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

Introduction

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

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 and BlueNRG-LP.

Moreover, some vendors have produced their own version of CMSIS-DAP compliant probe and STMicroelectronics has tested one of them in order to provide an example.

1 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⁽¹⁾**
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.

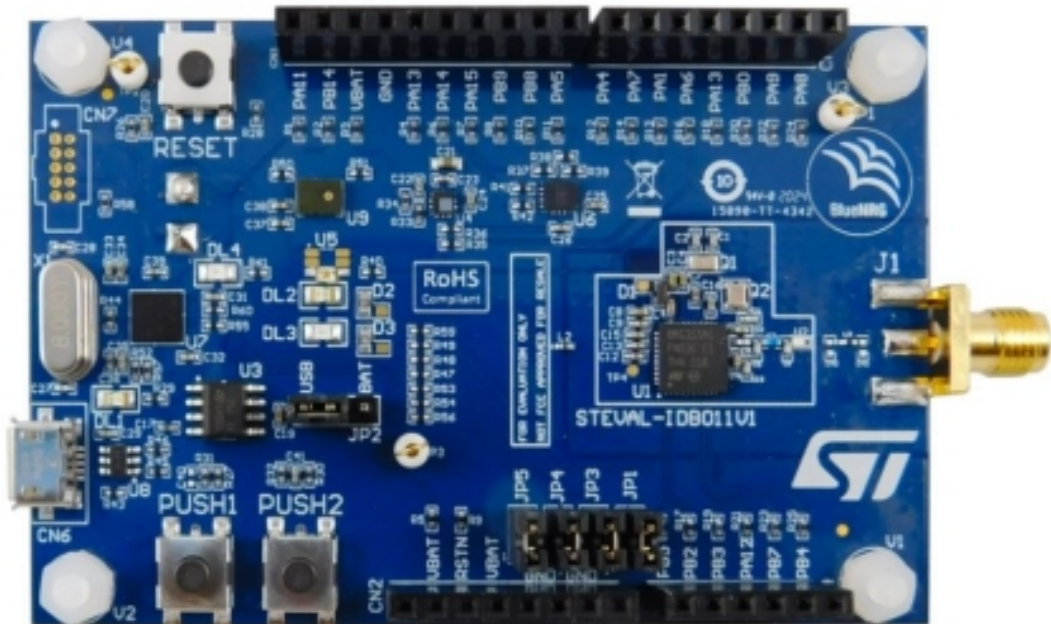
1. Valid for the selected device only because the Flashloader is inside the debugger itself.

2 ST CMSIS-DAP compliant probe

The STEVAL-IDB011V1 evaluation kit for the BlueNRG-LP provides 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-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&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



3 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.

- It is a Windows 10 driver free
- Capable to program all ARM Cortex M core chips, including: BlueNRG-LP, BlueNRG-1 and BlueNRG-2
- Firmware designed and supported by ARM
- It includes a USB-TTL serial port
- Very low-cost debugger.

Figure 2. CMSIS-DAP debugger board from Electrodragon



4 Debugger connection to evaluation kits

The following table shows how to connect the 3rd 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	Functional name
DIO	CN7.7	JP4.1	SWD data signal
CLK	CN7.9	JP3.1	SWD clock signal
RST ⁽¹⁾	CN7.15	JP5.1	Reset pin
3V3	CN7.1	VBLUE	3.3V connected to VBLUE
GND	CN7.4	GND	GND
V1TXO ⁽²⁾	CN3.1	CN3.1	Pin UART TX of the debugger connected to the pin UART RX of the BLE board.
V1RXO ⁽²⁾	CN3.2	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.

The following table shows how to connect the STEVAL-IDB011VX used as CMSIS-DAP debugger to the evaluation kit STEVAL-IDB007VX and STEVAL-IDB008VX.

Table 2. STEVAL-IDB011V1 debugger connection to the BlueNRG-1, BlueNRG-2 evaluation kits

STEVAL-IDB011VX DEBUGGER PIN	STEVAL-IDB007VX STEVAL-IDB008VX	Functional name
JP4.2	CN7.7	SWD data signal
JP3.2	CN7.9	SWD clock signal
JP5.2 ⁽¹⁾	CN7.15	Reset pin
VBRD	CN7.1	3.3V connected to VBLUE
GND	CN7.4	GND
CN3.2 ⁽²⁾	CN3.1	Pin UART TX of the debugger connected to the pin UART RX of the BLE board
CN3.1 ⁽²⁾	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.

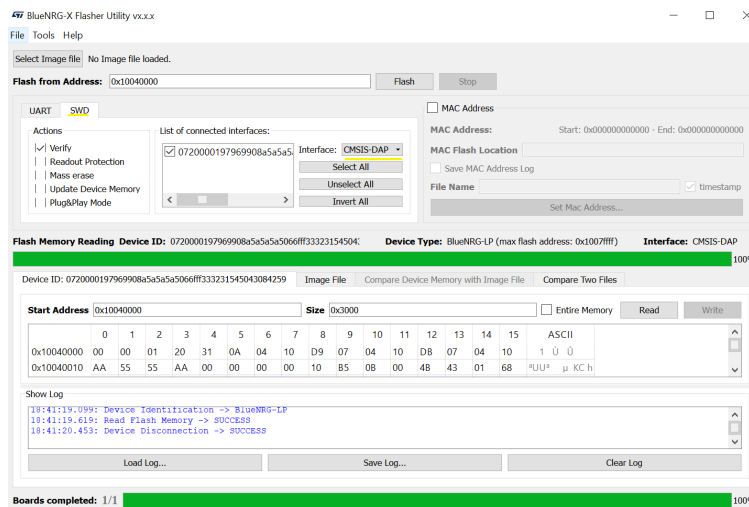
5 Software configuration

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

5.1 The BlueNRG-X Flasher utility setting

The BlueNRG-X 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 3. BlueNRG-X Flasher utility GUI



5.2 The BlueNRG-X Flasher Launcher

The BlueNRG-X Flasher Launcher is a command line version of the BlueNRG-X Flasher Utility.

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

```
> BlueNRG-X_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:

```
> BlueNRG-X_Flasher_Launcher.exe mass_erase -c -swd -all
```

Further information is in the dedicated user manual UM2406.

5.3 Open OCD settings

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

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

Here follows an example of command line to read the first 100 kB of memory Flash. The command line is at the folder level "Application".

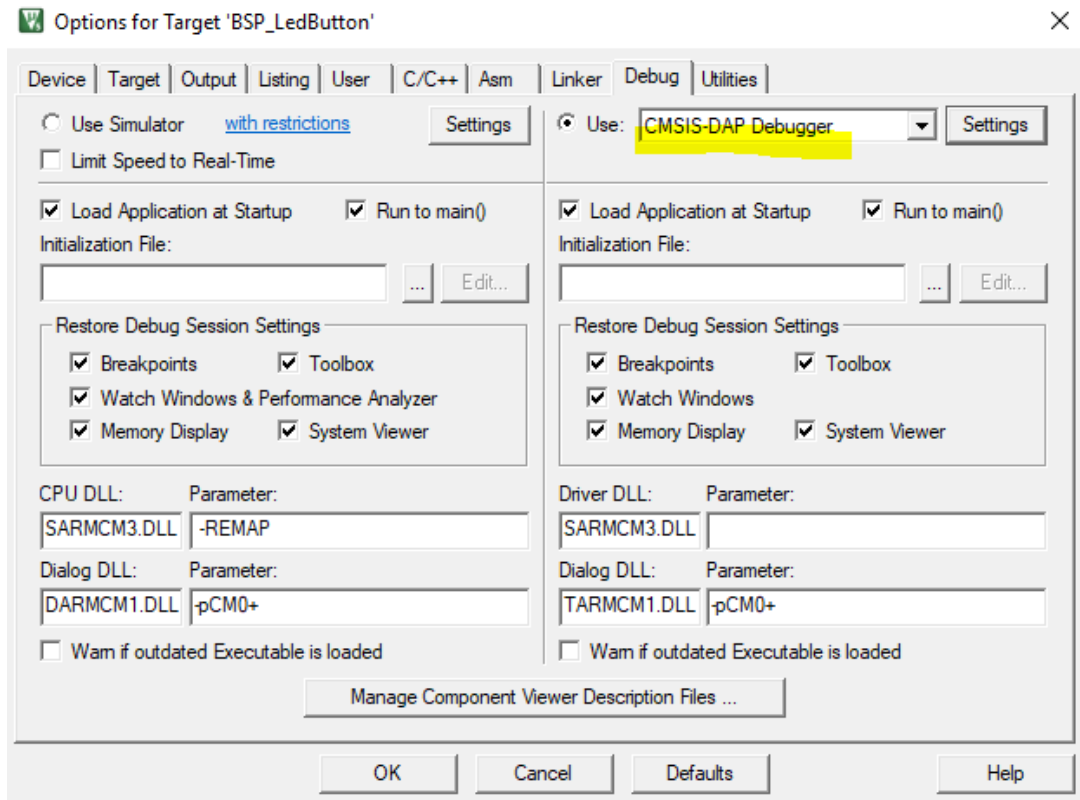
```
> ".\OpenOcd\bin\openocd.exe" -c "set cmsisdap 1" -c "set fName flash_dump_100KB.bin" -c "set fSize 0x19000" -c "set fOffset 0x0" -f ".\OpenOcd\read_flash.cfg"
```

The command has stored inside the file flash_dump_100KB.bin the content of the Flash memory for 100 kB.

5.4 Keil settings

Open the options of a project and select the tab "Debug". Then select the "CMSIS-DAP Debugger" as shown in Figure 4. Debug setting of Keil.

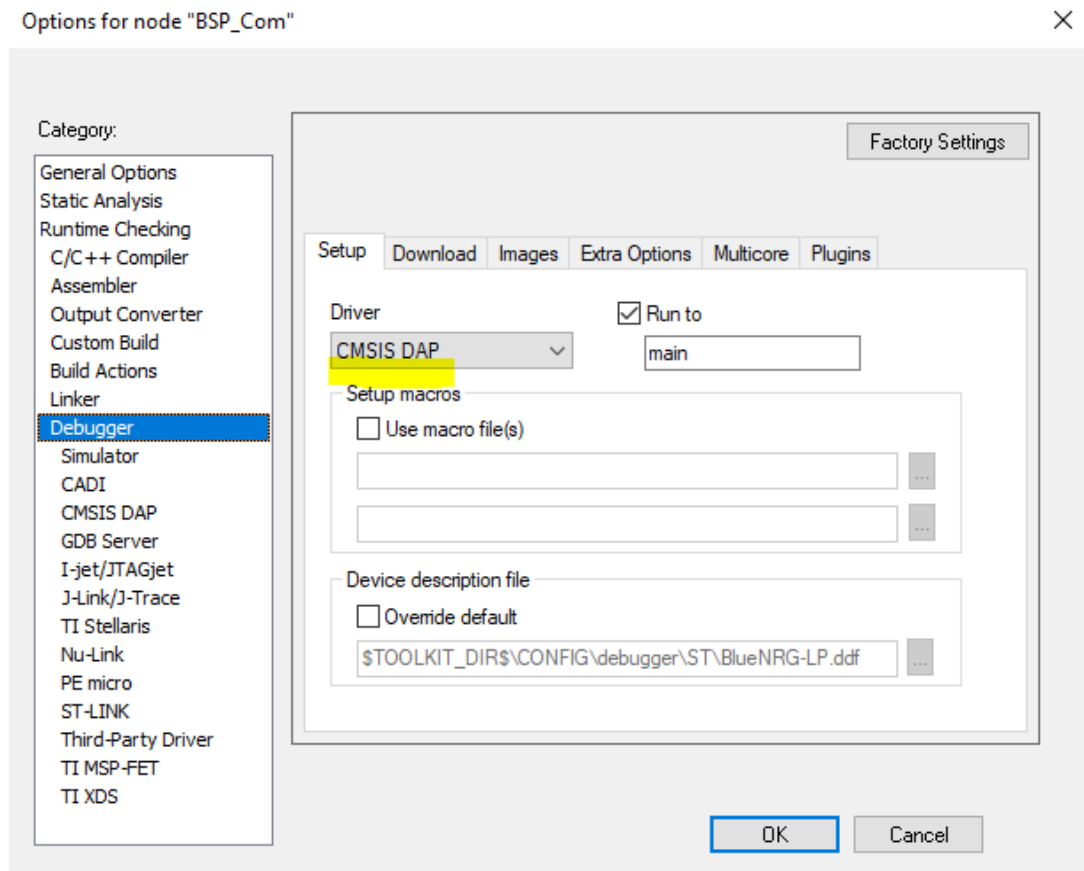
Figure 4. Debug setting of Keil



5.5 IAR settings

Open the options of a project and select Debugger. Then select "CMSIS DAP" as shown in Figure 5. Debug setting of IAR.

Figure 5. Debug setting of IAR



6 Reference

Table 3. References

What	Where	Description
BlueNRG-LP	www.st.com/bluenrg-lp	BlueNRG-LP device web page
BlueNRG-2	www.st.com/bluenrg-2	BlueNRG-2 device web page
BlueNRG-1	www.st.com/bluenrg-1	BlueNRG-1 device web page
STSW-BNRGFLASHER	https://www.st.com/content/st_com/en/products/embedded-software/wireless-connectivity-software/stsw-bnrgflasher.html	BlueNRG-X Flasher Utility web page
UM2406	https://www.st.com/resource/en/user_manual/dm00498829-the-bluenrgx-flasher-sw-package--stmicroelectronics.pdf	BlueNRG-X Flasher Utility User Manual
Arm Mbed DAPLink	https://armmbed.github.io/DAPLink/	ARM MBED DAPLink web page
Arm Mbed DAPLink	https://os.mbed.com/handbook/DAPLink	Arm Mbed DAPLink handbook
CMSIS-DAP	https://os.mbed.com/handbook/CMSIS-DAP	CMSIS-DAP handbook web page

Revision history

Table 4. Document revision history

Date	Version	Changes
29-Nov-2020	1	Initial release.

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