 Sensors

Draft Ver 0.91 June 2021

OpenSource with Market Ready Enclosure

SE6233F sensors support LoRa, Bluetooth 5.1, Thread, or Zigbee radio protocols. They are in market ready enclosure and pre-certified.

SE6233F consists of:

- A Nordic nRF52833 BLE 5.1 module, BM833F
- A Semtech SX1262 LoRa module, LR62E.
- An AMS ENS210 temperature and humidity sensor.
- A ST Micro LIS3DH 3-axis motion sensor.

Preloaded Codes

The Cortex M4F MCU in BM833F manages LR62E LoRa module. It is preloaded with application codes:

- To broadcast sensor data in BLE 5 Eddystone format.
- To broadcast sensor data in BLE 5 iBeacon format.
- To transmit sensor data over LoRa channel to a cloud server through a Fanstel LoRa gateway.
- An Android OS app. Is used to select and set up a broadcasting channel.

You can erase firmware and load new one by connecting to a Nordic nRF52833DK through SWD (Serial Wire Debug) connector and a 10-pin flat cable. The flat cable is included in PK-LEW840X,

Or, you can generate new firmware with Fanstel private key for OTA firmware upgrade.

Open source codes are available

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



Miscellaneous

- Enclosure size: 60x60x22 mm.
- Includes a wall mount bracket.
- Uses 2AAA batteries or a micro USB AC adapter, neither included.

Wireless Sensor Summaries

	SE6233F
BLE module	BM833F
Radio protocols	Bluetooth, Thread, Zigbee
Power supply	2AAA or micro USB adapter, neither included
FCC	
Industrial Canada	
QDID	108621

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1. Introduction

SE6233F sensors support LoRa, Bluetooth 5.1, Thread, or Zigbee radio protocols. They are in market ready enclosure and pre-certified. OpenSource codes are available to expedite your firmware development.

2. Hardware Description

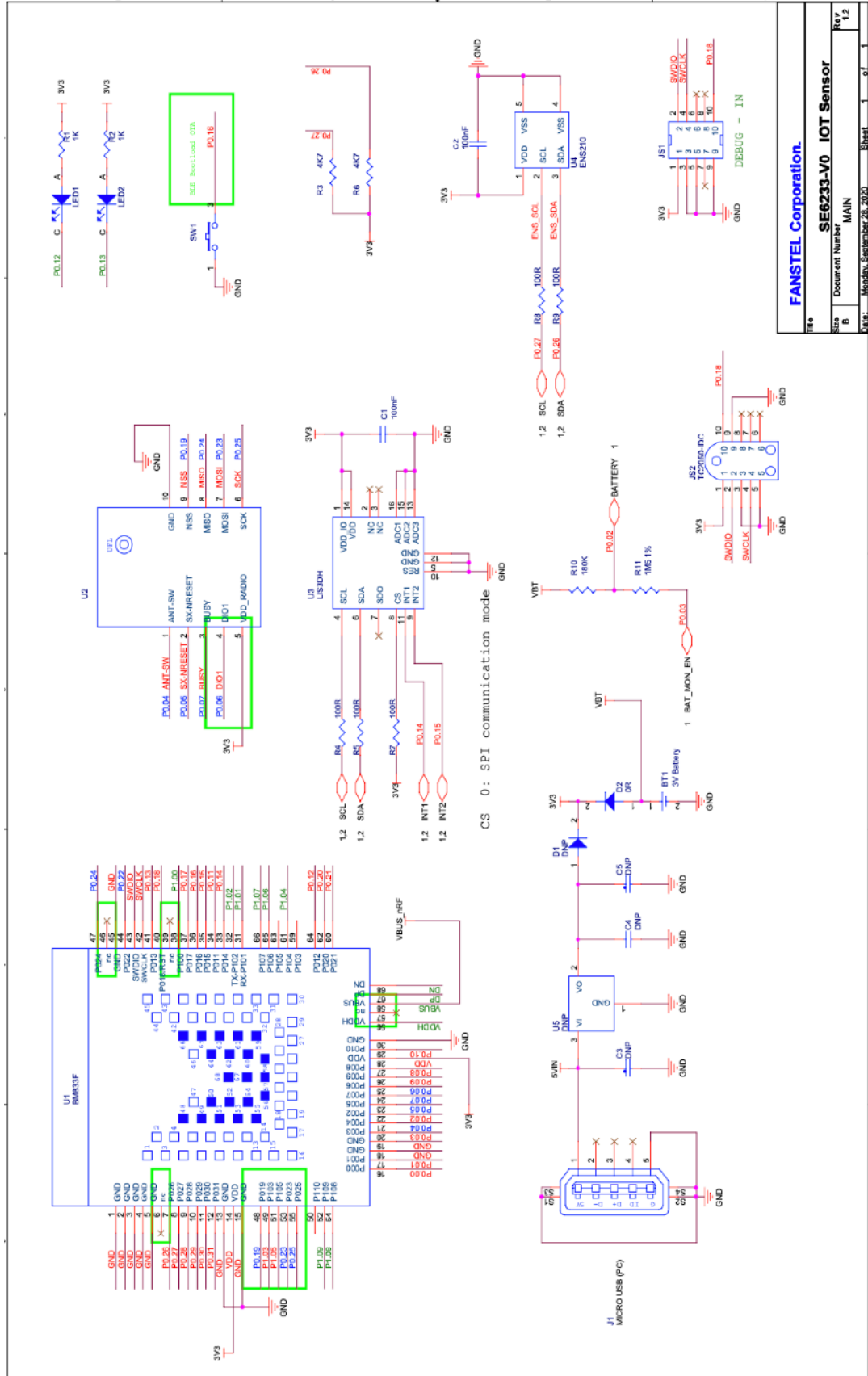
SE6233F consists of:

- A Nordic nRF52833 BLE 5.1 module, BM833
- A Semtech SX1262 LoRa module, LR62E.
- An AMS ENS210 temperature and humidity sensor.
- A ST Micro LIS3DH 3-axis motion sensor.

You can use 2 AAA batteries or an USB AC adapter to power SE6233. Neither is included.



Schematics of SE6233F



FANSTEL Corporation.			
SE6233-V0 IOT Sensor			
Docuement Number	MAIN	Rev	1.2
Date	Monday, September 25, 2020	Sheet	1 of 1

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3. Firmware Development and Testing

Preloaded Firmware

The SE6233F is pre-loaded LoRa sensor demo codes.

- The default region is US.
- Frequency is 915000000.

You can change the setting at SES preprocessor defines LORA_US, REGION_US915.

Basic Software tool for SE6233F

nRF command line tool 10.2.1 or newer.

<https://www.nordicsemi.com/Software-and-Tools/Development-Tools/nRF-Command-Line-Tools/Download>

nRF Connect desktop 3.2.0 or newer.

<https://www.nordicsemi.com/Software-and-Tools/Development-Tools/nRF-Connect-for-desktop>

The default source code and HEX code can download from following link

<https://www.dropbox.com/sh/89x2uqg5qklyli/AAB9dtf9KsYlY0Xf0NACEKDEa?dl=0>

PingPong demo project

The source project is located at

~\nRF5_SDK_17.0.2_d674dde\examples\ble_peripheral\BleNor_Lora_PingPong\pca10100\s140\ses

Copy lora.rar to ~\nRF5_SDK_17.0.2_d674dde and unzip.

Please make sure the GPIO is setting to match the SE6233.

~\nRF5_SDK_17.0.2_d674dde\lora\boards\FanstelLora\board.h

```
#define PIN_LORA_NSS      19
#define PIN_LORA_MISO    24
#define PIN_LORA_MOSI    23
#define PIN_LORA_SCLK    25
#define PIN_LORA_BUSY    7
#define PIN_LORA_RESET    5
#define PIN_LORA_DIO_1    6
```

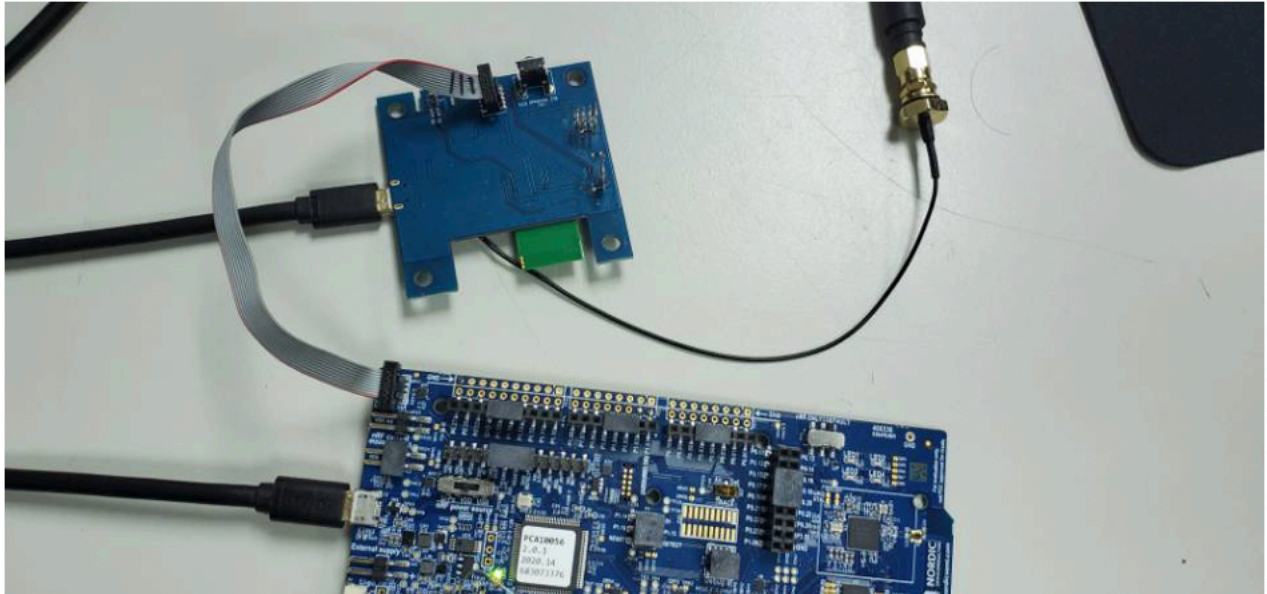
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Programming

You need the followings to program SE6233F.

- A Nordic nRF52833 DK or a Nordic nRF52840DK.
- 10-pin flat cable included in Fanstel EV-BM833F module evaluation board or PK-LEW840X gateway programming kit.

Connected nRF52 DK and SE6233F as shown below.



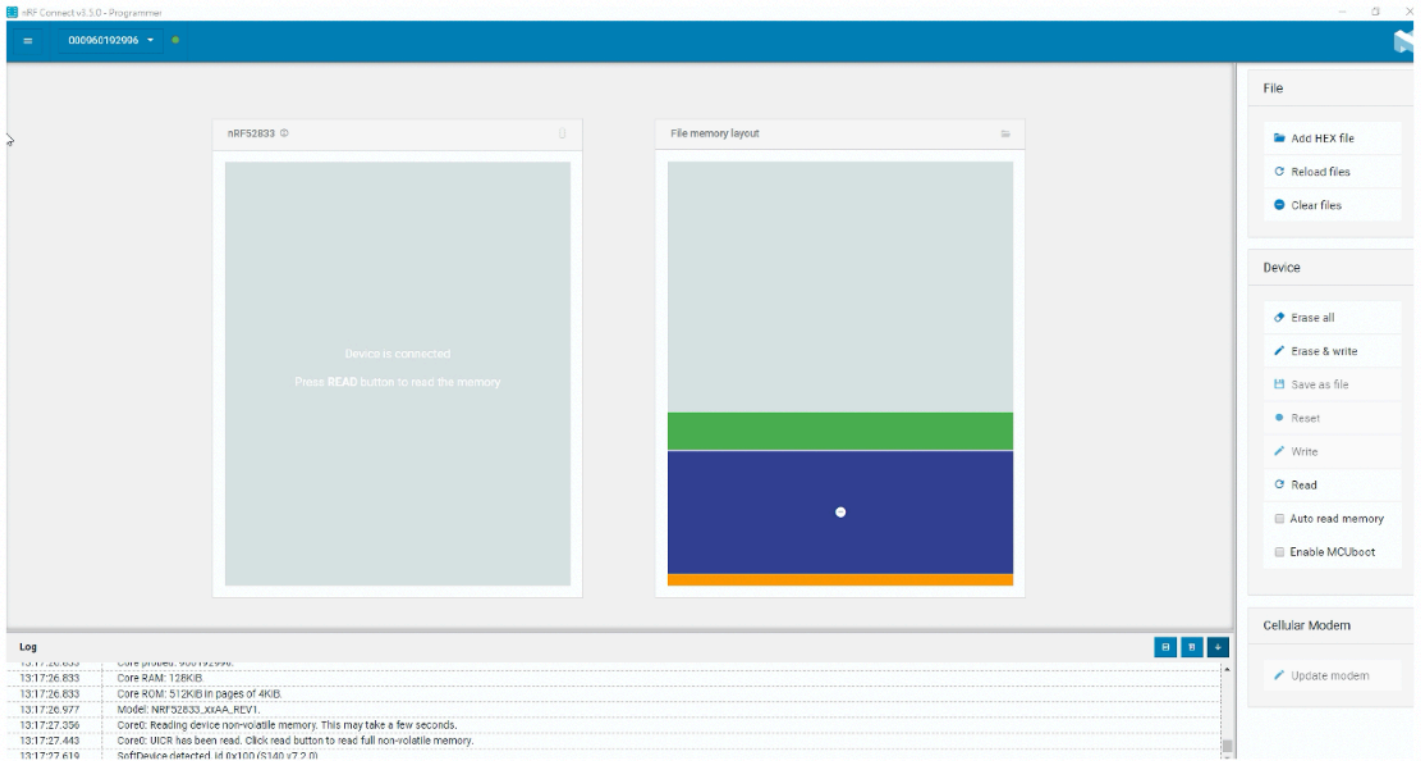
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Open the nRF connect/programmer.

Load the HEX file SE6233_Lora_PingPong2in1_201013.hex.

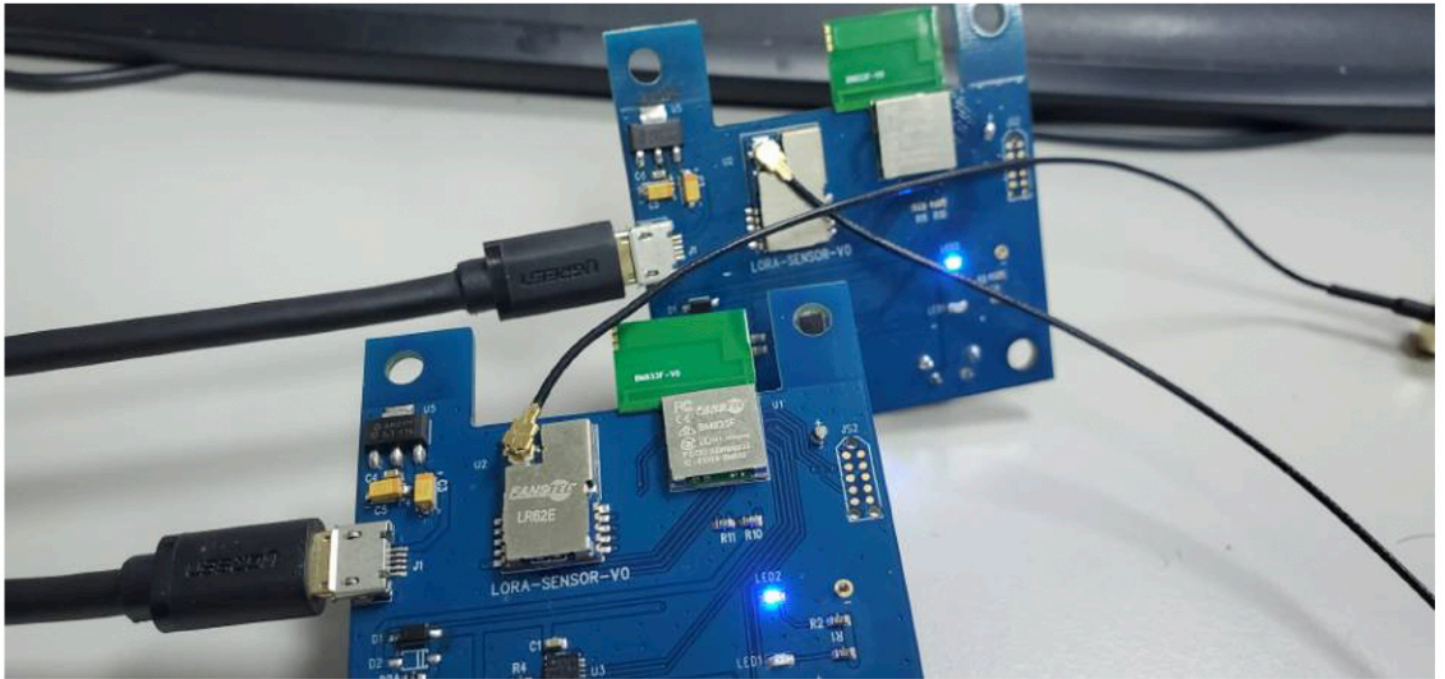
You need to program two units of SE6233F for this ping-pong demonstration project.



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After powering-up reset, LoRa transceivers of two SE6233F is linked.

The TX/RX LED on the SE6233 toggles.



Reading Transceiver Status

Open the Segger RTT Viewer with Nordic DK.

The log shows RSSI and TX/RX status.

```
00>
00> <info> app: RssiValue=-28 dBm, SnrValue=12
00>
00>
00> <info> app: OnTxDone
00>
00>
00> <info> app: OnRxDone
00>
00>
00> <info> app: RssiValue=-30 dBm, SnrValue=13
00>
00>
00> <info> app: OnTxDone
00>
00>
00> <info> app: OnRxDone
00>
00>
00> <info> app: RssiValue=-27 dBm, SnrValue=13
00>
00>
00> <info> app: OnTxDone
00>
00>
00> <info> app: OnRxDone
00>
00>
00> <info> app: RssiValue=-33 dBm, SnrValue=13
00>
00>
00> <info> app: OnTxDone
00>
00>
00> <info> app: OnRxTimeout
00>
00>
```

Sensor Demonstration Project

TX codes are available at:

~\nRF5_SDK_17.0.2_d674dde\examples\ble_peripheral\BleNor_Lora_SensorTX\pca10100\s140\ses

The TWI ports are GPIO 26,27.

Program the TX codes to an SE6233.

Open the Segger RTT Viewer and push reset button on SE6233

Sensor data are displayed.

```
<info> app: LIS3DH x =0.3 y =0.243 z =0.196
<info> app: "Temp":24,"Humi":60
<info> app: LIS3DH x =0.1 y =0.246 z =0.191
<info> app: "Temp":24,"Humi":61
<info> app: LIS3DH x =0.1 y =0.246 z =0.191
```

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RX codes are available at:

~\nRF5_SDK_17.0.2_d674dde\examples\ble_peripheral\BleNor_Lora_SensorRX\pca10100\s140\ses

Program the RX codes to another SE6233.

Connect the nRF DK and open Segger RTT Viewer to check log.

Power down reset both SE6233.

The RSSI and data are displayed at the RTT Viewer.

```
00>
00> <info> app: Temperature: 24
00>
00> <info> app: Humidity: 62
00>
00> <info> app: LoRa frame 2 received with RSSI: -14 dBm.
00>
00> <info> app: Temperature: 24
00>
00> <info> app: Humidity: 61
00>
00> <info> app: LoRa frame 0 received with RSSI: -17 dBm.
00>
00> <info> app: Temperature: 30
00>
00> <info> app: Humidity: 80
00>
00> <info> app: LoRa frame 1 received with RSSI: -9 dBm.
00>
00> <info> app: Temperature: 28
00>
00> <info> app: Humidity: 51
00>
00> <info> app: LoRa frame 2 received with RSSI: -9 dBm.
00>
00> <info> app: LoRa frame 9 received with RSSI: -19 dBm.
00>
00> <info> app: Temperature: 25
00>
00> <info> app: Humidity: 58
00>
00> <info> app: LoRa frame 10 received with RSSI: -19 dBm.
00>
00> <info> app: Temperature: 25
00>
00> <info> app: Humidity: 58
00>
```

Nordic Development Environment

Nordic Semiconductor provides a complete range of hardware and software development tools for the nRF52 Series devices. nRF52833 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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Revision History

- Oct. 2020, Ver. 90: Initial draft release
- June 2021, Ver. 0.91: Draft revision

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