
NRF51822 Eval Kit User Manual

Introduction

The nRF51822 is a powerful multi-protocol single chip solution for ULP wireless applications. It incorporates Nordic's latest best-in-class performance radio transceiver. The nRF51822 supports *Bluetooth*® low energy and 2.4 GHz protocol stacks.

Mother board

- On-board battery slot with multiply power supply modes supported
- Leading out all the IO ports for function expansion
- On-board CP2102 for debugging
- On-board LED and keys, compatible to Nordic's other device, easy operation.

Core board

Parameters of Core51822

- Main chip: nRF51822
- Communication distance: 30m (conditions: open air / rate:1M)
- Operating frequency: 2.4GHz
- Operating voltage: 2.0V ~ 3.6V
- Temp. Range: -40°C ~ 85°C
- Dimensions: 24.5mm x 32.26mm (PCB)
- Interfaces: all the I/Os are available, except for P0.26 and P0.27
- Pin distance: 2.00mm
- Row distance: 18.00mm
- Antenna: on-board antenna

Features of nRF51822

- Multi-protocol 2.4GHz radio
- 32-bit ARM Cortex M0 processor
- 128-bit AES co-processor
- 256kB flash / 32kB RAM
- Programmable Peripheral Interconnect – PPI
- Full set of digital interfaces including: SPI/I2C/UART
- 10-bit ADC
- Programmable output power from +4dBm to -20dBm
- Fully on-air compatible with nRF24L-series Pin compatible with other nRF51xxx series devices
- Individual power management for all peripherals
- Wide supply voltage range (1.8 V to 3.6 V)

Applications

- Wearable device
- Bluetooth Smart applications
- Mobile phone accessories
- Smart RF tags for tracking and social interaction
- Intelligent domestic appliances
- Domestic/Industrial control
- Data-acquisition system

Contents

1.	Out of box audit.....	3
1.1	PC development environment deployments	3
1.2	Mobile app download	3
1.3	Connection to a mobilephone (heartbeat rate meter demo)	3
2.	Program descriptions	4
2.1	SDK	4
2.2	Example application download explanations	4
2.3	How to download and compile blinky_example	4
2.4	How to download and compile ble_app_hrs	7
2.5	Functional descriptions of example programs	8
3.	FAQ.....	9

1. Out of box audit

1.1 PC development environment deployments

- WindowsXP or Windows 7
- nRFgo Studio v1.14 or higher versions
- Keil MDK-ARM Lite v4.54 or higher versions
- J-Link Software v4.52b or higher versions

1.2 Mobile app download

NORDIC provides relative apps which can be downloaded from Apple App Store for iPhone users and Google Play for Android users. The method is listed as below.

iPhone users: enter App Store and search “**nRF Utility**”

Android users: enter Google Play and search “**nRF Utility**”

Notice: Apps provided by NORDIC are not available for all types of mobile phones. Please login to the website <http://www.nordicsemi.com/Products/nRFready-Demo-APPS> to check whether your one is supported. If not, you may upgrade your mobile phone system to Android 4.3 or use another mobile phone supported.

1.3 How to connect with a mobile phone (heartbeat rate meter demo)

- a) Start the Bluetooth on a mobile phone
- b) Run **nRF Utility**, and enter **HRM**. Then, wait for connection building
- c) Press KEY1 on the BLE400, then a LED starts flickering, indicating that it is able to build the connection.
- d) Click the button **CONNECT** on the mobile phone, a number, “180”, will be shown in the mobile phone screen.
- e) Press KEY1 or KEY2 on the BLE400, the number shown in the mobile phone will increase or decrease.

2. Program descriptions

2.1 SDK

- a) Install Keil MDK-ARM (v4.54 or higher version) and J-Link for Windows.
- b) Install nRF51 SDK from the path of `Software\nrf51_sdk_v5_2_0_xxxx.msi`; please make sure KeilMDK-ARM option is selected.
- c) It is notice that if there are installation errors of SDK, please download and install Microsoft .NET Framework 3.5.
- d) Install nRFgo Studio (`nrfgostudio_win-32_1.15.1_installer.msi` for a 32-bit system, and `nrfgostudio_win-64_1.15.1_installer.msi` for a 64-bit system).

2.2 Example application programming explanations

There are a few differences in programming different example applications. In the following two sections, we will take `blink_example` testing program and `ble_app_hrs` testing program as two examples to illustrate how to program example applications.

Here are the main differences in programming `blink_example` and `ble_app_hrs` applications.

- The `blinky_example` testing program is a No OS. So it can be applied directly after downloading its codes.
- The `ble_app_hrs` testing program is similar to an OS program. Therefore, both relative firmware and its codes should be downloaded.

2.3 How to compile and program `blinky_example`

- a) Before programming, you should apply nRFgo Studio to erase all the programs preinstalled to the development board by manufactory. The erasure can be easily done by selecting **nRF51 Programming** and clicking **Erase all**. Now, it is ready to program the applications.

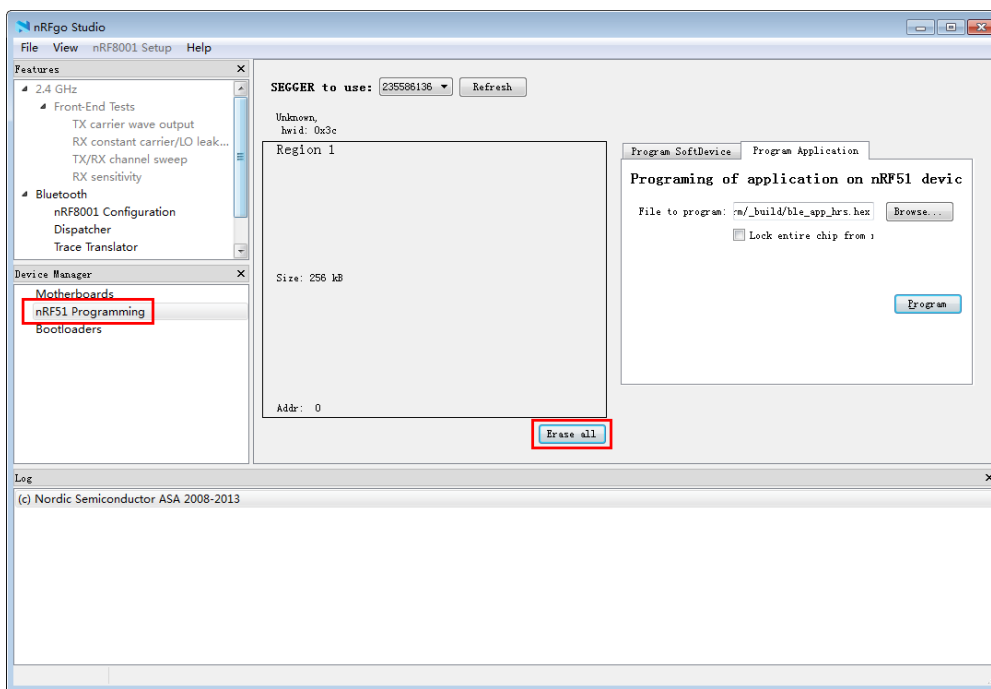


Figure 1: How to erase all

- b) Open Blinky Project in Keil µVision under the path of <KEIL_path> \ARM\Device\Nordic\NRF51822\Board\PCA10001\blinky_example\arm\blinky.uvproj or ...code\BLE4.0\nrf51822\Board\pca10001\blinky_example\arm\blinky.uvproj
- c) Click the icon **Build** or press the fast key, F7, to compile Blinky project.
- d) Click the icon **Download**. Run the Blinky_example after program download finished. Then, you can see the LED start to flick.



Build Download

Figure 2: How to use KEIL to download programs

Notice:

Sometimes, Jlink firmware may fail to cooperate with Nordic SDK, causing KEIL cannot download programs.

In this case, please select **nRF51 Programming** at the bottom left of nRFGo Studio, and click the option **Program Application** to start programming.

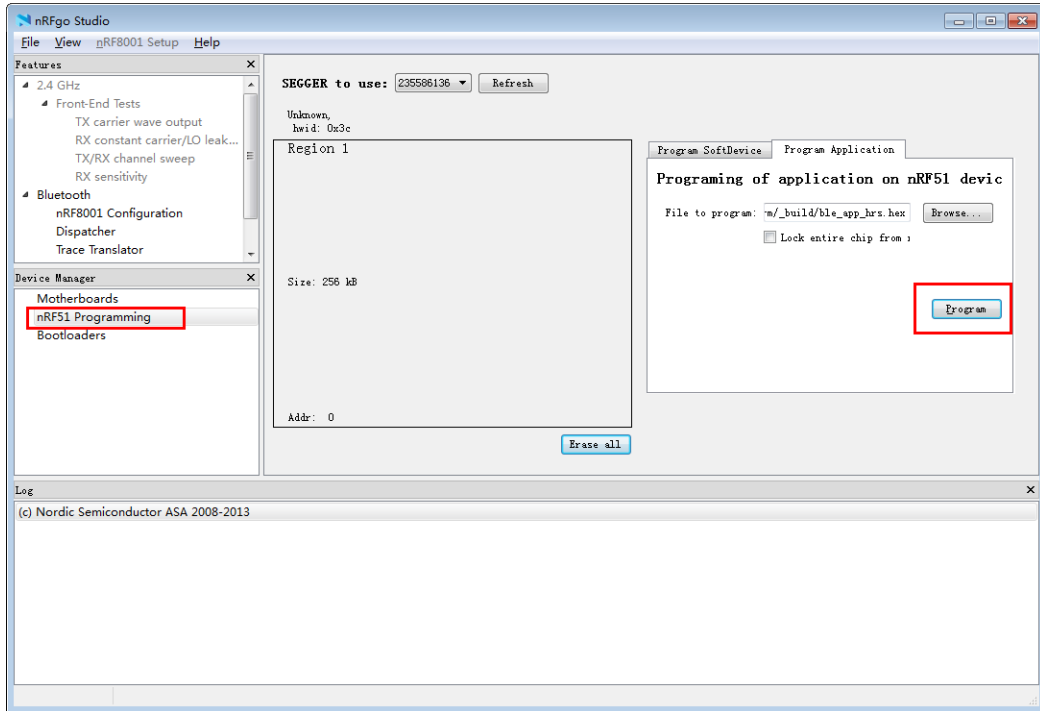


Figure 3: Program Application

2.4 How to compile and program ble_app_hrs

- a) Program S110 nRF51822 SoftDevice (Bluetooth protocol stack):
 Select nRF51 Programming > Program SoftDevice> Browse (choose corresponding Bluetooth protocol stack) > Program (wait for completing Bluetooth protocol stack programming).

Notes: The protocol stack file we used here, s110_nrf51822_6.0.0_softdevice.hex, is decompressed from \Software\s110_nrf51822_6.0.0.zip.

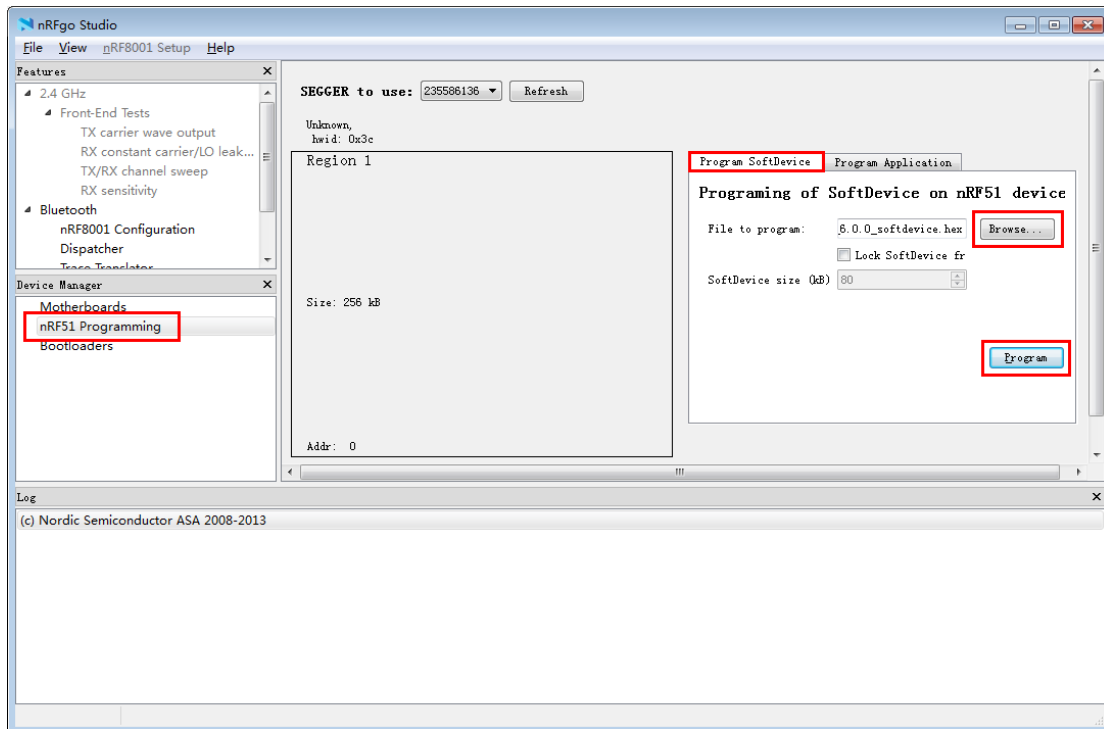


Figure 4: Program SoftDevice

- b) Program upper application.
 c) Enter `<KEIL_path> \ARM\Device\Nordic\nrf51822\Board\pca10001\s110\ble_app_hrs\arm` or `<code_path> \BLE4.0\nrf51822\Board\pca10001\s110\ble_app_hrs\arm`.

And then, open Keil project file.

After completing program compiling and download, you will find that all the configurations are restored to factory default settings, since ble_app_hrs is the very default program preinstalled by the factory. For more information about testing methods, please refer to the section "Out of box audit".

2.5 Functional descriptions of example programs

- a) All the programs are under the path of `<code path>\BLE4.0\nrf51822\Board\pca10001` and all the jumpers are connected.
- b) For the detail explanations of process ①, ②, ③ and ④ in the table below, please refer to the remarks at the bottom of the table.
- c) For the operations involving process ②, please refer to the section “How to compile and program ble_app_hrs” to find out relative program method.
- d) For other programs, please refer to the section “How to compile and program blinky_example” to find out relative program method.

Program name	Operations and phenomenon
blinky_example	LED is flickering
uart_example	①, and read back serial output information
at45dbxx_example	①, and connect AT45DBXX DataFlash Board to a SPI The ID of the module will be shown in the serial debugging assistant.
at24cxx_example	①, and connect AT24CXX EEPROM Board to an I ² C interface Press KEY1 on the development board, and then the data of the assigned address will be shown in the serial debugging assistant. Press KEY2 on the development board, and then the data of the assigned address will be increased by 1.
button_radio_example\led_radio_example	Development board A downloads button_radio_example Development board B downloads led_radio_example Press KEY1 on the development board A, and then LED0 starts flickering Press KEY2 on the development board B, and then LED1 starts flickering
ble_app_beacon	②, ③, ④
ble_app_proximity	②, ③, ④
ble_app_uart	①, ②, ③, ④, and transmit the data in the mobile phone to a serial port
Remarks: ① Connect the development board to a PC via a data cable, and start the serial debugging assistant; Baud rate: 38400, 8-bit data bit, 1-bit stop bit ② Download the Blue tooth protocol stack from Program SoftDevice ③ Testing software: LightBlue(iOS) ④ LightBlue displays relative information	

Table 1: Functional descriptions of example programs

3. FAQ

- Q: What should I do if KEIL cannot download programs?
A: First of all, check whether the power supply to the system is properly working. If yes, try to use nRF51 Programming in the nRFGo Studio to find out whether the setting of KEIL project is fine.
- Q: How to do when nRFGo Studio can perform downloading, but KEIL gives a warning of download error?

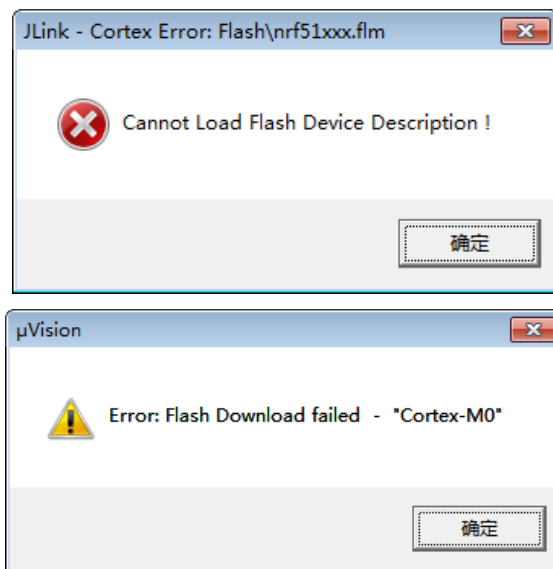


Figure 5: KEIL download error

- A: Please make sure SDK is installed properly. The setting of Flash Download is as the figure shown below.

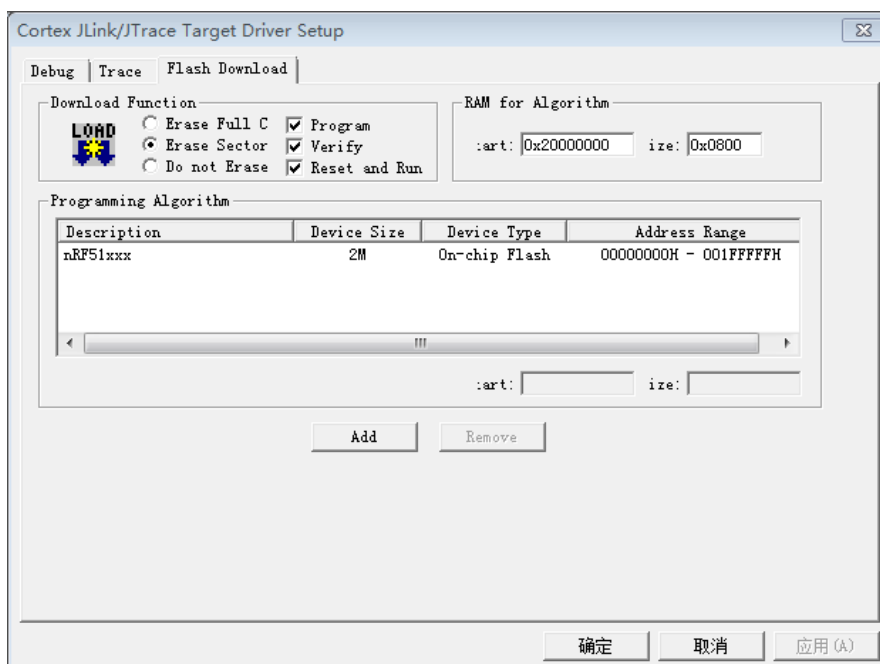


Figure 6: Flash Download settings

- Q: How to get more information after reading this document?
A: Please refer to relative documents provided in chip PDF folder, or reference datasheets provided in the website: [Documentation\index.html](#).