

---

## How to use the BlueNRG family devices with a CMSIS-DAP compliant probe

### Introduction

The BlueNRG system-on-chip family integrates a Cortex-M core with standard Arm SWD interface that allows interactive debugging and programming of the device with a lot of solutions such as: CMSIS-DAP, J-Link, U-Link and so on.

This document describes how to use a CMSIS-DAP compliant probe with the BlueNRG-LP, BlueNRG-LPS, and also with the BlueNRG-1 and the BlueNRG-2 systems-on-chip (SoCs).

The evaluation board of the BlueNRG-LP (STEVAL-IDB011V1) is used as reference within this document. The same concepts are valid for the BlueNRG-LPS (STEVAL-IDB012V1) evaluation board, and the BlueNRG-LP (STEVAL-IDB010V1) evaluation board.

The evaluation board of the BlueNRG-LP (STEVAL-IDB011V1) implements a customized version of the Arm open source project DAPLink. For this reason, the user can program and debug the BlueNRG-LP device directly using the USB connector of the board itself. Furthermore, the board can also be used to program and debug external devices such as the BlueNRG-1, BlueNRG-2, BlueNRG-LP and BlueNRG-LPS.

Besides, many vendors offer CMSIS-DAP probe solutions at a very affordable price (thanks to the fact that both software and hardware are available open source) which can be used for the BlueNRG family devices. STMicroelectronics has tested one of them in order to provide an example.

## 1 General information

BlueNRG-LP and BlueNRG-LPS devices embed the Arm® Cortex®-M0+ core.

*Note:* Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.  
For information on Bluetooth® refer to the [www.bluetooth.com](http://www.bluetooth.com) website.



## 2 CMSIS-DAP specifications

The CMSIS-DAP specifications provide a standardized way to access the Coresight debug access port (DAP) of an Arm Cortex microcontroller, via USB. It has been defined by Arm, and Arm itself has provided an open source implementation called DAPLink project.

A CMSIS-DAP compliant probe is a board where the DAPLink project or, in general, a CMSIS-DAP implementation is running. The connection to the target device can be over JTAG or SWD.

A CMSIS-DAP compliant probe can provide the following main features, all over a single USB connection.

- **HID interface for CMSIS-DAP based debugging**  
The driver-less HID interface provides a channel over which the CMSIS-DAP debug protocol runs. This enables all the leading industry standard toolchains to program and debug the target device.
- **MSC interface for USB drag and drop programming<sup>(1)</sup>**  
A CMSIS-DAP compliant probe can appear on the host computer as a USB disk. Program files in binary (.bin) and hex (.hex) formats can be copied into the USB disk, which then programs the image into the memory of the target device.
- **CDC interface for virtual serial port**  
A CMSIS-DAP compliant probe can appear as a USB serial port, which can be bridged through a TTL UART on the target device. The USB serial port appears on a Windows machine as a COM port, or on a Linux machine as a /dev/tty interface.

1. Valid for the selected device only because the Flashloader is inside the debugger itself.

### 3 ST CMSIS-DAP compliant probe

The STEVAL-IDB011V1/V2 evaluation kits for the BlueNRG-LP and the STEVAL-IDB012V1 evaluation kit for the BlueNRG-LPS provide the CMSIS-DAP capability. The customized version of the Arm open source project DAPLink offers:

- Windows 10 driver free
- Capable to program and debug the BlueNRG-LP, BlueNRG-LPS, BlueNRG-1 and BlueNRG-2
- It shows itself as a composite device which offers:
  - A HID interface for CMSIS-DAP based programming and debugging.
  - A CDC interface for virtual serial port that acts as a USB-to-serial port bridge, connecting the UART port of the BlueNRG-LP.
  - An MSC interface for USB drag-and-drop programming that allows to program the BlueNRG-LP by copying and pasting a binary or hex file inside the mass storage of the target board.
- Maintenance mode to upgrade the firmware with the latest version.

**Figure 1. STEVAL-IDB011V1 BlueNRG-LP evaluation board**

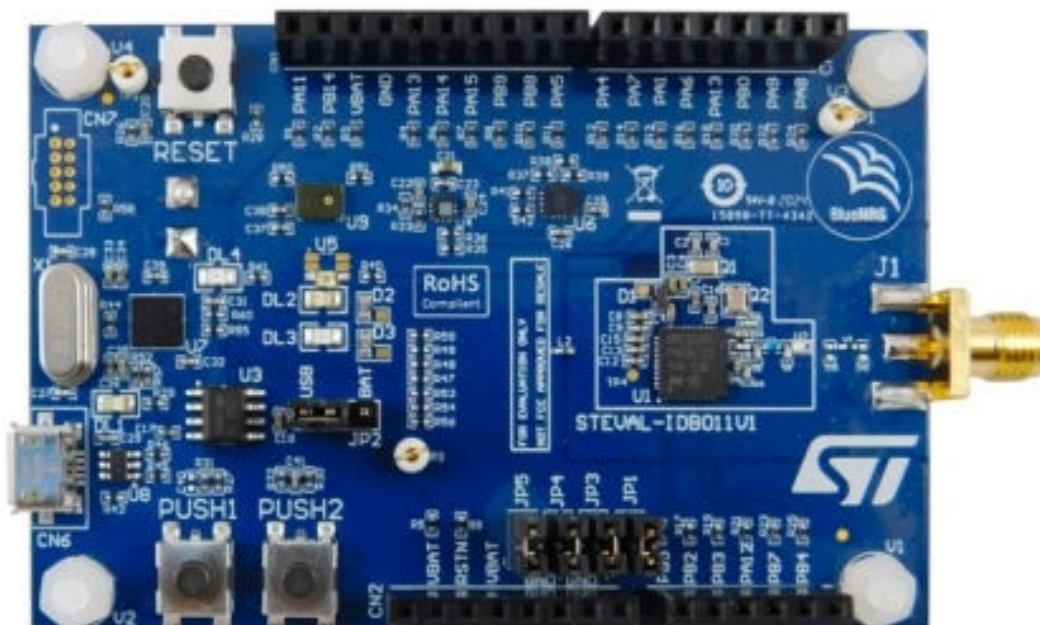


Figure 2. STEVAL-IDB011V2 BlueNRG-LP evaluation board

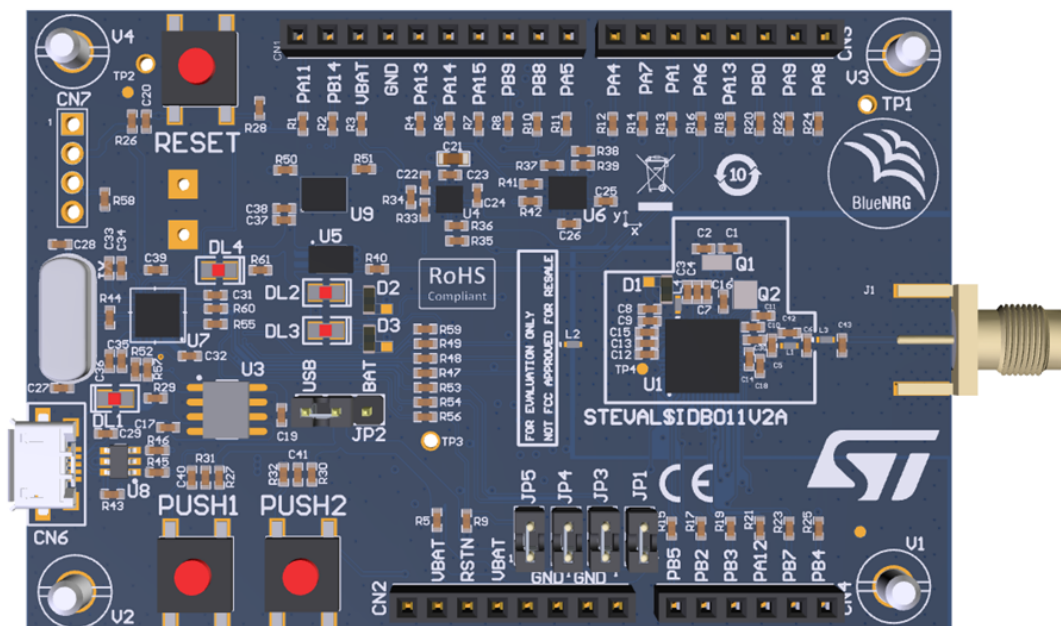


Figure 3. STEVAL-IDB012V1 BlueNRG-LPS evaluation board

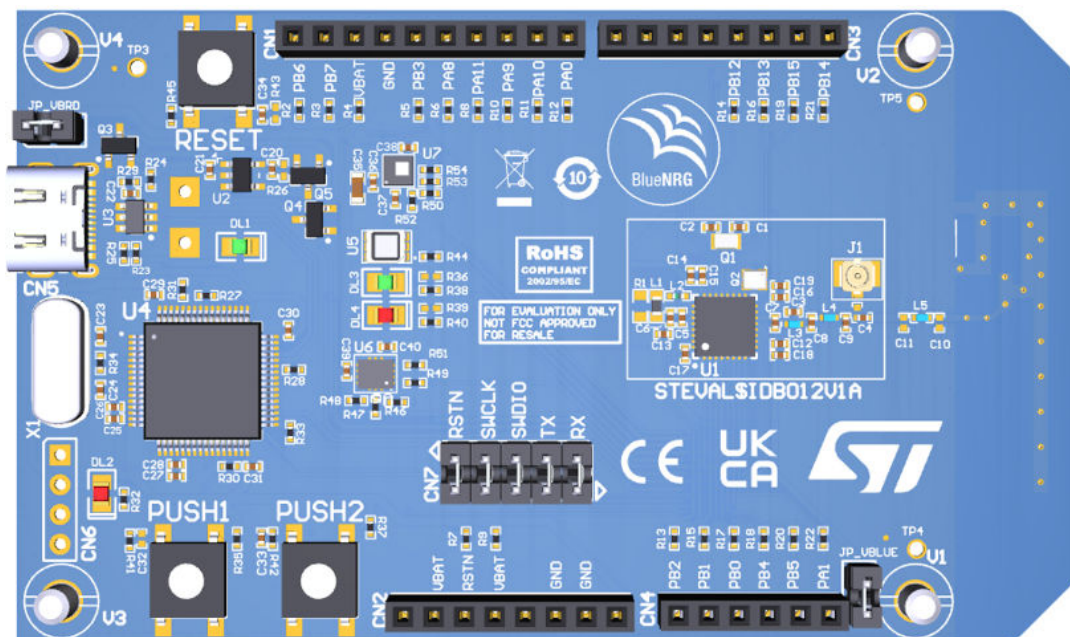
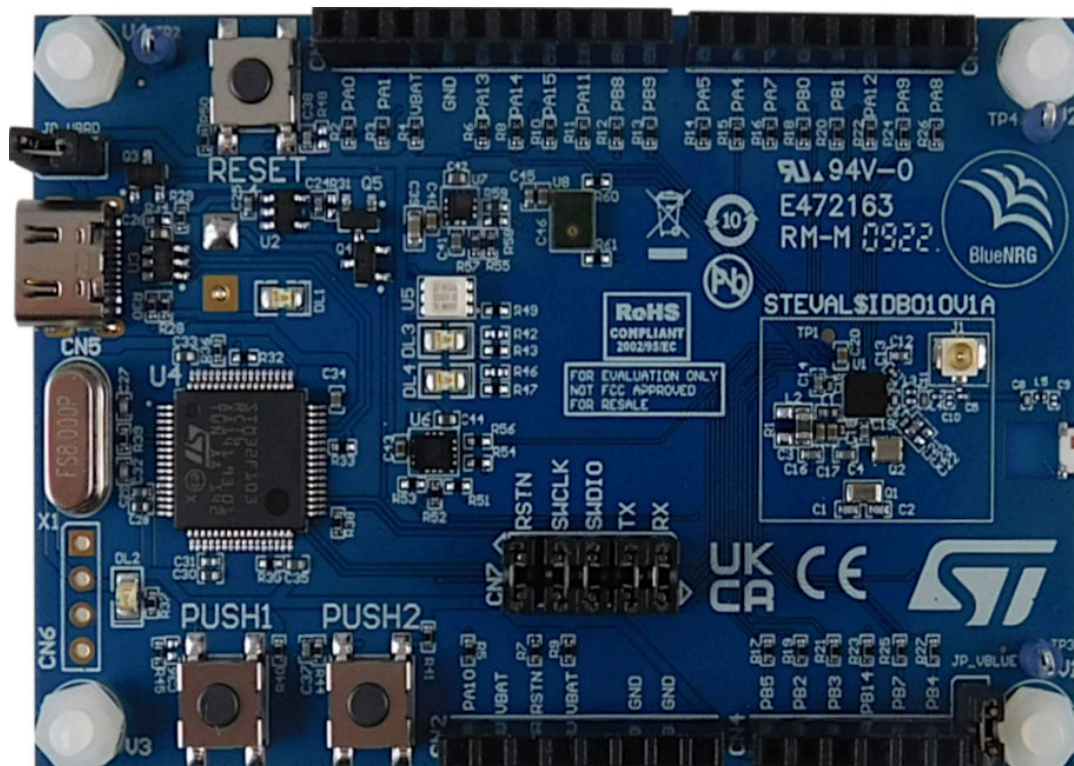




Figure 4. STEVAL-IDB010V1 BlueNRG-LP evaluation board



## 4 Third party CMSIS-DAP compliant probe tested

STMicroelectronics has tested the following debug probe from Electrodragon: [www.electrodragon.com/product/daplink-cmsis-dap-debugger-arm-cortex-stm32-mdk](http://www.electrodragon.com/product/daplink-cmsis-dap-debugger-arm-cortex-stm32-mdk):

- Free Windows 10 driver
- Capable of programming all Arm Cortex-M core chips, including: BlueNRG-LP, BlueNRG-LPS, BlueNRG-1 and BlueNRG-2
- Firmware designed and supported by Arm
- Includes a USB-TTL serial port
- Very-low cost debugger

**Figure 5. CMSIS-DAP debugger board from Electrodragon**



### 4.1 Other debugger/programmer probes

Several CMSIS-DAP compliant probes are available in the market. A list of some of these probes can be found below:

- CMSIS-DAP Debug Probe. [www.l-tek.com/web-shop/cmsis-dap-debug-probe](http://www.l-tek.com/web-shop/cmsis-dap-debug-probe)
- AK-CMSIS-DAP JTAG/SWD - Ultra low-cost Arm Cortex JTAG/SWD debugger based on the CMSIS-DAP standard. <https://www.artekit.eu/doc/guides/ak-cmsis-dap>
- Pitaya-Link CMSIS-DAP Debug Probe - An Open-Source CMSIS-DAP Debug Probe based on DAPLink. <https://wiki.makerdiary.com/pitaya-link>
- OSHChip's Programmer and Debugger. [http://oshchip.org/products/OSHChip\\_CMSIS\\_DAP\\_V1.0\\_Product](http://oshchip.org/products/OSHChip_CMSIS_DAP_V1.0_Product)
- CMSIS-DAP Arm Debug JTag/SWD, microSD, drag-and-drop. <http://www.i-syst.com/products/idap-link>
- CMSIS-DAP Compliant SWD Debugger. [www.tindie.com/products/ataradov/cmsis-dap-compliant-swd-debugger](http://www.tindie.com/products/ataradov/cmsis-dap-compliant-swd-debugger)
- IBDAP - CMSIS-DAP JTAG/SWD Debug Adapter. [www.facebook.com/armstart](https://www.facebook.com/armstart)

A list with J-Link and U-LINK probes as follows:

- Segger J-Link: [www.segger.com/products/debug-probes/j-link](http://www.segger.com/products/debug-probes/j-link)
- U-Link: <https://www2.keil.com/mdk5/ulink>

## 5 Debugger connection to evaluation kits

The following table shows how to connect the 3<sup>rd</sup> party debugger to the BlueNRG evaluation kits.

**Table 1. Electrodragon debugger connection to the BlueNRG evaluation kits**

Electrodragon debugger pin	STEVAL-IDB007VX STEVAL-IDB008VX	STEVAL-IDB011VX/ STEVAL-IDB01{0 2}V1	Functional name
DIO	CN7.7	JP4.1/CN7.6	SWD data signal
CLK	CN7.9	JP3.1/CN7.8	SWD clock signal
RST <sup>(1)</sup>	CN7.15	JP5.1/CN7.10	Reset pin
3V3	CN7.1	VBLUE	3.3V connected to VBLUE
GND	CN7.4	GND	GND
V1TXO <sup>(2)</sup>	CN3.1	CN3.1/CN3.4	Pin UART TX of the debugger connected to the pin UART RX of the Bluetooth LE board.
V1RXO <sup>(2)</sup>	CN3.2	CN3.2/CN7.2	Pin UART RX of the debugger connected to the pin UART TX of the Bluetooth LE board.

1. If HW reset is used.

2. Optional for UART TTL connection.

The following table shows how to connect the STEVAL-IDB011V{1|2}/STEVAL-IDB012V1/STEVAL-IDB010V1 used as CMSIS-DAP debugger to the evaluation kit STEVAL-IDB007V{1|2} and STEVAL-IDB008V{1|2}.

**Table 2. STEVAL-IDB011V{1|2}/STEVAL-IDB01{0|2}V1 debugger connection to the BlueNRG-1, BlueNRG-2 evaluation kits**

STEVAL-IDB011VX/ STEVAL-IDB01{0 2}V1 debugger pin	STEVAL-IDB007VX STEVAL-IDB008VX	Functional name
JP4.2/CN7.5	CN7.7	SWD data signal
JP3.2/CN7.7	CN7.9	SWD clock signal
JP5.2/CN7.9 <sup>(1)</sup>	CN7.15	Reset pin
VBRD	CN7.1	3.3 V connected to VBLUE
GND	CN7.4	GND
CN3.2/CN7.3 <sup>(2)</sup>	CN3.1	Pin UART TX of the debugger connected to the pin UART RX of the BLE board
CN3.1/CN7.1 <sup>(2)</sup>	CN3.2	Pin UART RX of the debugger connected to the pin UART TX of the BLE board

1. If HW reset is used.

2. Optional for UART TTL connection.



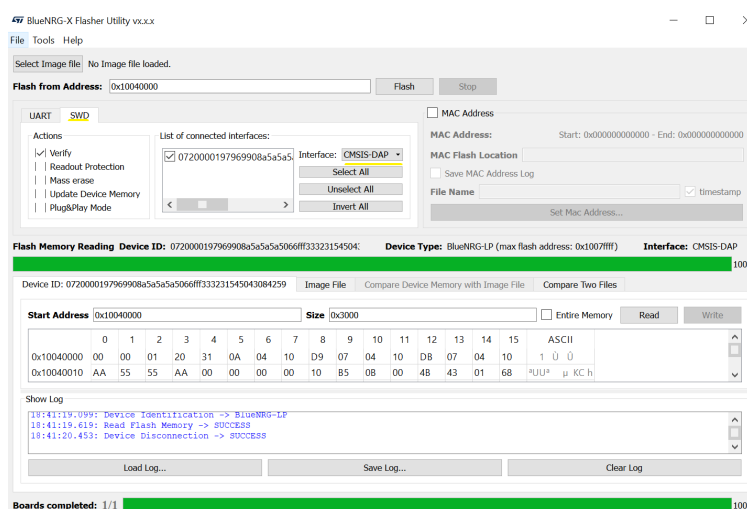
## 6 Software configuration

Here follows a quick summary about how to select the CMSIS-DAP debugger.

### 6.1 The RF-Flasher utility setting

The RF-Flasher utility allows the BlueNRG-X products to be connected through their UART port (using the internal bootloader) or through the SWD port. Inside the SWD tab, the user can choose the SWD interface to program the board: the CMSIS-DAP interface is also supported.

**Figure 6. RF-Flasher utility GUI**



### 6.2 The RF-Flasher Launcher

The RF-Flasher Launcher is a command line version of the RF-Flasher utility.

The command to list all the connected SWD HW tools (including the CMSIS-DAP ones) is:

```
> RF-Flasher_Launcher.exe swd
```

Then, it is possible to execute all the commands, such as: program and read the flash memory, verify the memory content, and perform a mass erase of the flash memory.

For example, a mass erase command if only one device is connected to the PC is:

```
> RF-Flasher_Launcher.exe swd mass_erase -c -swd -all
```

Further information is in the dedicated user manual UM2406.

### 6.3 Open OCD settings

The RF-Flasher utility GUI includes the folder OpenOcd that can be used directly by a user.

The common path is `C:\{Installation path}\ST\RF-Flasher Utility x.x.x\Application\OpenOcd`. The folders include the configuration files to connect the BlueNRG-LP, the BlueNRG-LPS, the BlueNRG-1 and the BlueNRG-2.

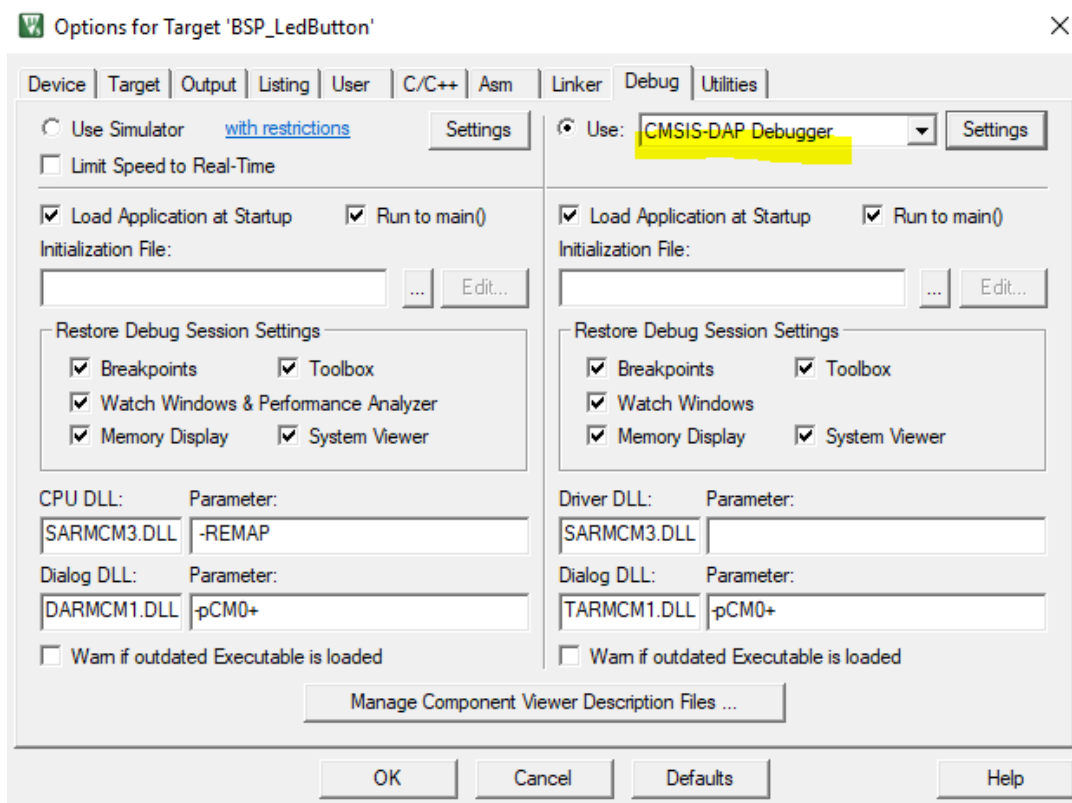
An example of command line to read the first 100 Kbytes of flash memory is shown below. The command line is at the "Application" folder level .

```
> ".\OpenOcd\bin\openocd.exe" -c "set cmsisdap 1" -c "set fName flash_dump_100KB.bin" -c "set fSize 0x19000" -c "set fOffset 0x0" -f ".\OpenOcd/read_flash.cfg"
```

This command stores the content of 100 Kbytes of flash memory in the file `flash_dump_100KB.bin` .

### 6.4 Keil settings

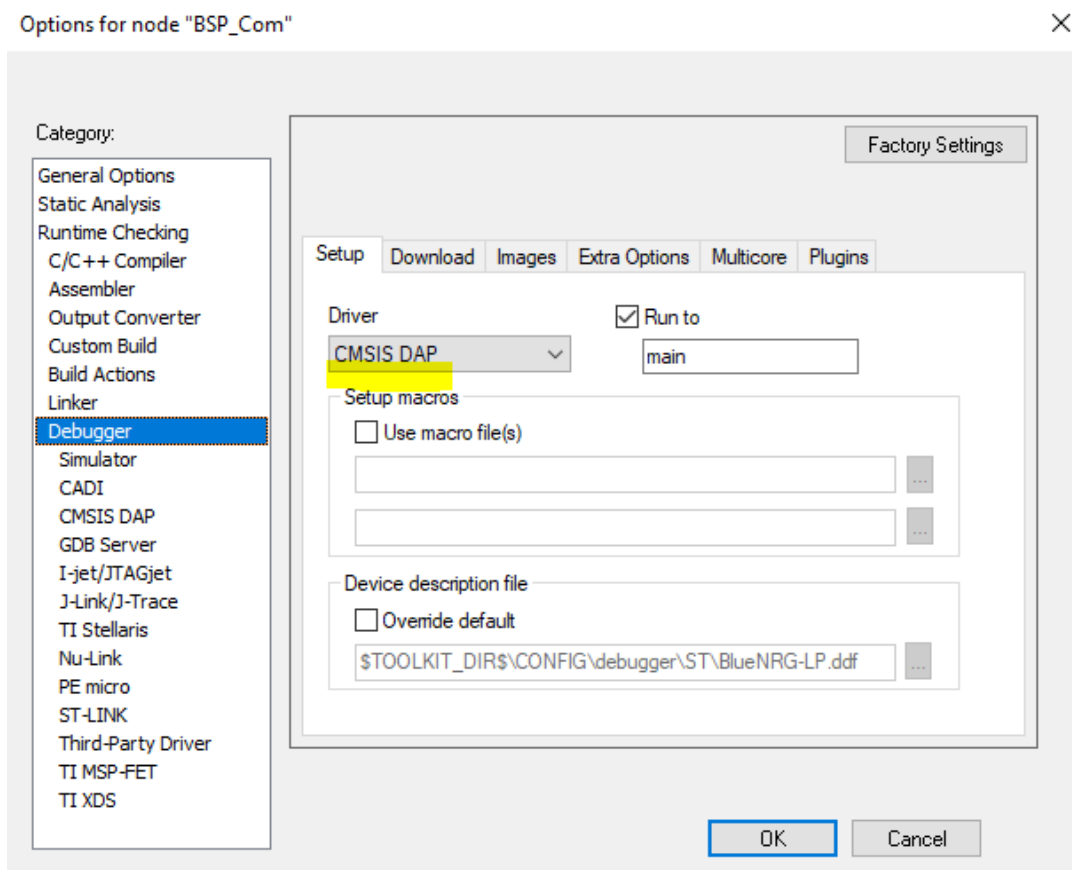
Open the options of a project and select the tab "Debug". Then select the "CMSIS-DAP Debugger" as shown in Figure 7. Debug setting of Keil.

**Figure 7. Debug setting of Keil**


## 6.5 IAR settings

Open the options of a project and select "Debugger". Then select "CMSIS DAP" as shown in Figure 8. Debug setting of IAR.

**Figure 8. Debug setting of IAR**



## 7 References

**Table 3. References**

What	Where	Description
BlueNRG-LP	<a href="http://www.st.com/bluenrg-lp">www.st.com/bluenrg-lp</a>	BlueNRG-LP device web page
BlueNRG-LPS	<a href="http://www.st.com/bluenrg-lps">www.st.com/bluenrg-lps</a>	BlueNRG-LPS device web page
BlueNRG-2	<a href="http://www.st.com/bluenrg-2">www.st.com/bluenrg-2</a>	BlueNRG-2 device web page
BlueNRG-1	<a href="http://www.st.com/bluenrg-1">www.st.com/bluenrg-1</a>	BlueNRG-1 device web page
STSW-BNRGFLASHER	<a href="http://www.st.com/content/st_com/en/products/embedded-software/wireless-connectivity-software/stsw-bnrgflasher.html">www.st.com/content/st_com/en/products/embedded-software/wireless-connectivity-software/stsw-bnrgflasher.html</a>	RF-Flasher utility web page
UM2406	<a href="http://www.st.com/resource/en/user_manual/dm00498829-the-bluenrgx--flasher-sw-package--stmicroelectronics.pdf">www.st.com/resource/en/user_manual/dm00498829-the-bluenrgx--flasher-sw-package--stmicroelectronics.pdf</a>	RF-Flasher utility user manual
Arm Mbed DAPLink	<a href="https://armmbed.github.io/DAPLink/">https://armmbed.github.io/DAPLink/</a>	Arm Mbed DAPLink web page
Arm Mbed DAPLink	<a href="https://os.mbed.com/handbook/DAPLink">https://os.mbed.com/handbook/DAPLink</a>	Arm Mbed DAPLink handbook
CMSIS-DAP	<a href="https://os.mbed.com/handbook/CMSIS-DAP">https://os.mbed.com/handbook/CMSIS-DAP</a>	CMSIS-DAP handbook web page

## Revision history

**Table 4. Document revision history**

Date	Version	Changes
29-Nov-2020	1	Initial release.
07-Apr-2021	2	Updated <a href="#">Section Introduction</a> . Added <a href="#">Section 4.1 Other debugger/programmer probes</a> .
15-Nov-2021	3	Added reference to RF-Flasher GUI and launcher utilities.
06-Apr-2022	4	Updated <a href="#">Section Introduction</a> , <a href="#">Section 3 ST CMSIS-DAP compliant probe</a> , <a href="#">Section 5 Debugger connection to evaluation kits</a> and <a href="#">Section 7 References</a> . Added the BlueNRG-LPS reference throughout the document.
18-Apr-2023	5	Added : <ul style="list-style-type: none"> <li>Arm and BlueTooth trademark notices in <a href="#">Section 1 General information</a></li> <li><a href="#">Figure 4. STEVAL-IDB010V1 BlueNRG-LP evaluation board</a></li> </ul> Updated: <ul style="list-style-type: none"> <li><a href="#">Table 1. Electrodragon debugger connection to the BlueNRG evaluation kits</a></li> <li><a href="#">Table 2. STEVAL-IDB011V{1 2}/STEVAL-IDB01{0 2}V1 debugger connection to the BlueNRG-1, BlueNRG-2 evaluation kits</a></li> </ul>

## Contents

<b>1</b>	<b>General information</b>	<b>2</b>
<b>2</b>	<b>CMSIS-DAP specifications</b>	<b>3</b>
<b>3</b>	<b>ST CMSIS-DAP compliant probe</b>	<b>4</b>
<b>4</b>	<b>Third party CMSIS-DAP compliant probe tested</b>	<b>7</b>
4.1	Other debugger/programmer probes	7
<b>5</b>	<b>Debugger connection to evaluation kits</b>	<b>8</b>
<b>6</b>	<b>Software configuration</b>	<b>9</b>
6.1	The RF-Flasher utility setting	9
6.2	The RF-Flasher Launcher	9
6.3	Open OCD settings	9
6.4	Keil settings	9
6.5	IAR settings	10
<b>7</b>	<b>References</b>	<b>12</b>
	<b>Revision history</b>	<b>13</b>



**IMPORTANT NOTICE – READ CAREFULLY**

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgment.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to [www.st.com/trademarks](http://www.st.com/trademarks). All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2023 STMicroelectronics – All rights reserved