How to port an existing project from the BlueNRG-M2SA module to the BlueNRG-M2SP module

By Salvo Bonina

Main components	
BlueNRG-M2	Very low power application processor module for Bluetooth® Low Energy v5.0

Purpose and benefits

The BlueNRG-M2 is a Bluetooth® Low Energy system-on-chip application processor based certified module, compliant with BT specifications v5.0 and BQE qualified. The BlueNRG-M2 module supports multiple roles simultaneously and can act simultaneously as a Bluetooth master and slave device. The BlueNRG-M2 is based on the BlueNRG-2 system-on-chip and the entire Bluetooth Low Energy stack and protocols are embedded into the module. The BlueNRG-M2 module provides a complete RF platform in a tiny form factor. Radio, embedded antenna and high frequency oscillators are integrated to offer a certified solution to optimize the time-to-market of the final applications. The BlueNRG-M2 can be powered directly with a pair of AAA batteries or any power source from 1.7 to 3.6 V.

The BlueNRG-M2 comes in two variants: the BlueNRG-M2SA and the BlueNRG-M2SP.

They have different internal HW configurations, which require a slightly different software initialization.

Both the BlueNRG-M2SA and the BlueNRG-M2SP modules embed the BlueNRG-2 chipset.

Both the BlueNRG-2 chipset and BlueNRG-M2 modules are BLE5.0 certified (with full BLE4.2 feature set).

The purpose of this document is to describe all the necessary steps to adapt an existing project available to the BlueNRG-2 software development kit (SDK) and having as a target the BlueNRG-M2SA module rather than the BlueNRG-M2SP module.

Description

The BlueNRG-M2SA and BlueNRG-M2SP modules are characterized by a different HW configuration, as showed in Figure *1* below.
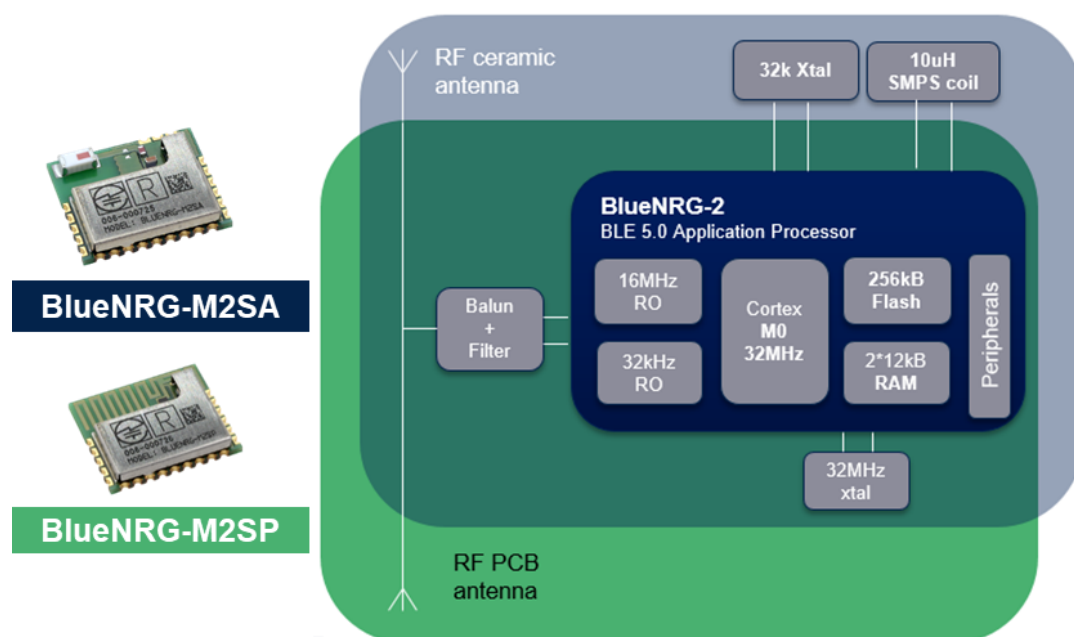

Figure 1 *BlueNRG-M2SA vs BlueNRG-M2SP*

The HW configuration of the design surrounding the BlueNRG-2 application processor has a direct impact on the values of the SW data structure used for initializing the BLE radio stack. In particular, 3 HW-related aspects are relevant:

1. the speed of the high speed crystal (16 or 32 MHz)

2. the presence or absence of an external 32 kHz low speed crystal

3. the presence or absence of a 10 uH inductor to enable the internal switch-mode power supply (SMPS) HW block

The user application, running on the BlueNRG-2 application processor, must configure 3 preprocessors defined symbols with values reflecting the exact HW design.

Table 1 Preprocessor summarizes the symbols and their related values both for the BlueNRG-M2SA and the BlueNRG-M2SP module.

Preprocessor symbol	BlueNRG-M2SA	BlueNRG-M2SP
HS_SPEED_XTAL	HS_SPEED_XTAL_32MHZ	HS_SPEED_XTAL_32MHZ
LS_SOURCE	LS_SOURCE_EXTERNAL_32KHZ	LS_SOURCE_INTERNAL_RO
SMPS_INDUCTOR	SMPS_INDUCTOR_10uH	SMPS_INDUCTOR_NONE

Table 1 Preprocessor symbols

In the product evaluation phase, concerning the BlueNRG-M2SA, ST recommends the STEVAL-IDB008V1M evaluation board (Figure 2). The related SDK is named STSW-BLUENRG1-DK (the same SDK used for the BlueNRG-2 and BlueNRG-1 chipsets). When working with the STEVAL-IDB008V1M and the STSW-BLUENRG1-DK, the primary aim is to use the integrated BlueNRG-2 device (and therefore the BlueNRG-M2SA module) as the system processor running the user's application.

Figure 2 STEVAL-IDB008V1M

As far as the BlueNRG-M2SP is concerned, ST recommends the X-NUCLEO-BNRG2A1 evaluation board (Figure 3). This board is an expansion board mainly designed to be connected on top of an STM32 Nucleo board through the Arduino connectors. The corresponding SDK is named X-Cube-BLE2. It can be either downloaded as a standalone SW package from st.com or it can be added to the STM32CubeMX initialization code generator as an embedded SW package. This helps for an easy adaptation to any microcontroller variant within the STM32 product families. Note that if downloaded as a standalone SW package, all the reference SW examples in the X-CUBE-BLE2 SDK are designed for a Nucleo-L476RG as the target microcontroller.

When the X-NUCLEO-BNRG2A1 is used, the primary mode of operation of the integrated BlueNRG-2 chipset is Network Co-Processor. This means that the BlueNRG-2 device runs the BLE stack only, while the user's application is implemented and runs on the STM32 microcontroller on the Nucleo board. Note that the X-NUCLEO-BNRG2A1 could work as a standalone board in case VDD is supplied from an external source, even though this is not its primary mode of operation.

Figure 3 X-NUCLEO-BNRG2A1

Since the HW configuration of the BlueNRG-M2SA module is the same as the one used in the STEVAL-IDB008V2, i.e. the evaluation board for the BlueNRG-2 chipset, this allows the user to adopt any available FW example in the BlueNRG-2 SDK. Moreover, all the available companion tools for the BlueNRG product family, e.g. BlueNRG GUI, BlueNRG Navigator, are compatible with the STEVAL-IDB008V1M. Actually, the STEVAL-IDB008V1M evaluation board is natively recognized from all the above-mentioned tools.

On the contrary, the X-Nucleo-BNRG2A1 (the evaluation board for the BlueNRG-M2SP module) is designed to be mainly used in companionship with an STM32Nucleo board. Therefore, the "out-of-the-box" tools for this board are those available for the STM32 Nucleo board, i.e. STM32CubeMX and the X-Cube SW packages.

To summarize the SDKs supported by the 2 evaluation boards, the reader can refer to Table 2 here below.

Eval kits	SW SDK	BlueNRG GUI compatibility	BlueNRG Navigator compatibility
X-NUCLEO-BNRG2A1	X-CUBE-BLE2	Yes – through the VCOM FW available in the X-Cube-BLE2 package. VCOM FW runs on STM32L4 on Nucleo	No
STEVAL-IDB008V1M	STSW-BLUENRG1-DK v.3.2.0 or later	Yes – loading the DTM UART application from the BlueNRG-1.2 SDK	Yes

Table 2 Eval kits

Finally, in the scenario where the user starts the evaluation phase with the BlueNRG-M2SA module (through the STEVAL-IDB008V1M board) and right after the design phase, he prefers to move to the BlueNRG-M2SP module, at this point, the two modules are pin-to-pin compatible, so the HW portion of the user's platform remains unchanged. Regarding to the SW, the only SW modifications to the application designed for the BlueNRG-M2SA consist of modifying the values of the preprocessor symbols as listed in Table 1, i.e. the application must be compiled with the preprocessor symbols as below:

- HS_SPEED_XTAL=HS_SPEED_XTAL_32MHZ

- LS_SOURCE=LS_SOURCE_INTERNAL_RO

- SMPS_INDUCTOR=SMPS_INDUCTOR_NONE

Support material

Related design support material
[STSW-BLUENRG1-DK](#) - BlueNRG-1, BlueNRG-2 DK SW package
[STSW-BNRGUI](#) - BLUENRG family GUI
[STEVAL-IDB008V1M](#) - Bluetooth® Low Energy evaluation platform based on the BlueNRG-M2SA module
[X-NUCLEO-BNRG2A1](#) - Bluetooth® Low Energy expansion board based on the BLUENRG-M2SP module for STM32 Nucleo
Documentation
[DS13053](#): BlueNRG-M2 very low power application processor module for Bluetooth® Low Energy v5.0
[DS12166](#): BlueNRG-2 Bluetooth® Low Energy wireless system-on-chip
[DB4086](#): X-NUCLEO-BNRG2A1 - Bluetooth Low Energy expansion board based on the BLUENRG-M2SP module for STM32 Nucleo
[UM2071](#): BlueNRG-1, BlueNRG-2 development kits
[PM0257](#): BlueNRG-1, BlueNRG-2 BLE stack v2.x programming guidelines
[UM2406](#): The BlueNRG-1, BlueNRG-2 Flasher SW package
[AN4872](#): BlueNRG-1 and BlueNRG-2 UART bootloader protocol
[DT0129](#): BLE module integration design guidelines
[DT0121](#): How to configure the BlueNRG-1 and BlueNRG-2 devices in network coprocessor mode
[DT0120](#): How to program and debug BlueNRG-1 and BlueNRG-2 devices

Revision history

Date	Version	Changes
02-Jul-2020	1	Initial release

IMPORTANT NOTICE – PLEASE READ CAREFULLY