

LTE-BLE 5.3, 802.15.4 Modules, M.2 Connector

Ver 1.01 Dec. 2022

LN60E840F Series modules integrate a Nordic nRF9160 LTE SIP module with a Fanstel BLE 5.3/Thread/Zigbee module, with an u.FL connector for external LTE antenna, an u.FL for external GPS antenna, and a SIM card connector. It allows faster time to market with reduced development cost.

An M.2 connector, B key is used to connect to the host processor.

LTE Specifications:

Microcontroller:

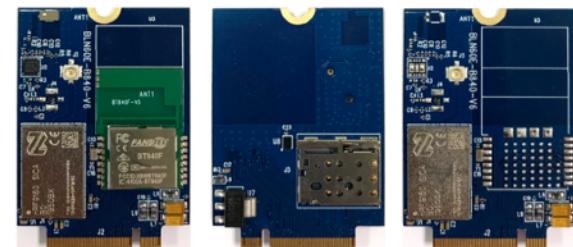
- ARM® Cortex® -M33
- 1 MB flash, 256 kB low leakage RAM
- ARM® Trustzone®
- ARM® Cryptocell 310
- 2x UART (CTS/RTS)
- 11 GPIOs
- SIM card interface for external ESIM.
- On board nano SIM card connector

LTE modem:

- Transceiver and baseband
- 3GPP LTE release 13 Cat-M1 and Cat-NB1 compliant
 - 3GPP release 13 coverage enhancement
- 3GPP LTE release 14 Cat-NB2 compliant
- GPS receiver
 - GPS L1 C/A supported
 - GPS antenna and amplifier integrated
- RF transceiver for global coverage
 - Up to 23 dBm output power
 - -108 dBm sensitivity (LTE-M) for low band, -107 dBm for mid band
 - An u.FL connector for external LTE antenna
- LTE band support in hardware:
 - Cat-M1: B1, B2, B3, B4, B5, B8, B12, B13, B14, B17, B18, B19, B20, B25, B26, B28, B66
 - Cat-NB1/NB2: B1, B2, B3, B4, B5, B8, B12, B13, B17, B18, B20, B25, B26, B28, B66
- IP v4/v6 stack
- Secure socket (TLS/DTLS) API

Bluetooth Specifications

- BLE 5.3 modules with nRF52840, nRF5340
- BT840XE, max. TX at +21 dBm, range over 4500 meters in free space at 125 Kbps.



- BT40F, BT40NE with dual core Cortex M33, up to 128 MHz
- USB interface
- UART interface
- 37 GPIOs

Miscellaneous

- Operation temperature: -40°C to +85°C
- All necessary clock sources integrated
- Size: 30x42mm.
- Package: for M.2 connector, B Key, 67 pins.
- EV board: EV-LN60G



Hardware for Development

- EV board: EV-LN60G, a base board with an M.2 connector, a flat cable, and an USB cable.
- Programming Kit: PK-BLG840G, an USB to UART bridge board for interfacing and monitoring UART.
- Nordic nRF9160DK
- Nordic nRF5340DK for LN60E40F/NE.



LTE Antennas

- nRF9160 is certified with P822601 LTE antenna.
- ANT032: add an u.FL connector for mounting inside an enclosure.
- ANT032E: an u.FL to SMA cable with panel mounting hardware.



An enclosure for external mounting.

LN Modules Supporting LTE and BLE

| Module | LN60E40F | LN60E40NE | LN60E840E | LN60E840F | LN60E840XE | LN60E |
|-----------------|---------------|---------------|---------------|---------------|---------------|--------------|
| BLE module | BT40F | BT40NE | BT840E | BT840F | BT840XE | |
| BLE antenna | Integrated | PCB+u.FL | u.FL | Integrated | PA + u.FL | |
| LTE module | nRF9160 SICA | nRF9160 SICA |
| LTE/GPS antenna | u.FL/u.FL | u.FL/u.FL | u.FL/u.FL | u.FL/u.FL | u.FL/u.FL | u.FL/u.FL |
| Certifications | FCC,IC,CE | | FCC,IC,CE | FCC,IC,CE | FCC,IC,CE | FCC,IC,CE |
| QDID | 119517/182626 | 119517/182626 | 108621/182626 | 108621/182626 | 108621/182626 | |
| Availability | Production | | Production | Production | Production | Production |

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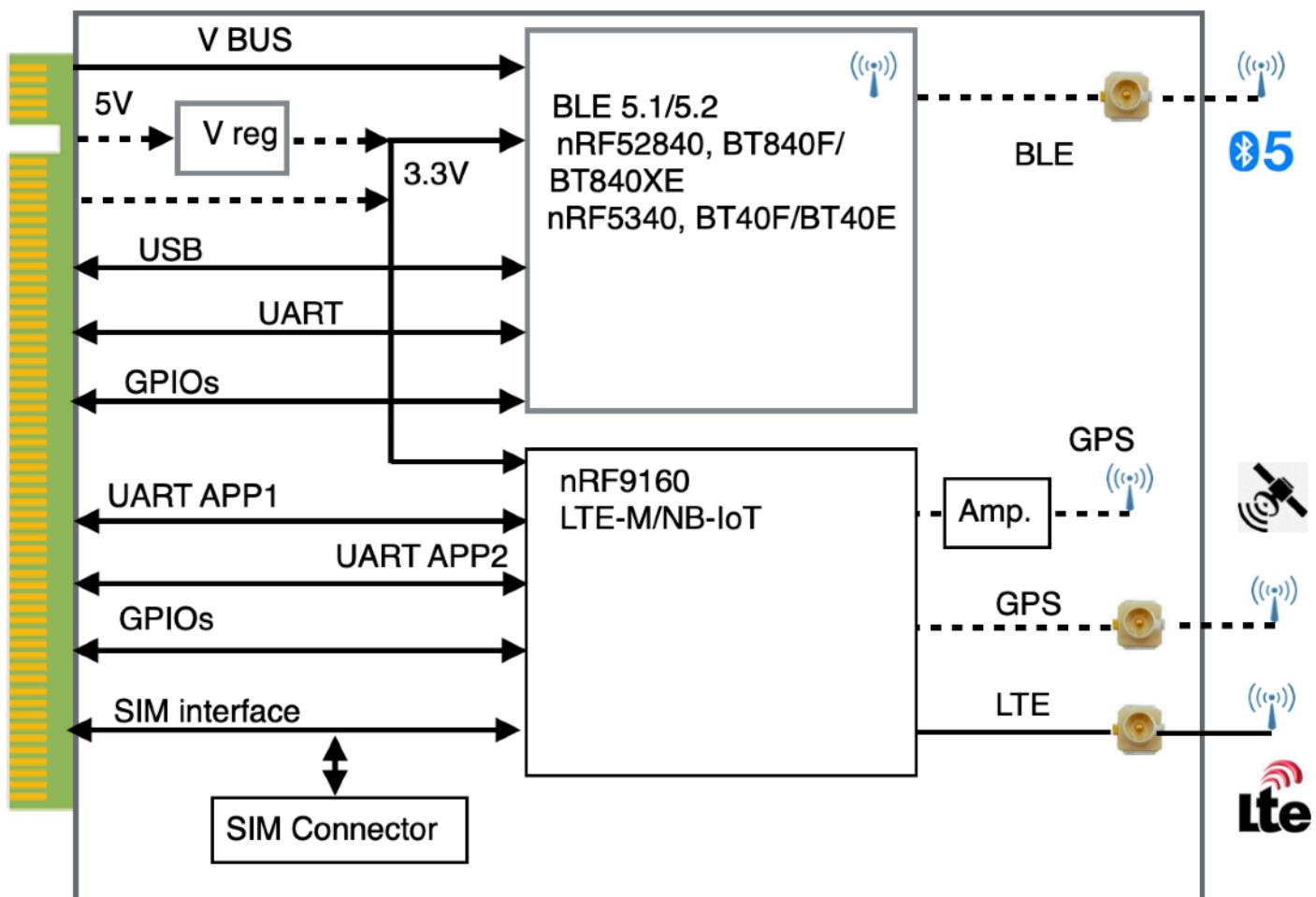
1. Introduction

LN60E840F Series modules are powerful, highly flexible, ultra low power wireless modules integrating Nordic nRF9160 SIP module and Fanstel BT40F Series BLE 5.1 or BT840F Series BLE 5 module. With an ARM Cortex™ M33F MCU, 1MB flash, 256KB RAM, embedded LTE-M and NB-IoT transceiver, an u.FL connector for external LTE antenna, integrated GPS antenna and amplifier or an u.FL for external GPS antenna, it allows faster time to market with reduced development cost.

This Series of modules for M.2 connector is referred as the **LN (LTE-M/NB-IoT) Module**.

LN60E Series, LTE with Optional BLE 5.3 Modules

The following is a block diagram of LN60E840F. Module can be standalone, needing only DC power supply and cross-connect UART on host board. Or, a host processor can control Bluetooth and LTE interfaces through M.2 connector pins.



LN60E Series, M.2 Connector B Key. Size 30x42mm

LN60E and LN60G without Bluetooth module.

Modules available in the LN60G40F Series.

LN60E

- nRF9160 SICA SIP module supporting LTE-M and NB-IoT at +23 dBm TX
- An u.FL connector for an external LTE antenna
- An u.FL connector for an external GPS antenna
- Cortex M33 MCU 1MB flash, 256 KB RAM

LN60G

- nRF9160 SICA SIP module supporting LTE-M and NB-IoT at +23 dBm TX
- An u.FL connector for an external LTE antenna
- GPS receiver with integrated amplifier and antenna
- Cortex M33 MCU 1MB flash, 256 KB RAM

LN60E40NE

- nRF9160 SICA SIP module supporting LTE-M and NB-IoT at +23 dBm TX
- An u.FL connector for an external LTE antenna
- An u.FL connector for an external GPS antenna.
- Cortex M33 MCU 1MB flash, 256 KB RAM
- nRF5340 BLE 5.3 module, BT40NE with an nRF21540 PA, an integrated PCB trace antenna and an u.FL for external antenna.
- Dual code Cortex M33, application core up to 128 MHz.

LN60E40F

- nRF9160 SICA SIP module supporting LTE-M and NB-IoT at +23 dBm TX
- An u.FL connector for an external LTE antenna
- An u.FL connector for an external GPS antenna.
- Cortex M33 MCU 1MB flash, 256 KB RAM
- nRF5340 BLE 5.3 module, BT40F with an integrated antenna.
- Dual code Cortex M33, application core up to 128 MHz.

LN60E840E

- nRF9160 SICA SIP module supporting LTE-M and NB-IoT at +23 dBm TX
- An u.FL connector for an external LTE antenna
- An u.FL connector for an external GPS antenna.
- Cortex M33 MCU 1MB flash, 256 KB RAM
- BT840E with u.FL for an external antenna.
- Bluetooth range with ANT060, 6 dBi antenna, is measured >3400 meters at 125 Kbps.

LN60E840F

- nRF9160 SICA SIP module supporting LTE-M and NB-IoT at +23 dBm TX
- An u.FL connector for an external LTE antenna

- An u.FL connector for an external GPS antenna.
- Cortex M33 MCU 1MB flash, 256 KB RAM
- BT840F with Integrated PCB trace antenna.
- Bluetooth range is measured 2300 meters

LN60E840XE

- nRF9160 SICA SIP module supporting LTE-M and NB-IoT at +23 dBm TX
- An u.FL connector for an external LTE antenna
- An u.FL connector for an external GPS antenna.
- Cortex M33 MCU 1MB flash, 256 KB RAM
- BT840XE with an u.FL for external antenna.
- Bluetooth range is measured >4500 meters or 2.8 miles at 125 Kbp.

Available LN60E Series Modules

The following table is a list of available LN Series modules.

| LN Module | LTE module | GPS antenna | BLE module | Description |
|------------|--------------|-------------|------------|--|
| LN60G | nRF9160 SICA | Integrated | None | nRF9160 LTE module with an integrated GPS antenna. |
| LN60E | nRF9160 SICA | u.FL | None | nRF9160 LTE module with an u.fl for an external GPS antenna. |
| LN60G840F | nRF9160 SICA | Integrated | BT840F | nRF9160-BT840F, LTE-BLE module, integrated BLE antenna. GPS |
| LN60G840E | nRF9160 SICA | Integrated | BT840E | nRF9160-BT840E, LTE-BLE module, u.FL for external BLE antenna. GPS |
| LN60G840X | nRF9160 SICA | Integrated | BT840X | nRF9160-BT840X, LTE-BLE+PA module, integrated BLE antenna. GPS |
| LN60G840XE | nRF9160 SICA | Integrated | BT840XE | nRF9160-BT840XE, LTE-BLE+PA module, u.FL for ext. BLE antenna. GPS |
| LN60E840F | nRF9160 SICA | u.FL | BT840F | nRF9160-BT840F, LTE-BLE module, integrated BLE antenna. |
| LN60E840E | nRF9160 SICA | u.FL | BT840E | nRF9160-BT840E, LTE-BLE module, u.FL for external BLE antenna. |
| LN60E840X | nRF9160 SICA | u.FL | BT840X | nRF9160-BT840X, LTE-BLE+PA module, integrated BLE antenna. |
| LN60E840XE | nRF9160 SICA | u.FL | BT840XE | nRF9160-BT840XE, LTE-BLE+PA module, u.FL for external BLE antenna. |
| LN60G40F | nRF9160 SICA | Integrated | BT40F | nRF9160-BT40F, LTE-BLE module, integrated BLE antenna. GPS |
| LN60G40E | nRF9160 SICA | Integrated | BT40E | nRF9160-BT40E, LTE-BLE module, u.FL for external BLE antenna. GPS |
| LN60E40F | nRF9160 SICA | u.FL | BT40F | nRF9160-BT40F, LTE-BLE module, integrated BLE antenna. |
| LN60E40E | nRF9160 SICA | u.FL | BT40E | nRF9160-BT40E, LTE-BLE module, u.FL for external BLE antenna. |
| LN60G40NE | nRF9160 SICA | Integrated | BT40NE | nRF9160-BT40NE, LTE-BLE module, BLE + PA +uFL+ PCB antenna. GPS. |
| LN60E40NE | nRF9160 SICA | u.FL | BT40NE | nRF9160-BT40NE, LTE-BLE module, BLE + PA +uFL+ PCB antenna. |

LTE Antenna

The LN60E Series modules are certified with ANT032E and ANT032 LTE antennas.

ANT032

- Uses a AVX P822601 LTE antenna certified with nRF9160.
- A cable with u.FL connectors at both ends.
- A 2-sided tape for gluing to the internal wall of an enclosure.



ANT032E

- Uses a AVX P822601 LTE antenna certified with nRF9160.
- An enclosure with an SMA connector.
- A 100mm long u.FL to SMA adapter cable. SMA side with panel mounting hardware.



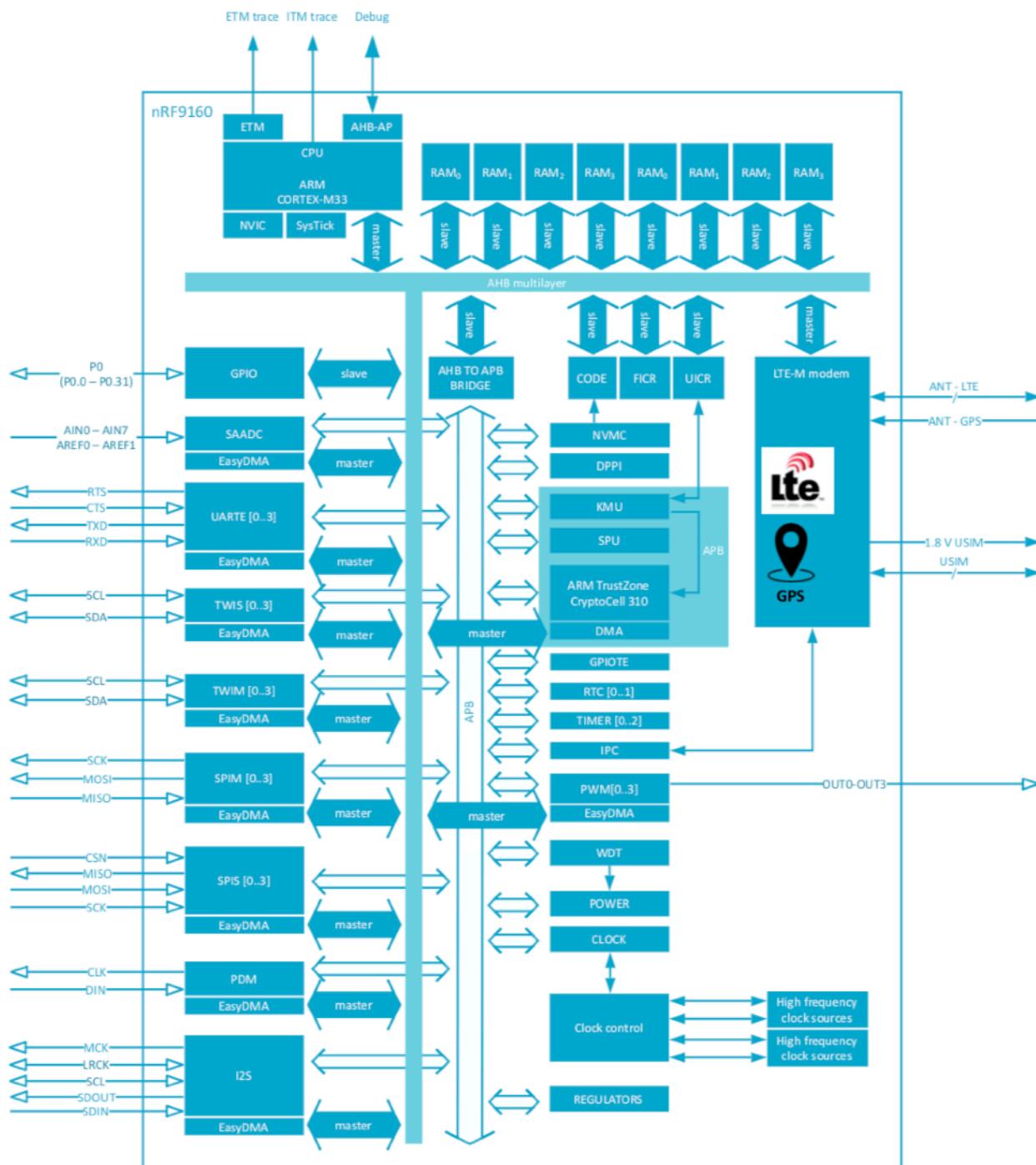
2. Product Descriptions

nRF9160 Specifications

nRF9160 SIP module Product Specifications can be downloaded from.

https://infocenter.nordicsemi.com/index.jsp?topic=%2Fug_nrf91_dk%2FUG%2Fnrf91_DK%2Fintro.html&cp=2_0_2

Block diagram of nRF9160 is shown below.

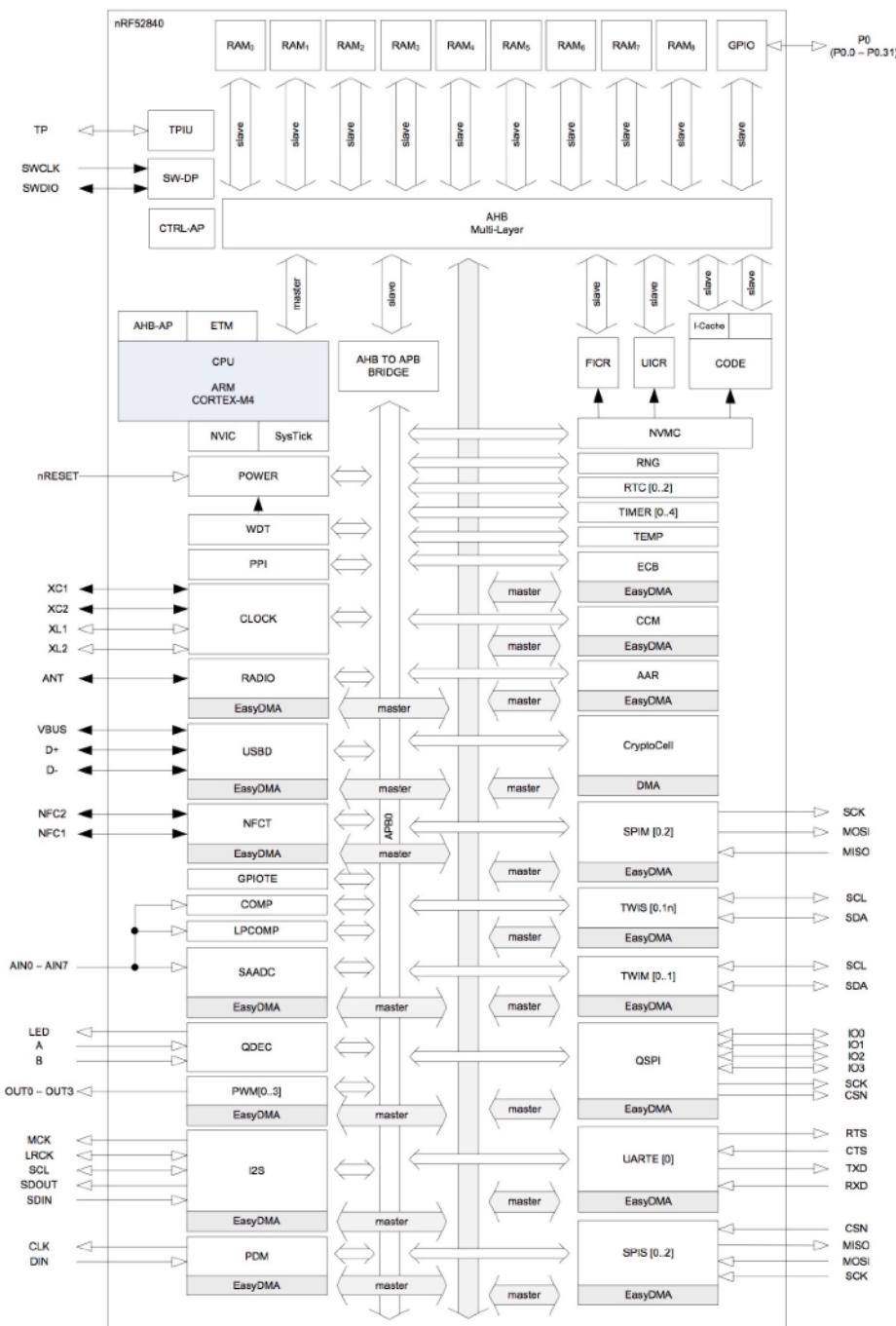


BT840F

BT840F is a long range nRF52840 module. Product Specifications of nRF52840 can be downloaded from.

https://infocenter.nordicsemi.com/index.jsp?topic=%2Fug_nrf91_dk%2FUG%2Fnrf91_DK%2Fintro.html&cp=2_0_2

The following is a block diagram of Nordic nRF52840 Bluetooth Low Energy (BLE) SoC. Arrows with white heads indicate signals that share physical pins with other signals.



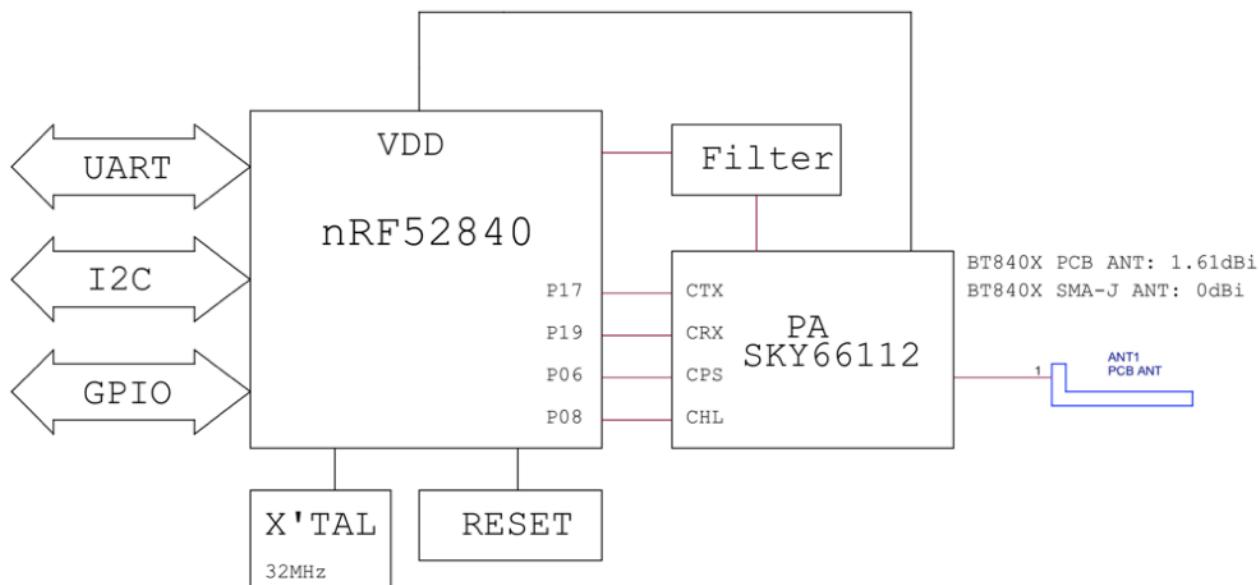
BT840F data sheets can be downloaded from:

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

BT840XE

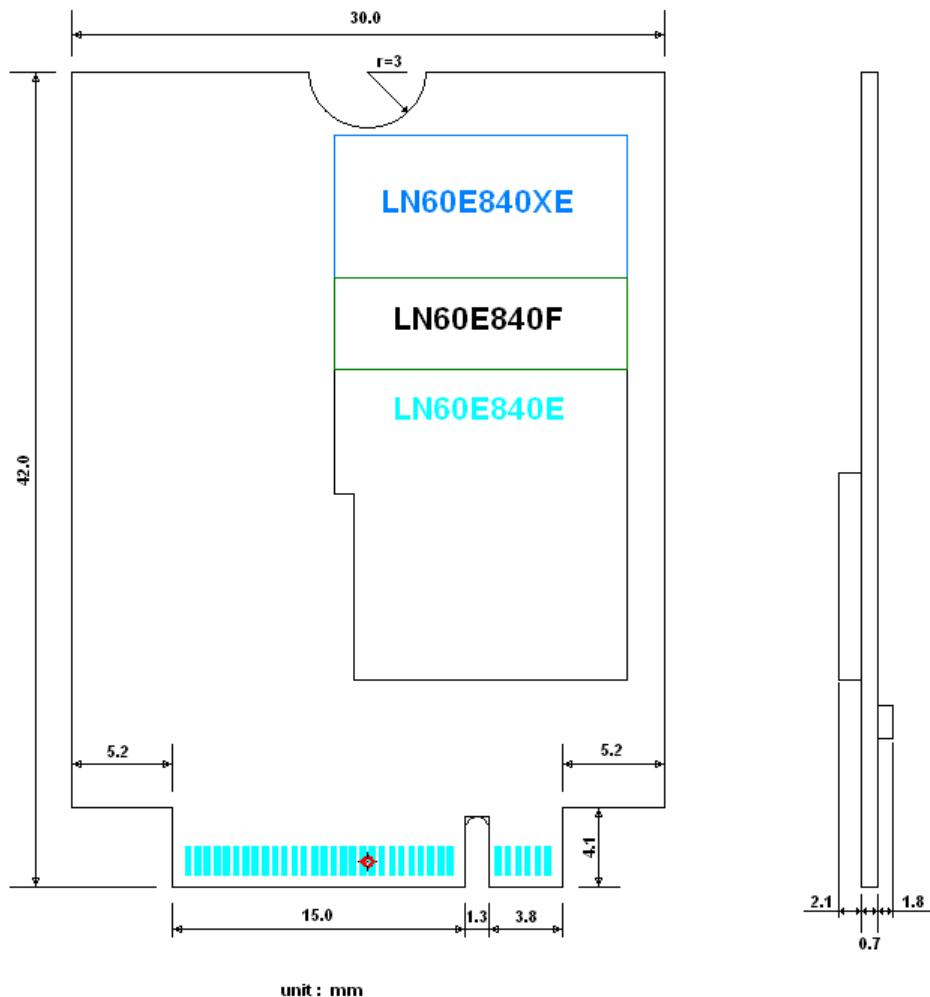
A Skyworks power amplifier SKY66112 is integrated with nRF52840 in BT840XE. A block diagram is shown below. nRF52840 codes to control SKY66112 are included in this data sheets. They can be downloaded from Fanstel webpage.

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



Mechanical Drawings

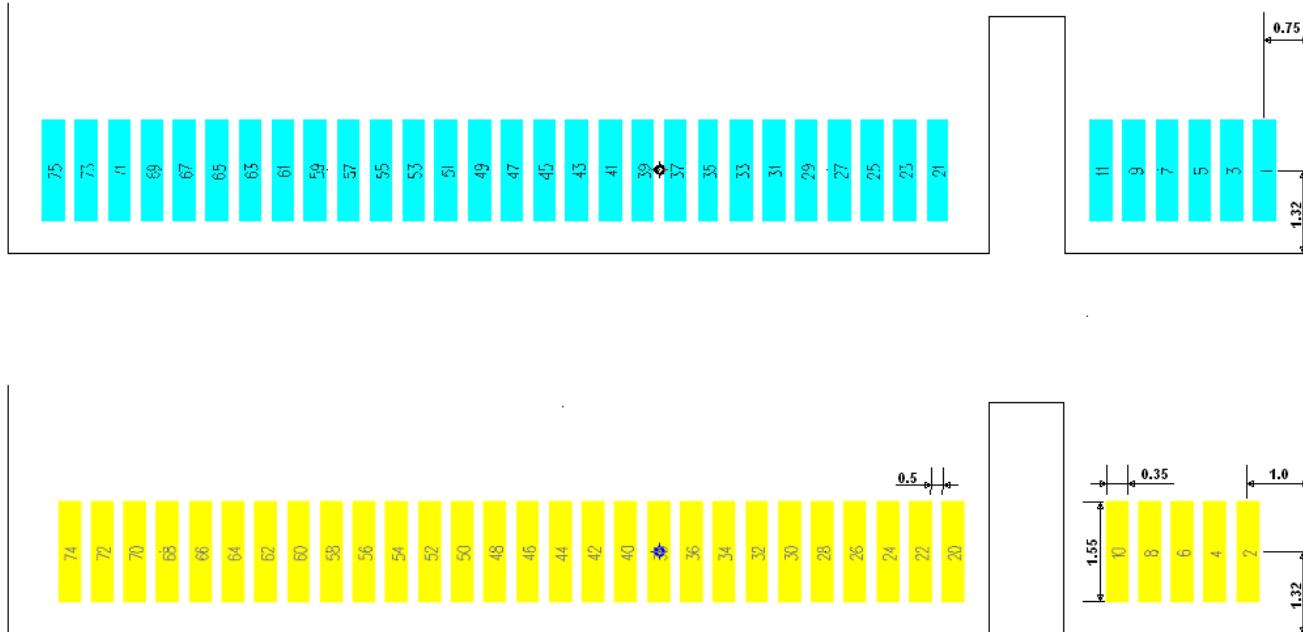
Size of LN60E840F is 30x42mm.



LTE-BLE 5.3, 802.15.4 Modules, M.2 Connector

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The following is detailed drawing of the M.2 connector.



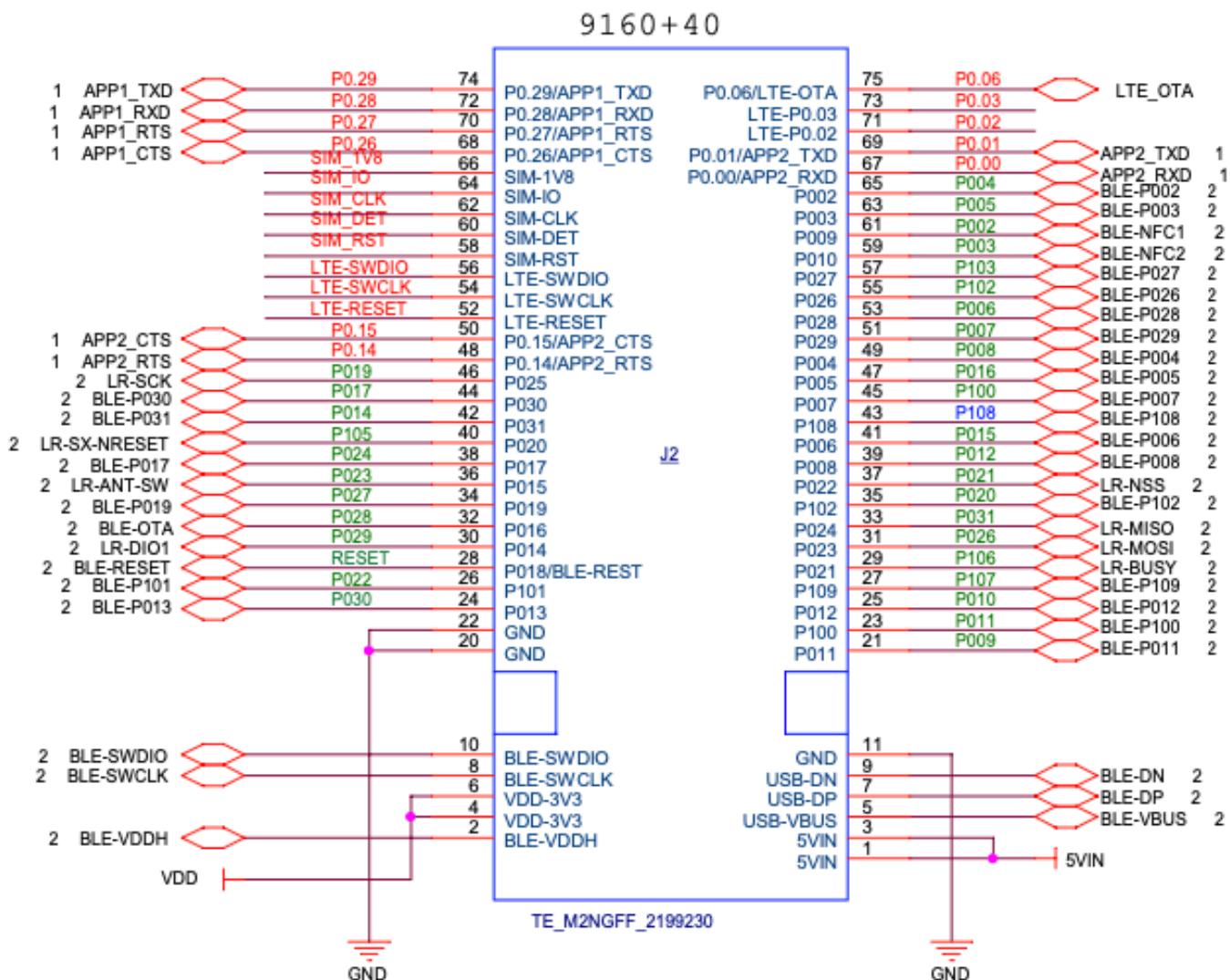
unit: mm

M.2 Connector Pin Assignments

The followings are LN60E40F M.2 connector pin assignment. Pin functions are in a table in next section. Please refer to Nordic nRF9160, nRF5340, and nRF52840 Product Specifications for detailed descriptions and features supported. Pin names begin with BLE are Bluetooth module pins.

If you are working on a design accommodating both nRF52840 and nRF5340 modules,

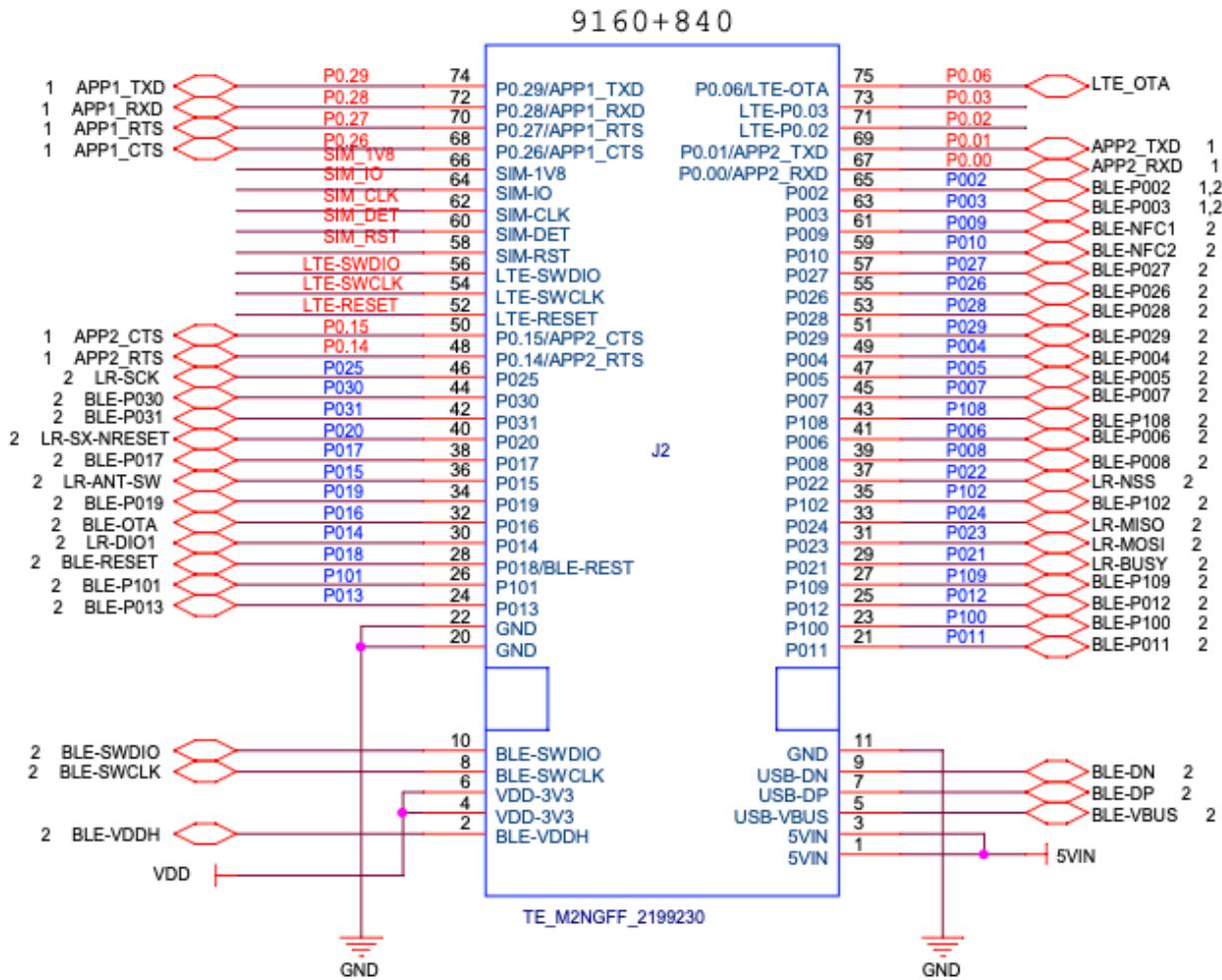
- Blue color port names inside the rectangular are for nRF52840 modules.
- Green color port names outside the rectangular are for nRF5340 modules.
- Red color port names outside the rectangular are for nRF9160 module.



LTE-BLE 5.3, 802.15.4 Modules, M.2 Connector

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Pin assignments with nRF52840 module.



Pin Function

| M.2 | 9160 | BT840F | BT840F/9160 | BT40F | BT40F/9160 | |
|------|------|--------|-------------|-------|------------|--|
| pin# | pin# | pin# | Name | pin# | Name | Descriptions |
| 1 | | | | | 5V IN | DC input for 3.3V regulator; 3.2V to 15V. 4.35V minimum if connected to USB-VBUS externally. |
| 2 | | F4 | BLE-VDDH | F4 | BLE-VDDH | High voltage input for nRF52840/nRF5340, 2.5V to 5.5V |
| 3 | | | | | 5V IN | DC input for 3.3V regulator; 3.2V to 15V. 4.35V minimum if connected to USB-VBUS externally. |
| 4 | | 9 | VDD-3V3 | 9 | VDD-3V3 | Regulated 3.3V DC input, 800 mA minimum |
| 5 | | F6 | USB-VBUS | F6 | USB-VBUS | USB power supply, 4.35V to 5.5V. |
| 6 | | 9 | VDD-3V3 | 9 | VDD-3V3 | Regulated 3.3V DC input, 800 mA minimum |
| 7 | | E4 | USB DP | E4 | USB DP | USB data pin |
| 8 | | 15 | BLE-SWDCLK | 15 | BLE-SWDCLK | Serial Wire Debug clock input for BLE |
| 9 | | E5 | USB DN | E5 | USB DN | USB data pin |
| 10 | | 16 | BLE-SWDIO | 16 | BLE-SWDIO | Serial Wire Debug data for BLE |
| 11 | | 10 | GND | 10 | GND | Ground |
| 12 | | | | | | |
| 13 | | | | | | |
| 14 | | | | | | |
| 15 | | | | | | |
| 16 | | | | | | |
| 17 | | | | | | |
| 18 | | | | | | |
| 19 | | | | | | |
| 20 | | | GND | | GND | Ground |
| 21 | | 11 | P011 | 11 | P009 | BLE GPIO |
| 22 | | | GND | | GND | Ground |
| 23 | | 12 | P100 | 12 | P011 | BLE GPIO |
| 24 | | 13 | P013 | 13 | P030 | BLE GPIO |
| 25 | | E6 | P012 | E6 | P010 | BLE GPIO |
| 26 | | D5 | P101 | D5 | P022 | BLE_UART RXD |
| 27 | | E3 | P109 | E3 | P107 | BLE GPIO |
| 28 | | 14 | P018/RESET | 14 | RESET | Reset for BT40F, Reset or P018 for BT840F |
| 29 | | E2 | P021 | E2 | P106 | BLE GPIO |
| 30 | | D4 | P014 | D4 | P029 | BLE GPIO |
| 31 | | D1 | P023 | D1 | P026 | BLE GPIO |
| 32 | | D3 | P016 | D3 | P028 | BLE-OTA |
| 33 | | C1 | P024 | C1 | P031 | BLE GPIO |

| | | | | | | |
|----|----|----|------------|------|------------|-----------------------------------|
| 34 | | D2 | P019 | D2 | P027 | BLE GPIO |
| 35 | | C5 | P102 | C5 | P020 | BLE_UART-TXD |
| 36 | | C4 | P015 | C4 | P023 | BLE GPIO |
| 37 | | C2 | P022 | C2 | P021 | BLE GPIO |
| 38 | | C3 | P017 | C3 | P024 | BLE GPIO |
| 39 | | B5 | P008 | B5 | P012 | BLE GPIO |
| 40 | | E1 | P020 | E1 | P105 | BLE GPIO |
| 41 | | B4 | P006 | B4 | P015 | BLE GPIO |
| 42 | | B3 | P031 | B3 | P014 | BLE GPIO |
| 43 | | A6 | P108 | A6 | P108 | BLE GPIO |
| 44 | | B2 | P030 | B2 | P017 | BLE GPIO |
| 45 | | A5 | P007 | A5 | P100 | BLE GPIO |
| 46 | | B1 | P025 | B1 | P019 | BLE GPIO |
| 47 | | A4 | P005 | A4 | P016 | BLE GPIO |
| 48 | 24 | | P0.14 | | P0.14 | LTE_UART_APP2-RTS |
| 49 | | A3 | P004 | A3 | P008 | BLE GPIO |
| 50 | 25 | | P0.15 | | P0.15 | LTE_UART_APP2-CTS |
| 51 | | A2 | P029 | A2 | P007 | BLE GPIO |
| 52 | 32 | | LTE-RESET | | LTE-RESET | LTE reset, Active low |
| 53 | | A1 | P028 | P006 | P006 | BLE GPIO |
| 54 | 33 | | LTE-SWDCLK | | LTE-SWDCLK | LTE-Single Wire Debug clock input |
| 55 | | 1 | P026 | 1 | P102 | BLE_I2C, SDA |
| 56 | 34 | | LTE-SWDIO | | LTE-SWDIO | LTE-Single Wire Debug data |
| 57 | | 2 | P027 | 2 | P103 | BLE_I2C, SCL |
| 58 | 43 | | SIM-RESET | | SIM-RESET | LTE_SIM reset |
| 59 | | 8 | P010 | 8 | P003 | BLE_GPIO, NFC2 |
| 60 | 45 | | SIM-DET | | SIM-DET | LTE_SIM detect |
| 61 | | 7 | P009 | 7 | P002 | BLE_GPIO, NFC1 |
| 62 | 46 | | SIM-CLK | | SIM-CLK | LTE_SIM clock |
| 63 | | 6 | P003 | 6 | P005 | BLE_GPIO, AIN1 |
| 64 | 48 | | SIM-IO | | SIM-IO | LTE_SIM data |
| 65 | | 5 | P002 | 5 | P004 | BLE_GPIO, AIN 0 |
| 66 | 47 | | SIM-1V8 | | SIM-1V8 | LTE_SIM 1.8V power supply |
| 67 | 95 | | P0.00 | | P0.00 | LTE_UART_APP2-RXD |
| 68 | 83 | | P0.26 | | P0.26 | LTE_UART_APP1-CTS |
| 69 | 96 | | P0.01 | | P0.01 | LTE_UART_APP2_TXD |
| 70 | 84 | | P0.27 | | P0.27 | LTE_UART_APP1-RTS |

| | | | | | | |
|----|----|--|-------|--|-------|-------------------|
| 71 | 97 | | P0.02 | | P0.02 | LTE-GPIO |
| 72 | 86 | | P0.28 | | P0.28 | LTE_UART_APP1-RXD |
| 73 | 99 | | P0.03 | | P0.03 | LTE-GPIO |
| 74 | 87 | | P0.29 | | P0.29 | LTE_UART_APP1-TXD |
| 75 | 3 | | P0.06 | | P0.06 | LTE-OTA |

3. Codes Development Using Nordic Tools

Development tools by Nordic and other third party development tools recommended by Nordic should be used.

Nordic development environment for nRF52840 offers a clean separation between application code development and embedded protocol stacks. This means compile, link and run time dependencies with the embedded stack and associated debugging challenges are removed. The Bluetooth low energy and ANT stack is a pre-compiled binary, leaving application code to be compiled stand-alone. The embedded stack interface uses an asynchronous and event driven model removing the need for RTOS frameworks.

Over-The-Air DFU

The nRF52840 is supported by an Over-The-Air Device Firmware Upgrade (OTA DFU) feature. This allows for in the field updates of application software and SoftDevice.

SoftDevices

The Nordic protocol stacks are known as SoftDevices and complement the nRF52 Series SoCs. All nRF52 Series are programmable with software stacks from Nordic. This bring maximum flexibility to application development and allows the latest stack version to be programmed into the SoC.

SoftDevices available from Nordic:

S140: Bluetooth low energy concurrent central/peripheral/observer/broadcaster stack.

Development Tools

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.

Nordic software development tools can be downloaded from the following webpage.

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

Control nRF21540 in BT40NE

To be provided.

Control Skyworks Power Amplifier in BT840X

BT840X in LN60E840X uses SKYWORKS SKY66112-11 power amplifier.

A firmware example to control Skyworks SKY66112 power amplifier is below. This firmware file can be downloaded from <http://www.fanstel.com/download-document/>.

Settings for BT840F and BT840E:

- nRF52840 SoC TX power is set to +8dBm for FCC, ISED, CE, RCM, and TELEC certification testings.
- BT840E passes FCC and ISED certification testings with ANT060, a 6 dBi antenna.
- BT840E passes CE, RCM, and TELEC certification testings with ANT000 antenna.
- VDD is set to 3.3V with DCDC converter enabled.

Settings for BT840X and BT840XE:

- nRF52840 SoC TX is set to +2dBm for FCC and ISED testings.
- nRF52840 SoC TX is set to -4 dBm for CE and RCM testings.
- BT840XE passes FCC, ISED, CE, and RCM certification testings with ANT000, a 0dBi antenna.
- VDD is set to 3.3V.

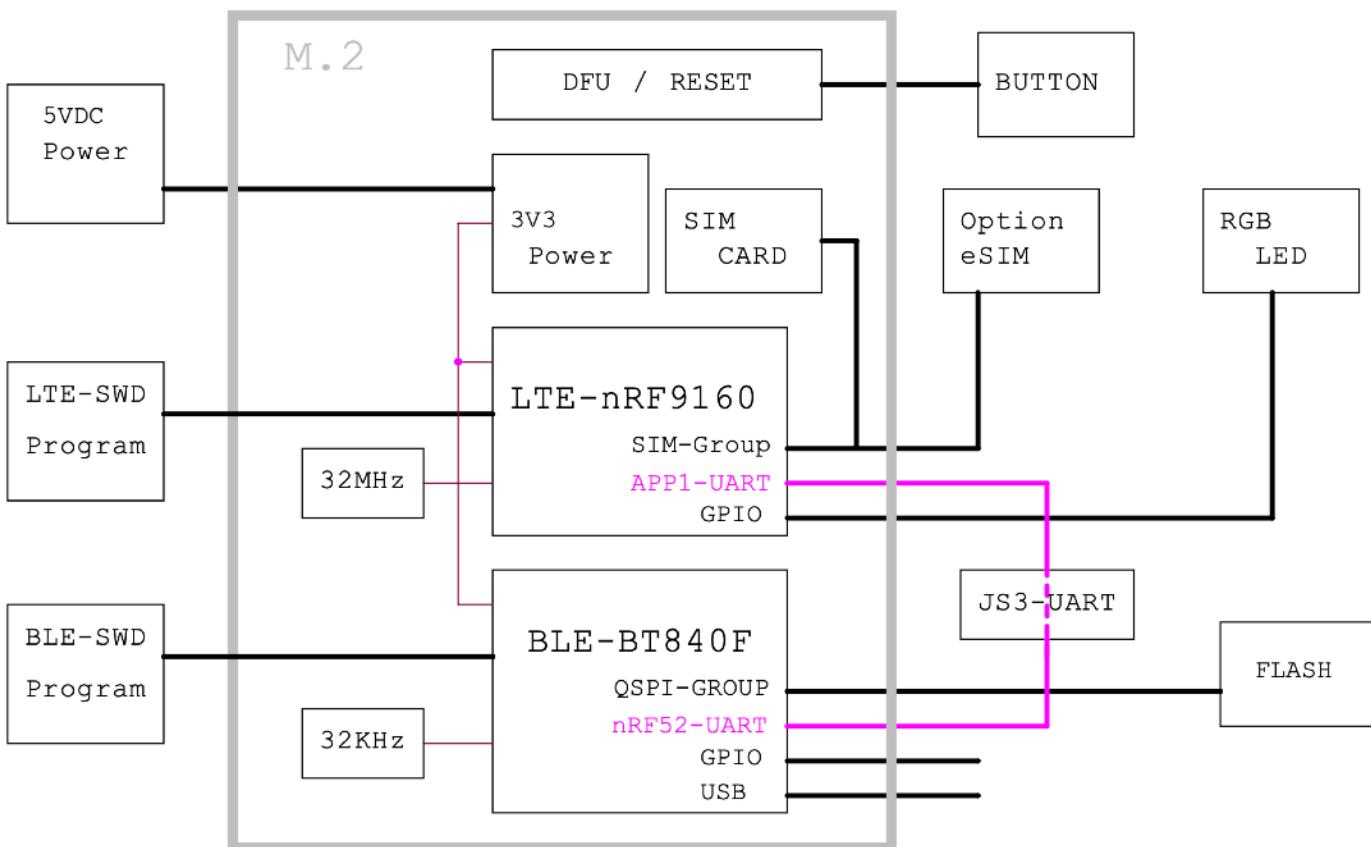
Please refer to BT840F Product Specifications for firmware to control SKY66112 power amplifier in BT840X and BT840XE.

4. Application Examples

BLG840F, BLE to LTE Gateway

In this basic BLE 5/802.15.4 to LTE-NB-IoT gateway design:

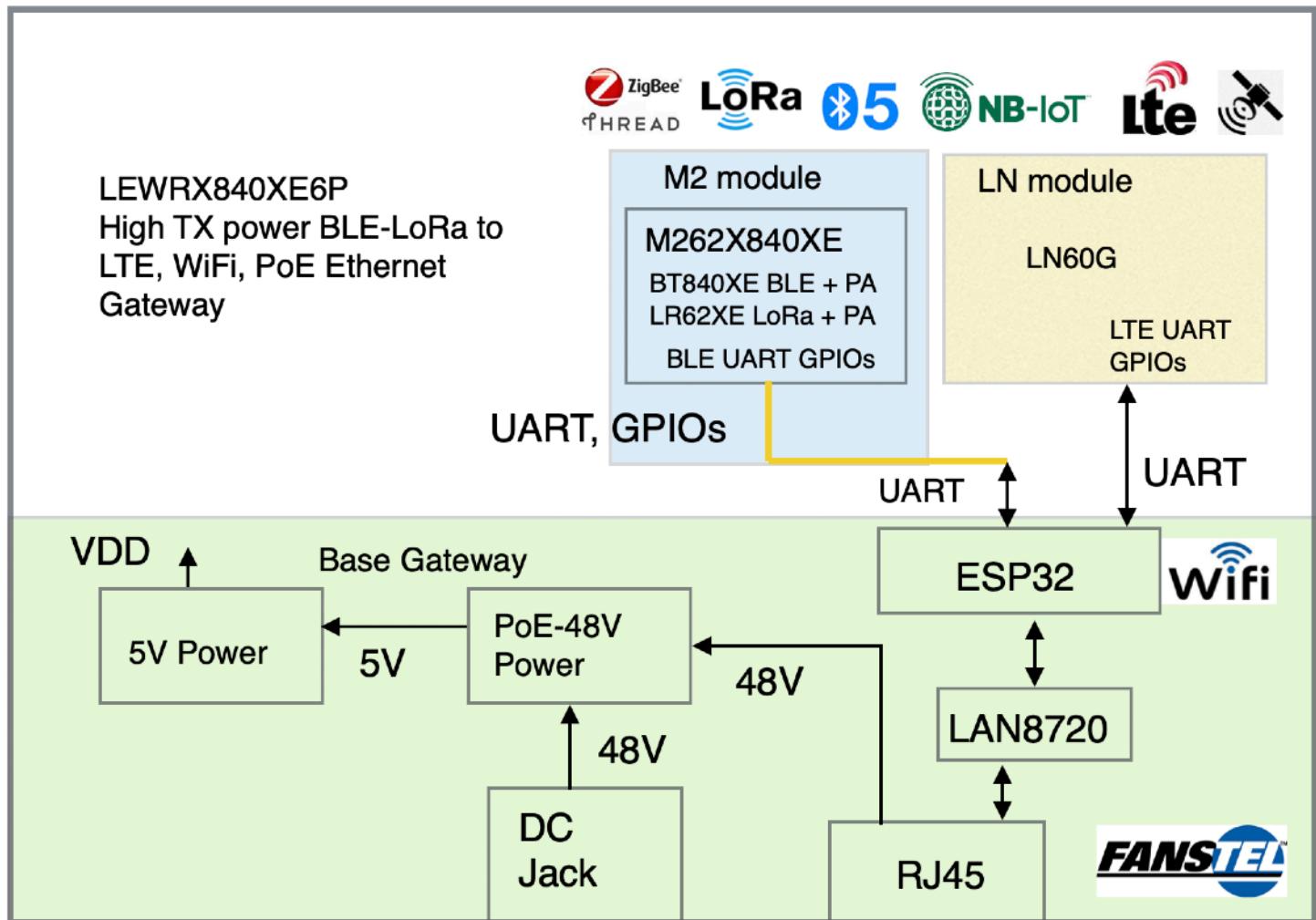
- The bold, gray rectangular box is the boundary of M.2 connector, B Key.
- Most of free GPIOs on M.2 connector are from BLE module.
- nRF9160 is connected to BT840F/BT40F through host board using UART.
- Optional flash memory can be installed for BLE module without SKY66112 power amplifier. QSPI pins are used for PA control inside BT840X/XE.
- Nano SIM connector is on the LN module. eSIM interface is available on M.2 connector to install eSIM on host board.
- The M.2 module in the following block diagram is an LN60G840F.



LEW840X, BLE-LoRa to LTE, WiFi, PoE Ethernet Gateway

This application example supports multiple network interfaces and multiple protocols.

- PoE Ethernet and 802.11 b/g/n WiFi circuitry is on gateway host board.
- An LN60E, LN module for LTE/NB-IoT network expansion
- An M262X840XE, M2 module to support Bluetooth, Thread, Zigbee, LoRa device interfaces.
- Data from sensors and other devices can be processed in the host board MCU (ESP32) before sending to cloud server.



5. Establishing Cloud Connection and Programming

PK-BLG840F, the LTE Monitor Board

PK-BLG840F can be used:

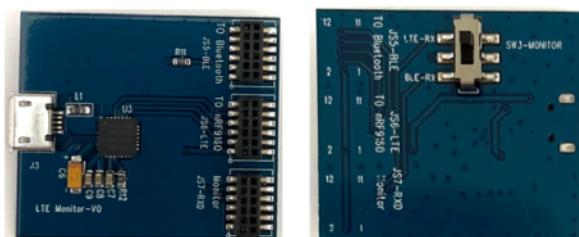
- to interface with the BLE module or the LTE module on LN60G Series M.2 modules or BLG840F Series gateways.
- To monitor UART data traffic to the LTE module or the BLE module.

It contains:

- an UART to USB bridge board, called **LTE Monitor** board,
- a 10-pin flat cable,
- and an USB cable.

There are three 12-pins square connectors on the **LTE Monitor** board.

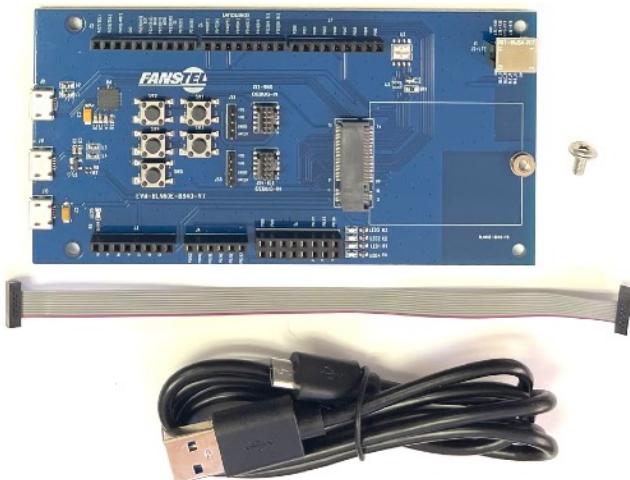
- JS5-BLE for connection to the BLE module on LN60G840F module or in BLG840F gateway.
- JS6-LTE for connection to the LTE module on LN60G840F module or in BLG840F gateway.
- JS7-RXD for monitor UART data to the receiver of the BLE or the LTE module. It can be selected by the SW3 switch on the back side.



EV-LN60G

An evaluation board consists of the followings:

- Micro USB cable
- Evaluation board
- 10-conductor cable for connection to Nordic nRF52840 DK (DK is not included)
- A screw for locking the M.2 module on the EV board.



An EV-LN60G can be used to evaluate any Fanstel M.2 module.

- An M.2 module is **not** included.
- An LN module (for example, an LN60G840F) has a nano SIM card connector. A nano SIM card is **not** included.

The following photo is for an LN60G840F module installed on the EV-LN60G.



EV-LN60E840F

After installing LN60G840F module into EV-LN60G evaluation board, it is called EV-LN60G840F. The LN60G840F module is pre-loaded Nordic modem mfw_nrf9160_1.2.3 and MQTT application.

MQTT tool or MQTT APP<->MQTT broker <-> LN60E40F <->BLE Sensor

The default application is for NB IoT. If you need to run CAT M. Please download the HEX file from Fanstel website.

The LN60E840F preloaded firmware will send the temperature and humidity preset data to Fanstel MQTT server. One can use Fanstel MQTT PC tool or mobile APP to monitor data.

Download and set up Basic Software tools for LN60E40F.

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>

Fanstel MQTT PC tool to test default firmware.

https://www.dropbox.com/s/27xzy1kytb8t918/MQTT_PC_Tool190916.rar?dl=0

Fanstel LTE PC tool to test default firmware.

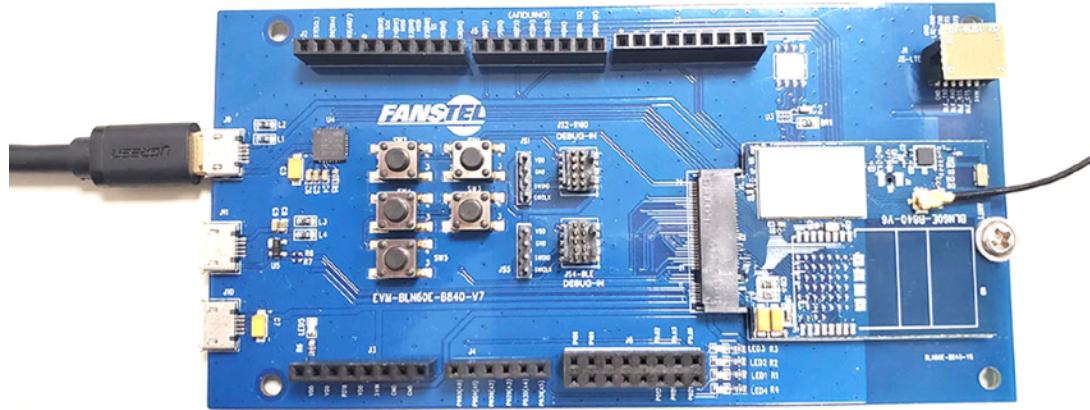
https://www.dropbox.com/s/beyhbbh78lowlzal/LTE_PC_Tool190718.rar?dl=0

Establishing an LTE Connection to a Cloud Server

The following example establishes a connection between nRF9160 on LN60G840F and Fanstel development server. You will enter artificial temperature and humidity data for uploading to the Fanstel MQTT server.

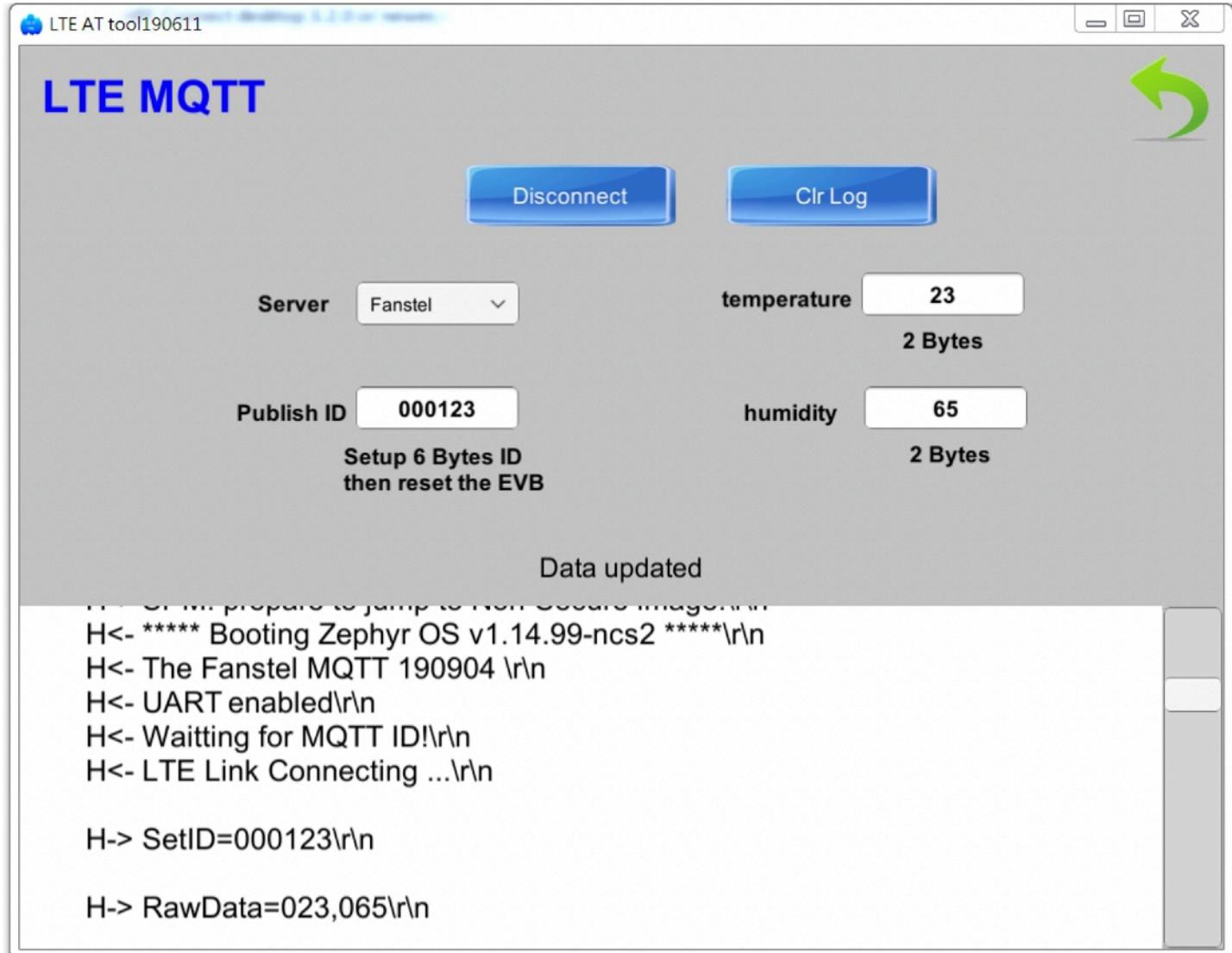
Programming the nRF9160 only HEX code.

- Connect the external antenna.
- Connect the small JS7 board to JS-LTE connector.
- Connect the micro USB port to a PC with an USB cable.



- Open Fanstel LTE monitor and MQTT listener PC tools.
- Select the COM port.
- Reset the BLG840F, the log appears.

- Configure Publish ID and artificial temperature.



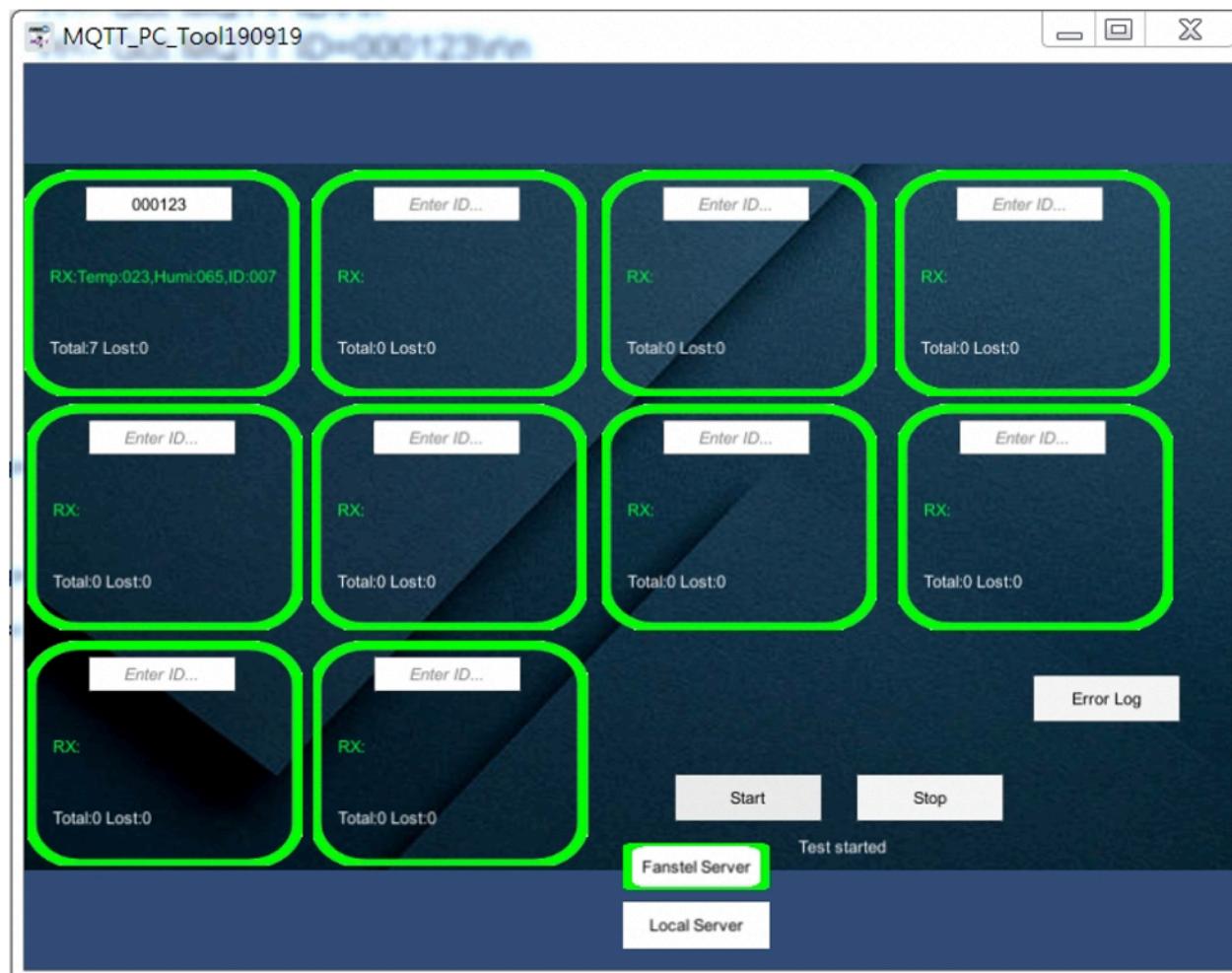
When nRF9160 module is connected to the MQTT server, you will see the temperature and humidity data uploaded.

```

H<- IPv4 Address found 59.124.228.194\r\n
H<- Got MQTT ID\r\n
H<- Got MQTT ID=000123\r\n
H<- AT+MQTT=1\r\n
H<- Subscribing to: /my/9160_sub len 12\r\n
H<- Publishing: Temp:023,Humi:065,ID:001\r\n
H<- to topic: esp32_000123/Odemo len: 18\r\n
H<- [mqtt_evt_handler:267] SUBACK packet id: 1234\r\n
H<- Publishing: Temp:023,Humi:065,ID:002\r\n
H<- to topic: esp32_000123/Odemo len: 18\r\n

```

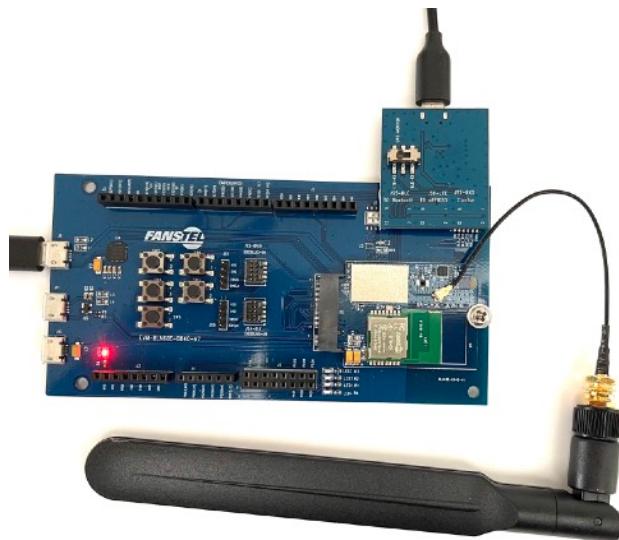
- Open the MQTT PC tool and enter the same Publish ID you just setup.
- Press start icon.
- The data from nRF9160 is displayed.



Relaying Sensor Data to a Cloud Server

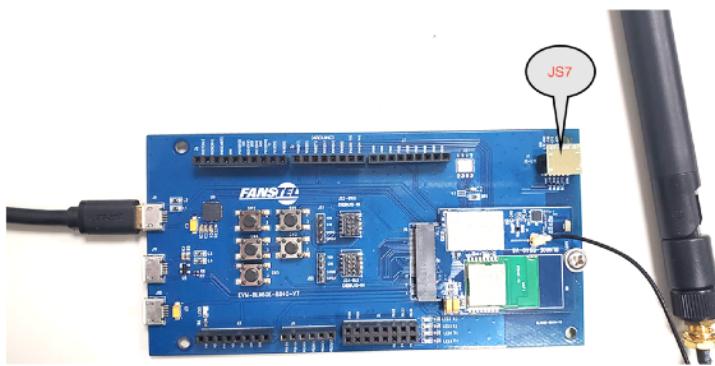
This application example relays temperature and humidity sensor data from Fanstel sensors through a LTE connection to Fanstel louder server.

- Programming mqtt9160NB_210115.HEX code.
- Remove the small JS7 board.
- Insert the JS7 connector of the **LTE Monitor** board (the USB to UART bridge board included in PK-BLG840F) to JS-LTE connector of EV-LN60G board.
- Use SW3 on the **LTE Monitor** board to select monitoring the UART data to the BLE or to the LTE receiver.
- Check both nRF9160 and nRF52840 UART logs, running normally.



You can use this set up to monitor traffic at the UART interface when developing your own code.

After checking the log, insert the small JS7 board back to JS-LTE.

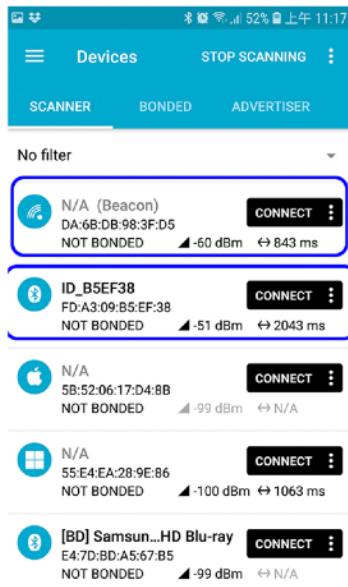


Using Android OS

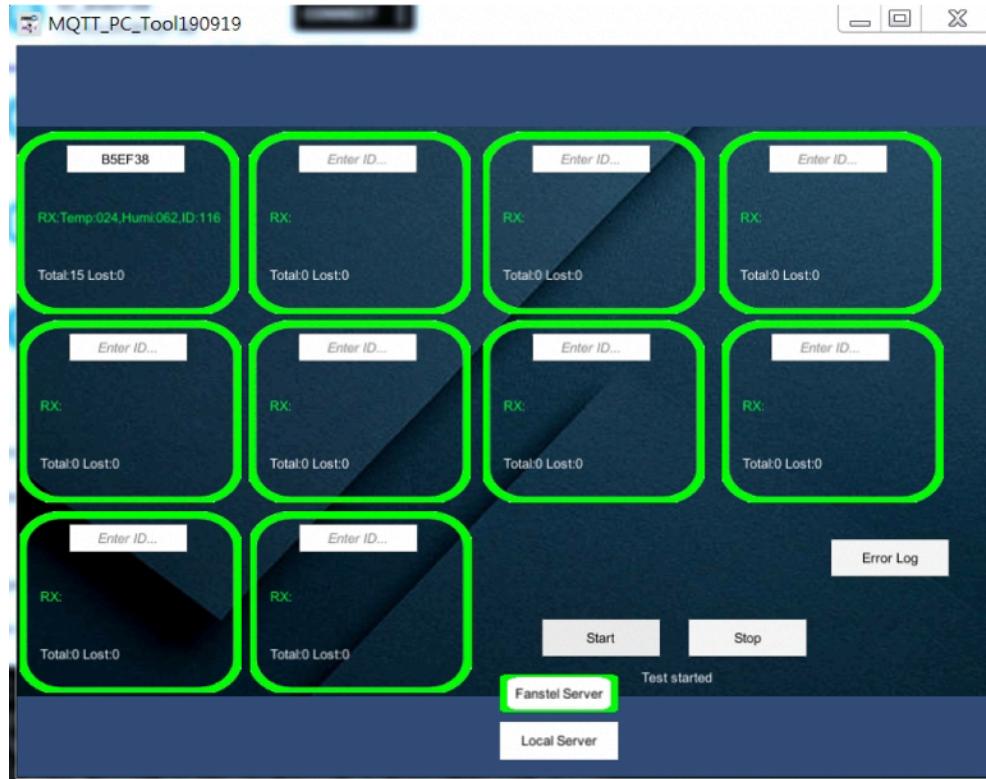
Download and install nRF Connect mobile App.

<https://play.google.com/store/apps/details?id=no.nordicsemi.android.mcp&hl=zh-TW>

Open the nRF Connect mobile App when a Fanstel sensor is powered up nearby. The sensor is advertising the 6 bytes ID.

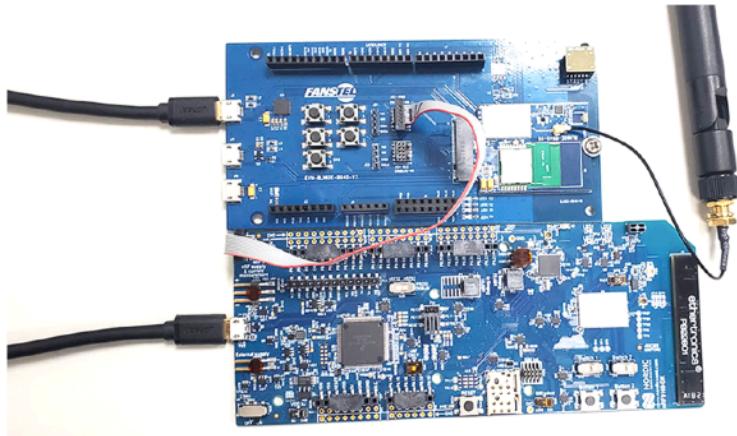


Enter the sensor ID into Fanstel MQTT tool. The real sensor data are displayed on the tool.



Programming the nRF9160.

- Connected PCA10090 debug out to EVLN60G840F JS2-9160



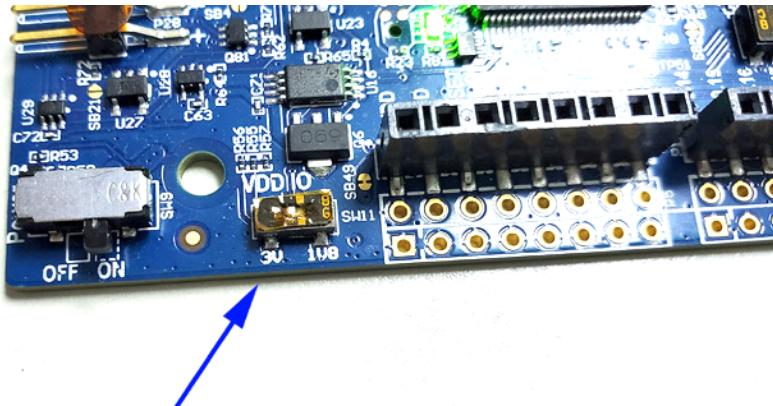
- Open the command line and go to the folder where the HEX file located.
- Execute the programming command
"nrfjprog --program mqtt9160NB_190904.hex --chiperase -f nrf91 --reset"

```
C:\Users\Administrator\Desktop\Nordic Firmware\LTE9160_MQTT190904>nrfjprog --program mqtt9160NB_190904.hex --chiperase -f nrf91 --reset
Parsing hex file.
Erasing user available code and UICR flash areas.
Applying system reset.
Checking that the area to write is not protected.
Programming device.
Applying system reset.
Run.
```

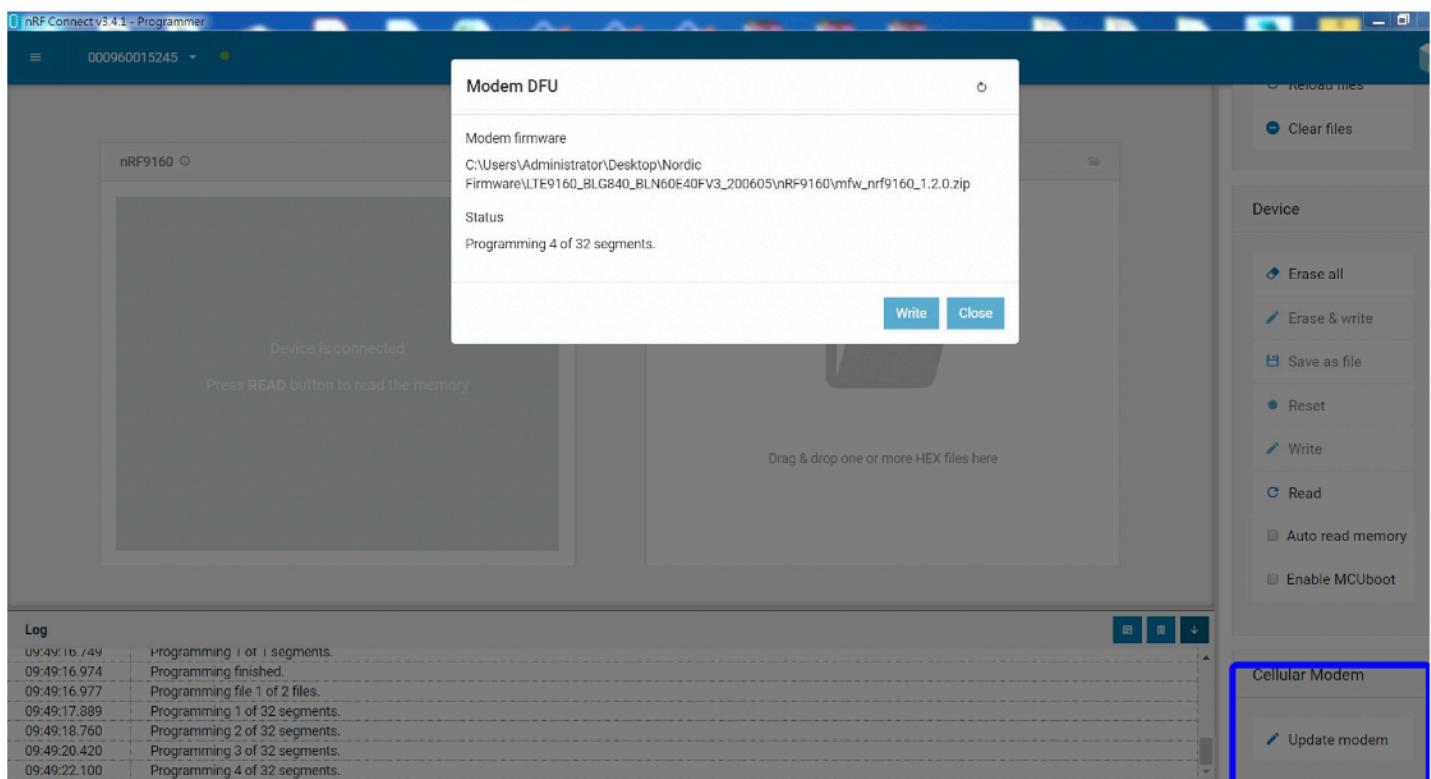
LTE-BLE 5.3, 802.15.4 Modules, M.2 Connector

Ver 1.01 Dec. 2022

Note: The voltage supported by external debugging/programming is the VDD voltage. This voltage can be selected to 1.8 V or 3 V using slide switch SW11. Make sure the voltage level of the external board matches the VDD of the nRF9160 DK. Please select 3V if programming the BLG840F gateway.



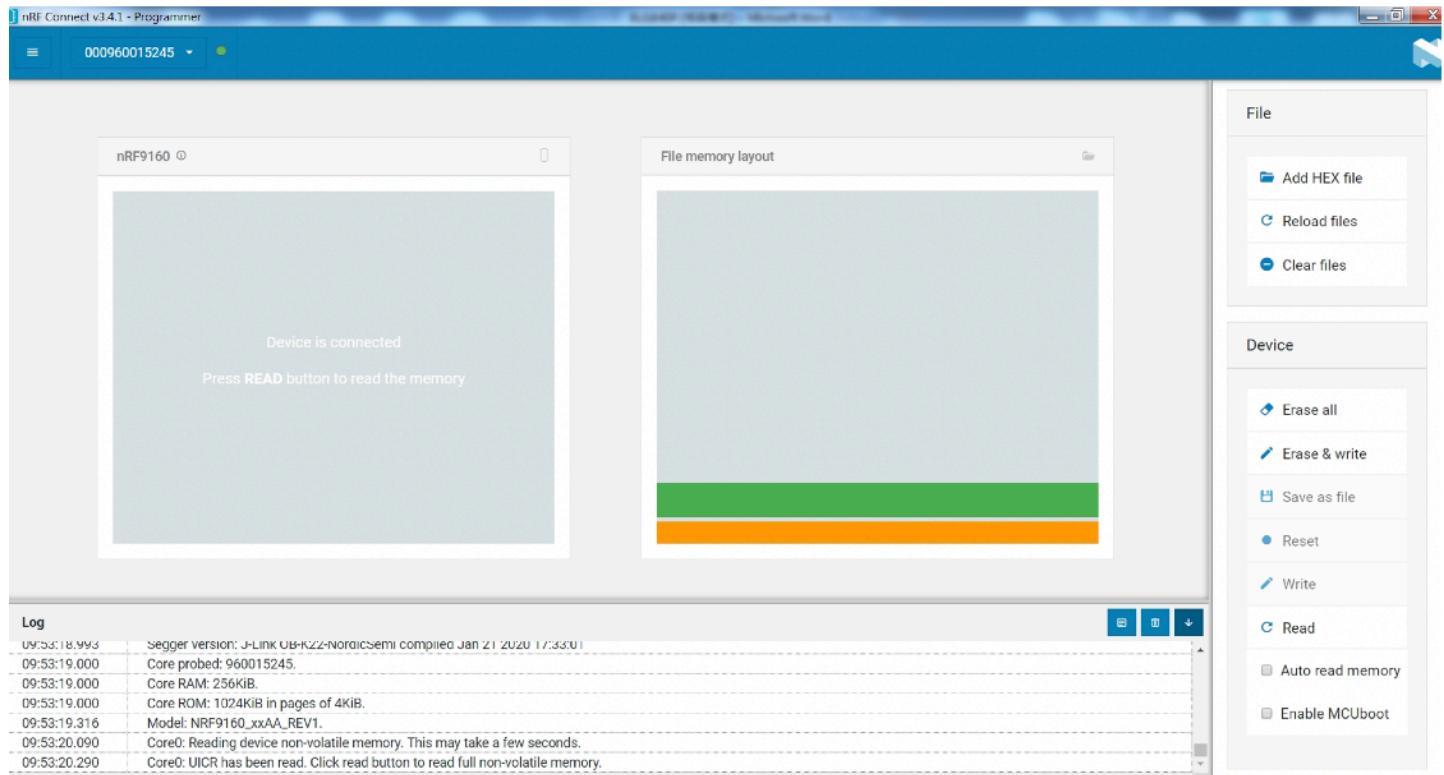
Programming the nRF9160 with nRF Connect for desktop.
Upgrade modem.



LTE-BLE 5.3, 802.15.4 Modules, M.2 Connector

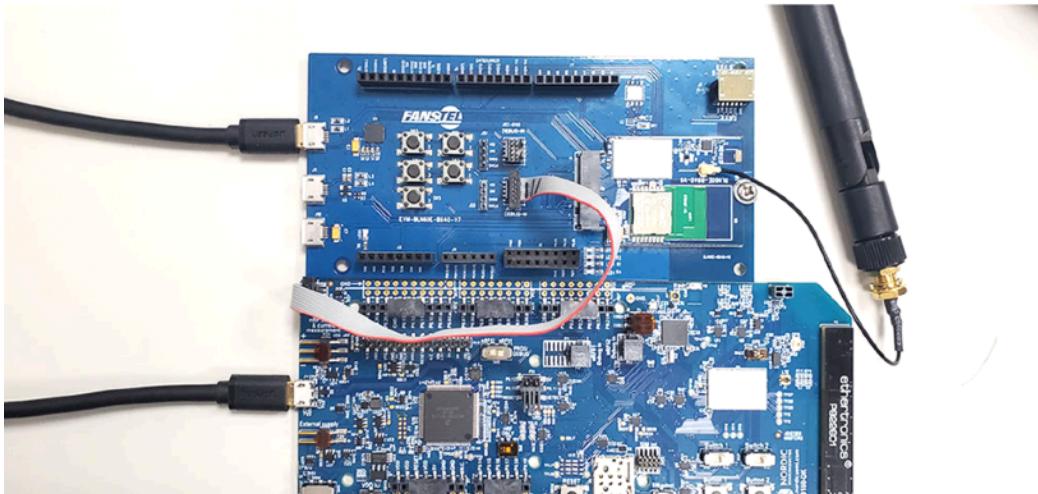
Ver 1.01 Dec. 2022

Upgrade application



Programming the BT840F HEX code.

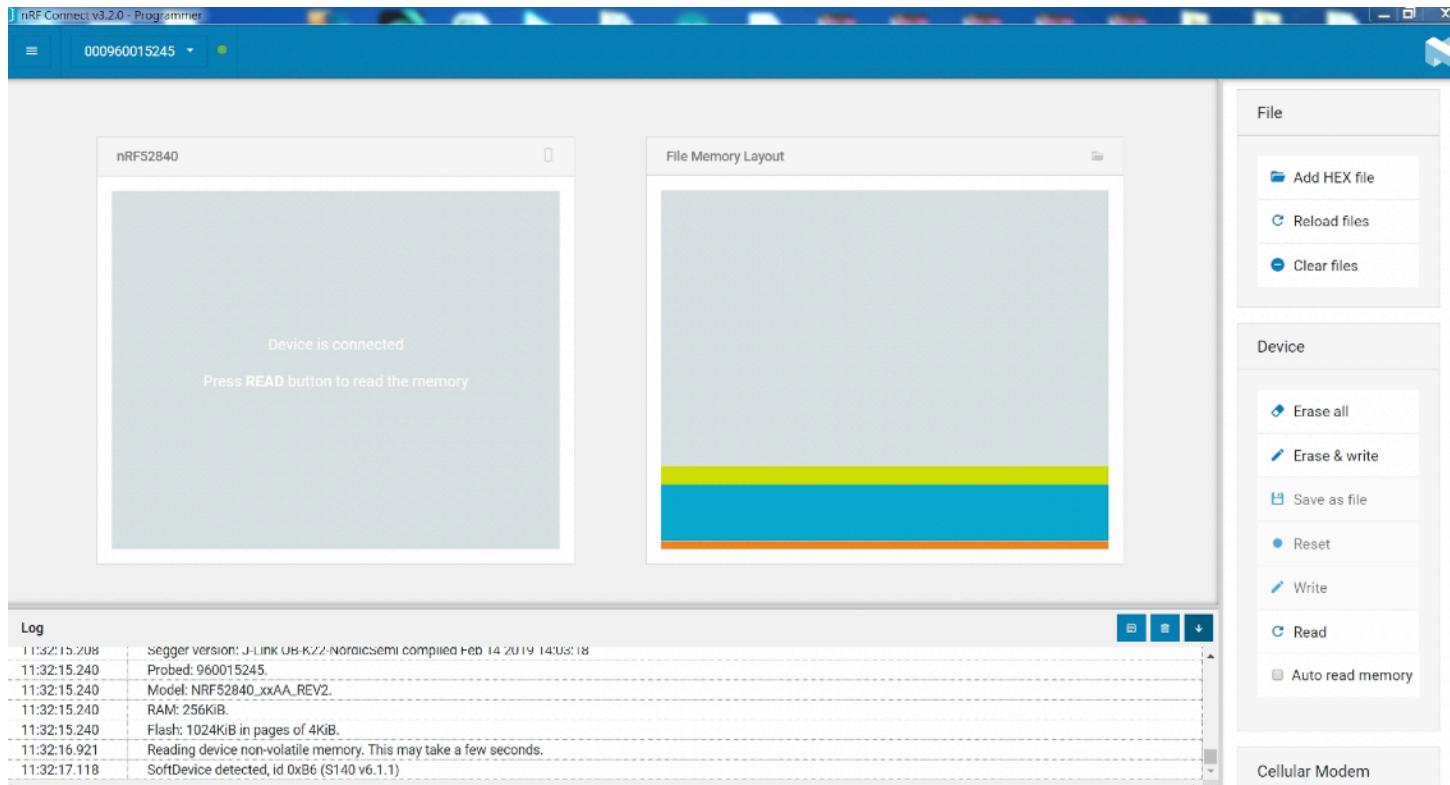
- Connected PCA10090 debug out to EV-LN60G840F JS4-BLE.
- Set SW10 slide switch of the PCA10090 to nRF52.
- Set SW9 slide switch of the PCA10090 to 3V.



LTE-BLE 5.3, 802.15.4 Modules, M.2 Connector

Ver 1.01 Dec. 2022

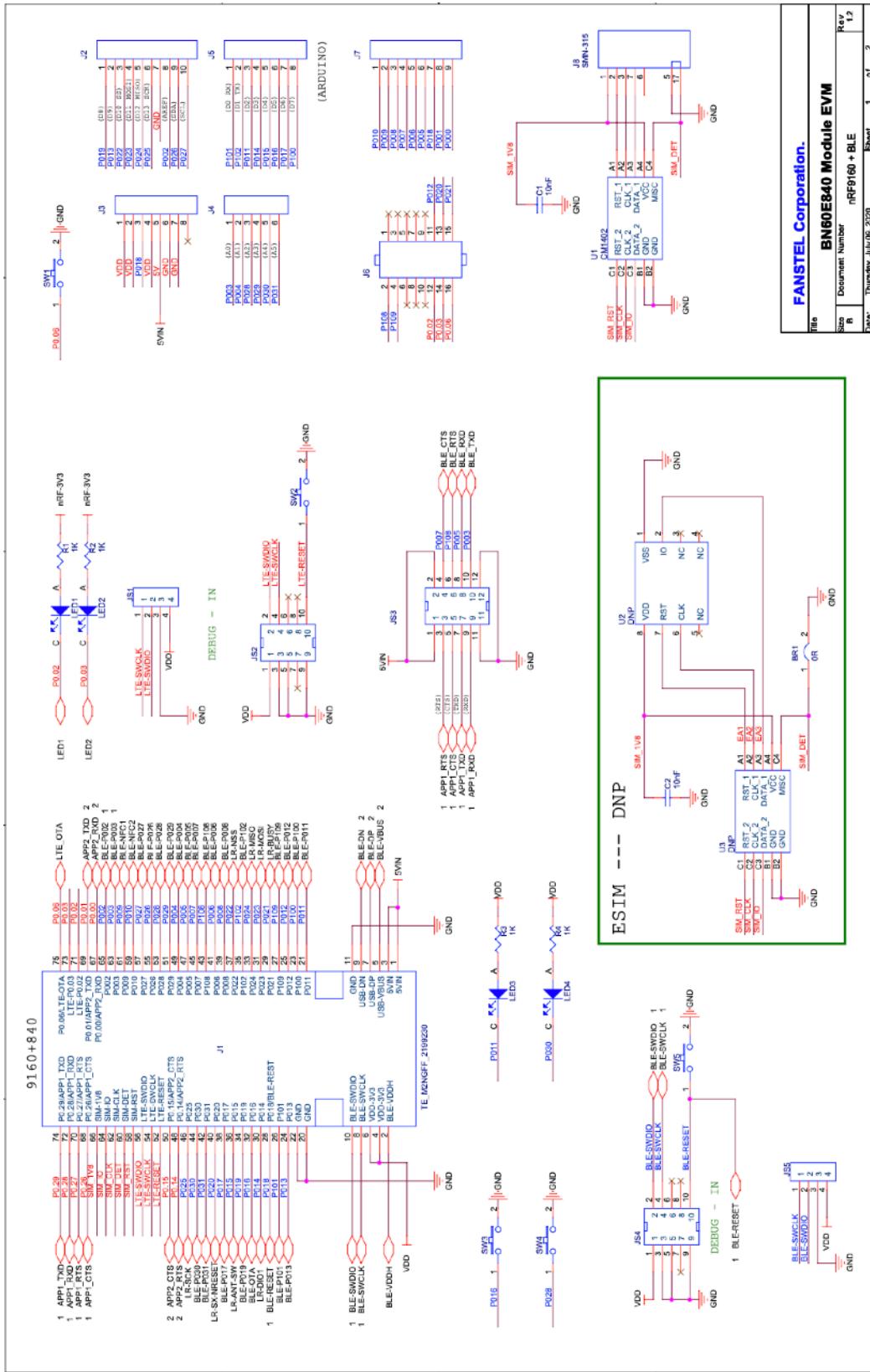
Open nRF connect\programmer and load the HEX code.
Execute Erase & Write.
The log will show write success.



EV-LN60G EvaluationBoard Schematics

Evaluation board schematics and Gerber files can be downloaded from

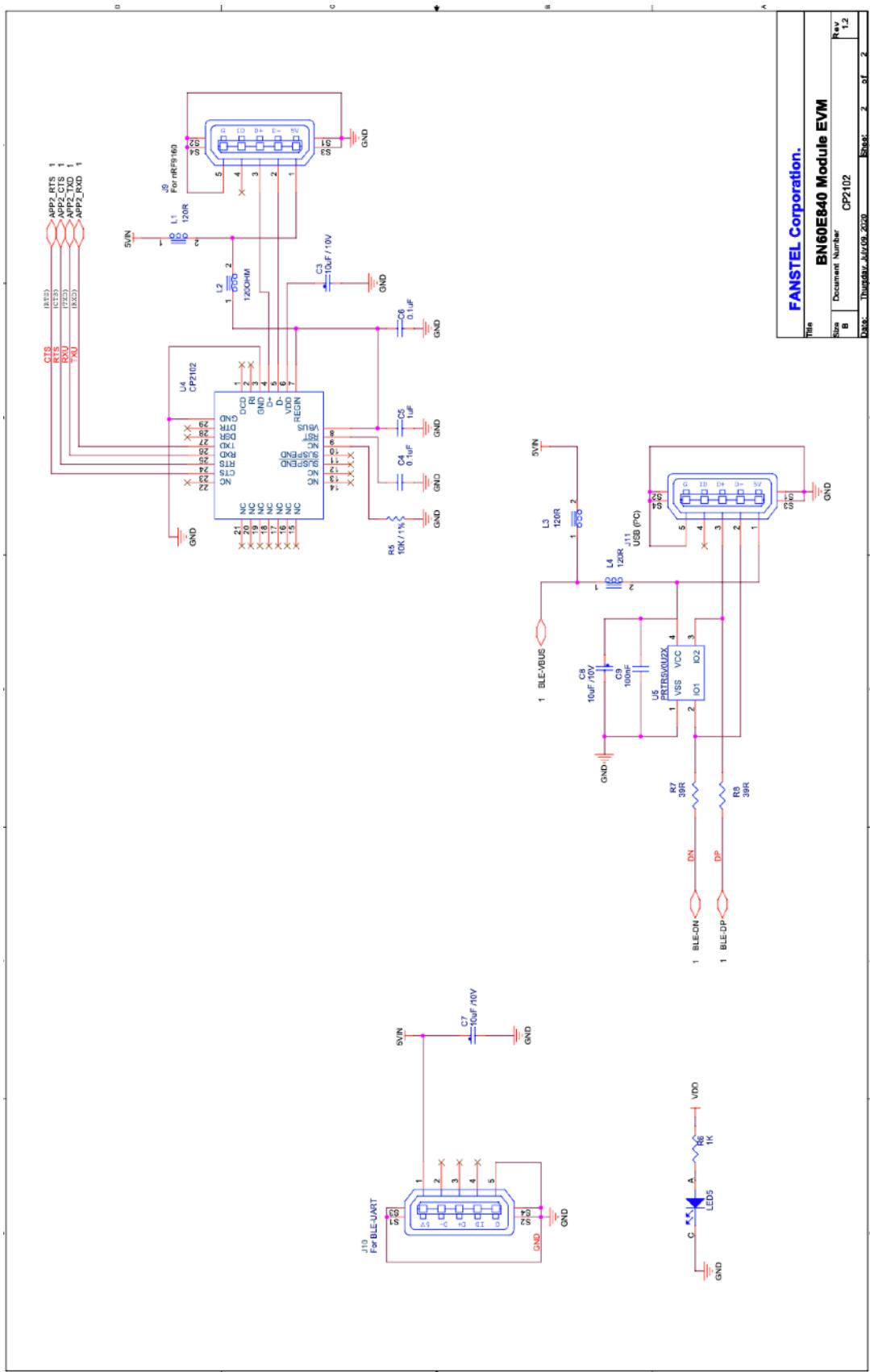
<http://www.fanstel.com/download-document/>



LTE-BLE 5.3, 802.15.4 Modules, M.2 Connector

Ver 1.01 Dec. 2022

Page 2 of EV-LN60G schematics. EV board schematics can be used as a reference design for using modules.



Packaging and Lot Number

LN60E840F Series module is individual packed.

FCC LABEL

The Original Equipment Manufacturer (OEM) must ensure that the OEM modular transmitter must be labeled with its own FCC ID number. This includes a clearly visible label on the outside of the final product enclosure that displays the contents shown below. If the FCC ID is not visible when the equipment is installed inside another device, then the outside of the device into which the equipment is installed must also display a label referring to the enclosed equipment

The end product with this module may subject to perform FCC part 15 unintentional emission test requirement and be properly authorized.

This device is intended for OEM integrator only.

Revision History

- Aug. 2020, Ver. 0.60: Initial draft release
- Sep. 2020, Ver. 0.61: Draft update
- Jan. 2021, Ver. 0.90: Draft revision
- April 2021, Ver. 0.91: Draft revision
- Aug. 2021, Ver. 1.00: Initial release.
- Dec. 2022, Ver. 1.01: Update certifications, add LTE antenna information.

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