Update procedure and configuration in DTM firmware for X-NUCLEO-BNRG2A1

Introduction

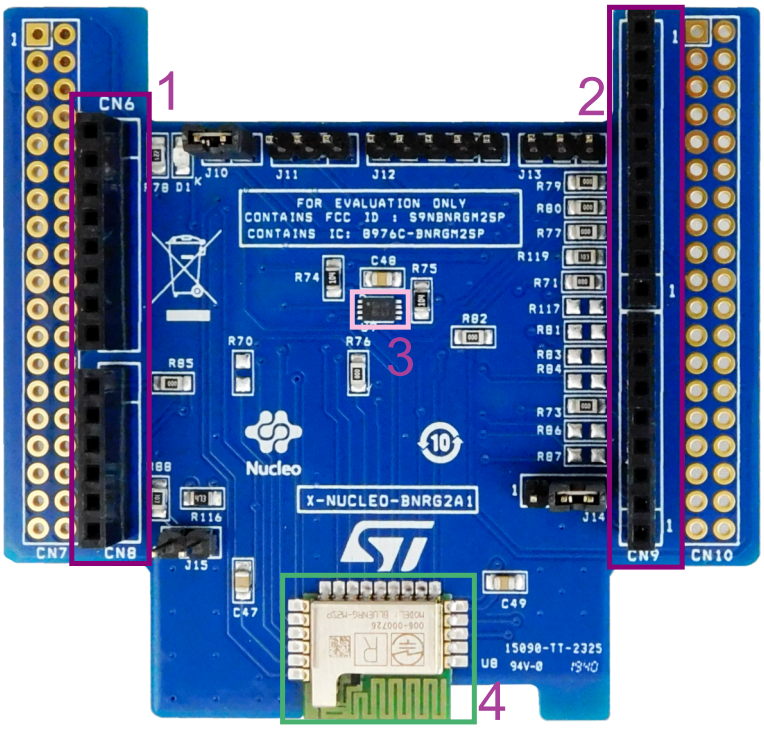
This document describes how to update the DTM firmware in the X-NUCLEO-BNRG2A1 expansion board and different hardware settings to be configured to port the BlueNRG-2 SDK DTM firmware for X-NUCLEO-BNRG2A1 to any custom application.

The X-NUCLEO-BNRG2A1 is a Bluetooth® Low Energy (BLE) evaluation and development board system designed around BlueNRG-M2SP Bluetooth® Low Energy module based on the BlueNRG-2 processor.

The processor communicates with the STM32 microcontroller, hosted on the STM32 Nucleo development board, through the SPI link available on the Arduino UNO R3 connectors.

Figure 1. X-NUCLEO-BNRG2A1 expansion board components

1. Arduino UNO R3 connectors
2. Arduino UNO R3 connectors
3. M95640-RMC6TG
4. BlueNRG-M2SP



1 System requirements

1.1 Hardware requirements

The table below lists the boards to be used to upgrade the DTM firmware on the BlueNRG-M2SP.

Table 1. Hardware requirements

Boards	Description
X-NUCLEO-BNRG2A1	Evaluation platform based on the BlueNRG-M2SP module for STM32 Nucleo
NUCLEO-L476RG	STM32 Nucleo-64 development board with STM32L476RG MCU

To program the X-NUCLEO-BNRG2A1, its 5-pin SWD connector (J12) has to be connected to the NUCLEO-L476RG via ST-LINK and a mini-USB cable is required to connect the development board to your laptop/PC.

Figure 2. X-NUCLEO-BNRG2A1 and NUCLEO-L476RG connection via ST-LINK programming cable

Important:
Connect the STM32 Nucleo development board debug connector first five pins only and leave pin 6 unconnected.

1.2 PC/laptop requirements

The minimum requirements to set up the software environment are:

- a PC/laptop with Intel or AMD processor running one of the following Microsoft operating systems: Windows XP or Vista/Windows 7/Windows 10
- 2 USB ports
- At least 128 MB of RAM
- 40 MB of hard disk space
- BlueNRG-1ST-LINK Utility to update the firmware through SWD connector

2 DTM firmware update procedure

2.1 Direct update on the X-NUCLEO-BNRG2A1 expansion board

Step 1. Remove CN2 jumper from the NUCLEO-L476RG development board.

Figure 3. NUCLEO-L476RG development board CN2 pin (highlighted in purple)

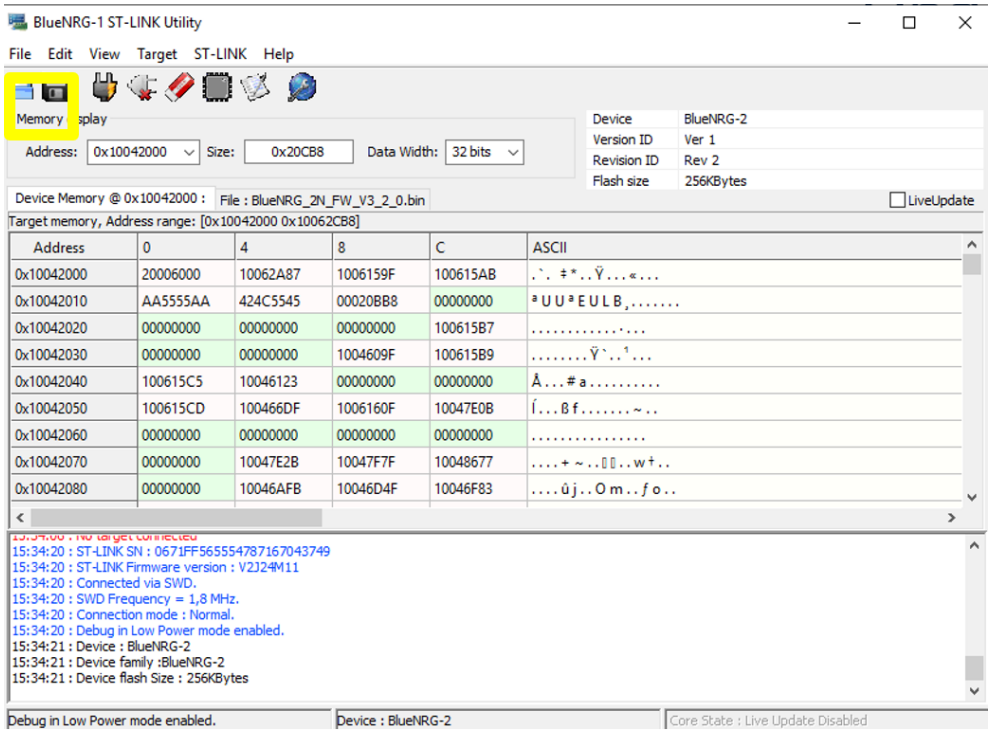
Step 2. Connect the board via ST-LINK using the programming cable or wires.

Step 3. Add a jumper to X-NUCLEO-BNRG2A1 J15 to wake up the device when in sleep mode.
This jumper is connected to the BlueNRG-2 DIO7 pin and must be shorted for boot pin high. DIO7 can be used for bootloader activation.

Figure 4. X-NUCLEO-BNRG2A1 expansion board J15 pin (highlighted in light blue)

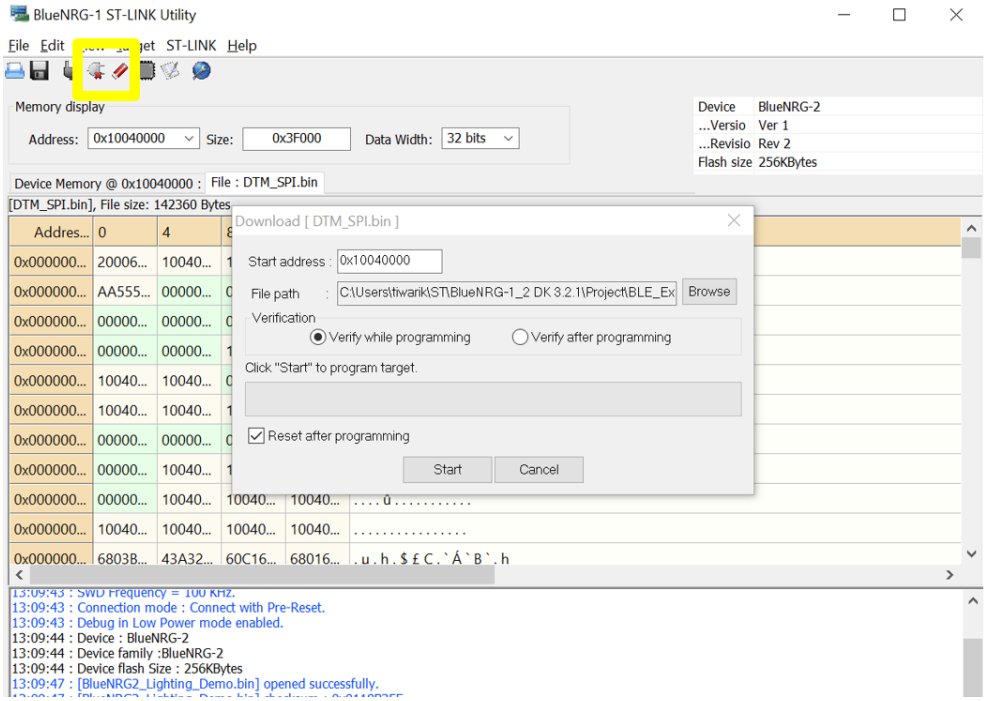
Step 4. Download the latest DTM image from the BlueNRG-M2SP web page, selecting the Documentation tab and then Utilities at the page bottom.

Figure 5. BlueNRG-1 ST-LINK Utility



Step 5. Open BlueNRG-1 ST-LINK Utility tool and connect to the target.

Figure 6. BlueNRG-1 ST-LINK Utility - target connection



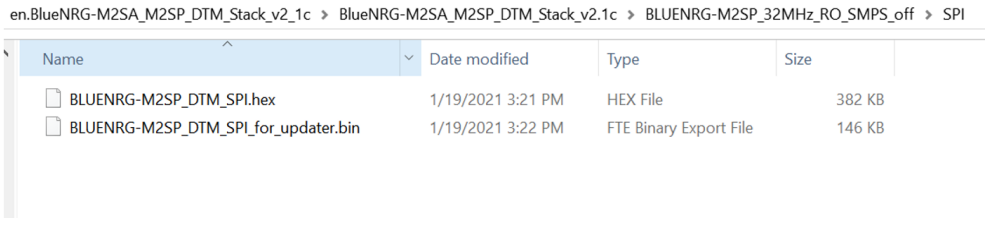
Step 6. From the package downloaded at 4., select the DTM image to be uploaded onto the X-NUCLEO-BNRG2A1 and click **[Start]**.

By default, the DTM image for the BlueNRG-M2SP is:

`en.BlueNRG-M2SA_M2SP_DTM_Stack_v2_1c\BlueNRGM2SA_M2SP_DTM_Stack_v2.1c\BLUENRG-M2SP_32MHz_RO_SMPS_off\SPI\BLUENRG-M2SP_DTM_SPI.hex`

as shown in the following figure (you can find it in the BlueNRG-M2 web page by selecting the Documentation tab and then Utilities at the page bottom, as detailed in step 4).

Figure 7. BlueNRG-2 DTM image



Step 7. Add the jumper back on CN2 and remove it from J15.

2.2 Update through BlueNRG GUI

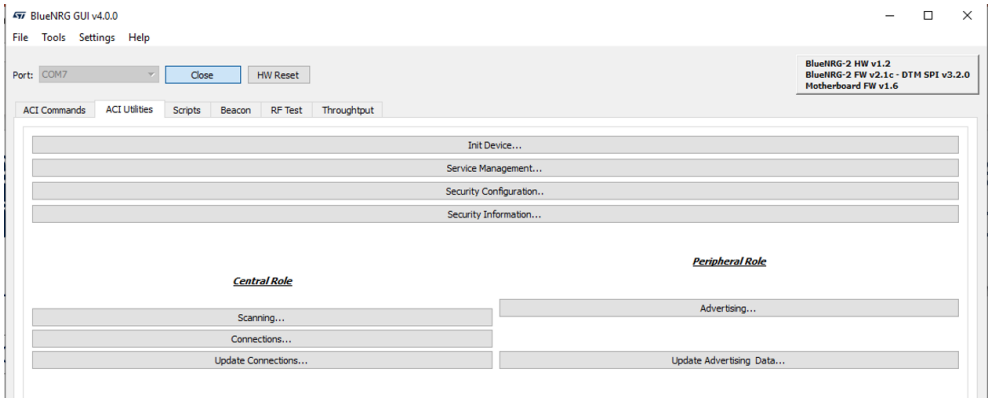
Step 1. Download the X-CUBE-BLE2 package from www.st.com.

Step 2. Load the VCOM binary on the NUCLEO-L476RG (the binary path is: `X-CUBE-BLE2\Projects\STM32L476RG-Nucleo\Applications\Virtual_COM_Port\Binary`).

Step 3. Open BlueNRG GUI

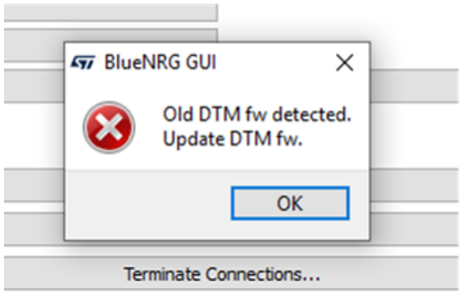
Step 4. From [**Tools**]>[**Settings**], set baud rate to 115000 and open the COM port.

Figure 8. BlueNRG GUI v4.0.0



The following message appears:

Figure 9. Old DTM firmware detected



Step 5. Ignore the pop-up and, in [**Tools**]>[**Stack Updater**] menu, select *en.BlueNRG-M2SA_M2SP_DTM_Stack_v2_1c\BlueNRGM2SA_M2SP_DTM_Stack_v2.1c\BLUENRG-M2SP_32MHz_RO_SMPS_off\SPI\BLUENRG-M2SP_DTM_SPI_for_updater.bin* and click [**Update**].

2.3 Update through IFRStack_Updater application

Step 1. Download the X-CUBE-BLE2 package from www.st.com.

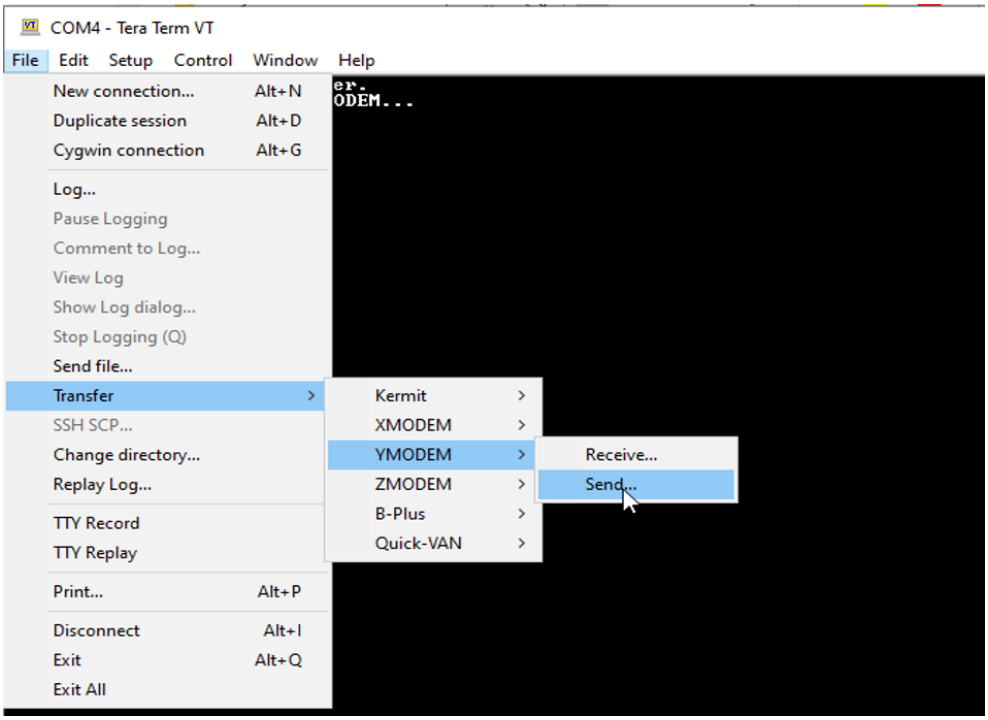
Step 2. Load the YMODEM_Stack_Updater_L476RG.bin binary on the NUCLEO-L476RG (the binary path is: *X-CUBE-BLE2\Projects\STM32L476RG-Nucleo\Applications\IFRStack_Updater\Binary*).

Step 3. Launch a serial terminal (e.g., Tera Term) and open a connection setting the parameters as follows:

- Speed: 115200
- Data: 8-bit
- Parity: None
- Stop bits: 1
- Flow control: none
- New-line: Receive=AUTO
- Transmit=CR

Step 4. In **[File]>[Transfer]>[YMODEM]>[Send]**, select `en.BlueNRG-M2SA_M2SP_DTM_Stack_v2_1c\BlueNRGM2SA_M2SP_DTM_Stack_v2.1c\BLUENRG-M2SP_32MHz_RO_SMPS_off\SPI\BLUENRG-M2SP_DTM_SPI_for_updater.bin`

Figure 10. YMODEM selection in Tera Term



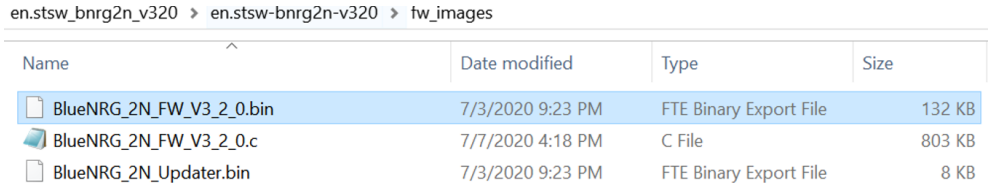
At the end of the file transfer, the fast-blinking LD2 LED (T = 0.5 secs) on the NUCLEO-L476RG indicates that the updating process has successfully terminated (the slowly blinking LD2 LED (T = 3 secs) indicates that the updating process has failed).

2.4 Emulating the BlueNRG-2N device with the X-NUCLEO-BNR2A1 expansion board

The BlueNRG-2N device is an ultra-low power (ULP) network coprocessor solution for Bluetooth® low energy applications and can be emulated on the X-NUCLEO-BNRG2A1 as described hereafter.

Step 1. Download and unpack the STSW-BNRG2N-V320, which contains the BlueNRG-2N image (BlueNRG_2N_FW_V3_2_0.bin).

Figure 11. BlueNRG-2N image



Step 2. Follow steps 1 to 4 of Section 2.1 to flash the BlueNRG-2N firmware image to emulate the BlueNRG-2N device.

3 Custom DTM image generation for applications on X-NUCLEO-BNRG2A1

DTM firmware available in the STSW-BLUENRG1-DK (BlueNRG-1_2DK 3.2.1 \Firmware\BLE_Examples\DTM\BlueNRG-2) is a starting point for the generation of an image based on applications.

The pre-processor in the DTM SPI example has to be configured for the BlueNRG-M2SP module.

Table 2. Pre-processor symbol value for BlueNRG-M2SP mounted on X-NUCLEO-BNRG2A1

Pre-processor symbol	BlueNRG-M2SP
HS_SPEED_XTAL	HS_SPEED_XTAL_32MHZ
LS_SOURCE	LS_SOURCE_INTERNAL_RO
SMPS_INDUCTOR	SMPS_INDUCTOR_NONE

The above pre-processor symbols will be configured in the project workspace as shown in the following figures.

Figure 12. Pre-processor symbols in IAR workspace of DTM SPI project

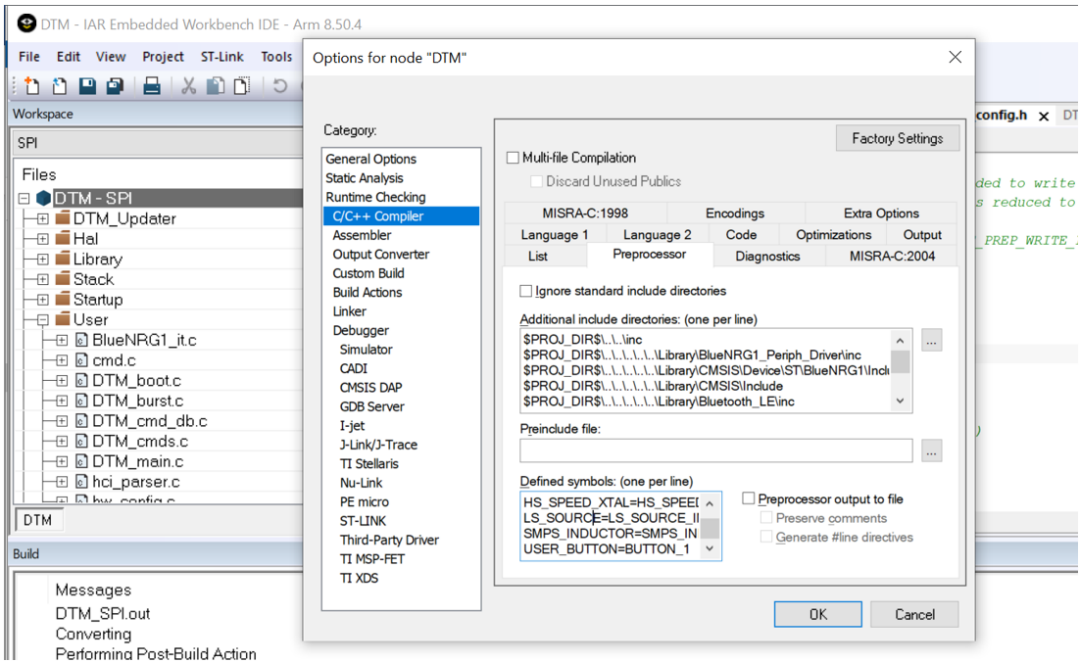
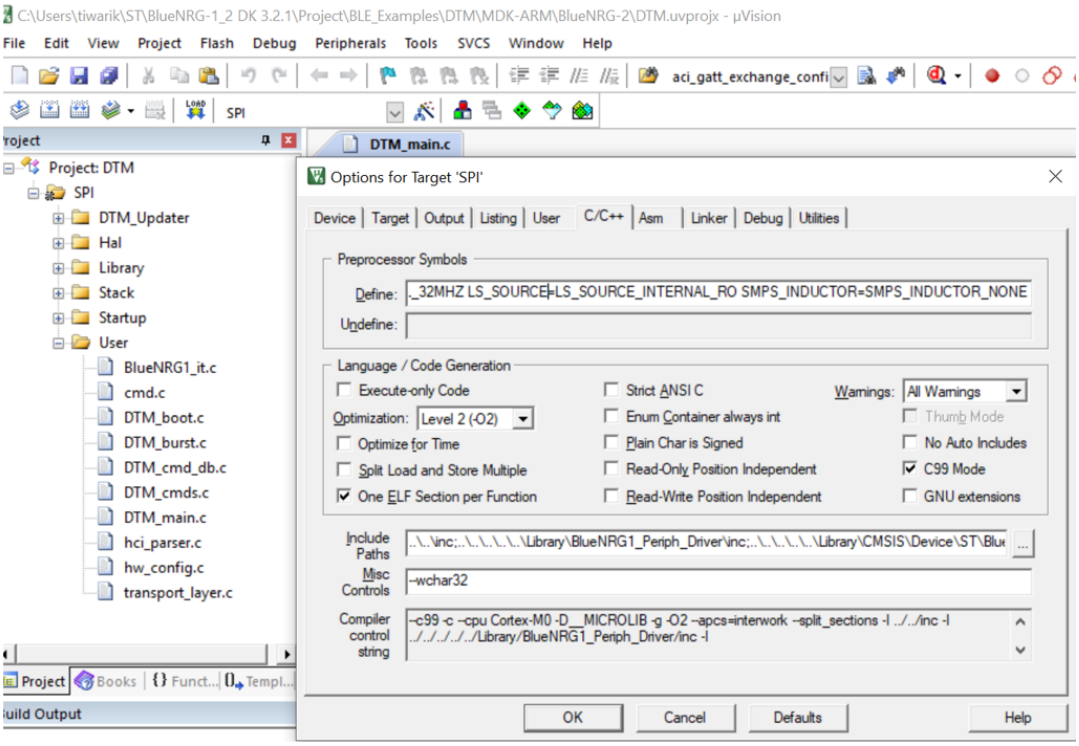
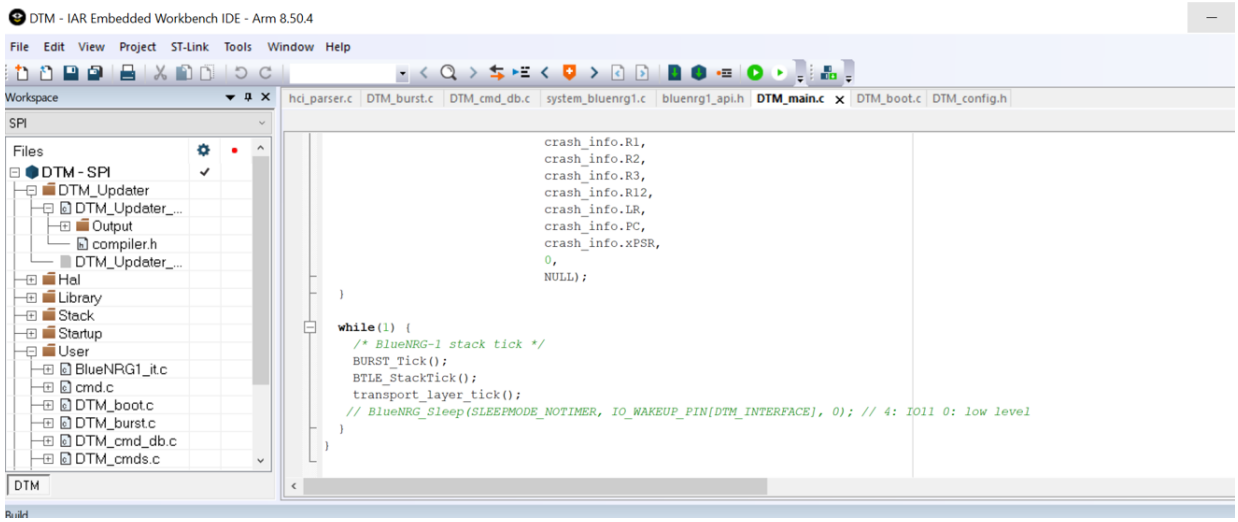


Figure 13. Pre-processor symbols in Keil workspace of DTM SPI project



`BlueNRG_Sleep` API can be commented to generate X-NUCLEO-BNRG2A1 image to avoid the BlueNRG-2 device to go into sleep mode when not required.

Figure 14. BlueNRG_Sleep API commented in while loop of DTM SPI project



Other configurations, such as max. value for ATT MTU, can be changed by modifying the `MAX_ATT_MTU` macro in DTM_config.h (by default, set to 220 in the DTM firmware available in STSW-BLUENRG1-DK).

Revision history

Table 3. **Document revision history**

Date	Revision	Changes
22-Mar-2021	1	Initial release.

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