Geolocation Module flashing Operation

AN-Geoloc Module initial FW flashing

28/05/2024

Revision History

Revision	Date	Author	Description of Changes
1.0	24/09/2020	L. Tombakdjian	Initial Release (V1 board)
1.1	01/02/2022	S. Boudaud	Update Firmware update section
2.0	21/08/2022	S. Boudaud	Update document post Alpha SDK release
2.1	18/09/2023	S. Boudaud	Update document with new FW revision and BLE stack FW start at address 0x080CE000 LR1110 FW update in bridge mode
3.0	28/05/2024	J-P Togbe	Add section to flash the bootloader and new application (mfg and AT3 FW)

LEGAL

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Purpose

The goal of this document is to provide a simple guide on how to flash and test the functionality of the Geolocation Module.

This includes the software components running on ST32WB MCUs such as the firmware Upgrade Service (FUS) and the Bluetooth LE stack for the Cortex M0 and the application firmware for cortex M4 MCU. The document also describes the FW update operations for the LR1110 and MT3333 chipsets done at production test.

1.2 Intended Audience

The intended audience for this document is for the hardware, test, and production teams.

1.3 Minimum requirements

To follow this tutorial, you should have:

- ✓ A EVK board of the Geoloc Module i.e EVK v2.3 or v2.4
- ✓ A computer with the following software installed:
  - STM32CubeProgrammer
  - Tera Term (https://ttssh2.osdn.jp/index.html.en)

2 PREPARING THE EVB BOARD AND FLASHING STM32WB

2.1 First flashing operation of the STM32WB

To flash custom firmware, we first need to flash STMicroelectronic's firmware. It consists of two parts:

- ✓ Firmware Upgrade Service ("FUS")
- ✓ BLE Stack firmware

2.2 STM32CubeProgrammer with ST-Link

If you have not yet installed the software, you can get it (for free) here: https://www.st.com/en/development-tools/stm32cubeprog.html.

Once installed, connect the EVK on the ST-link USB3 interface and open STM32CubeProgrammer. The figure below shows the minimum configuration to program the geoloc module with USB cable connected to USB3

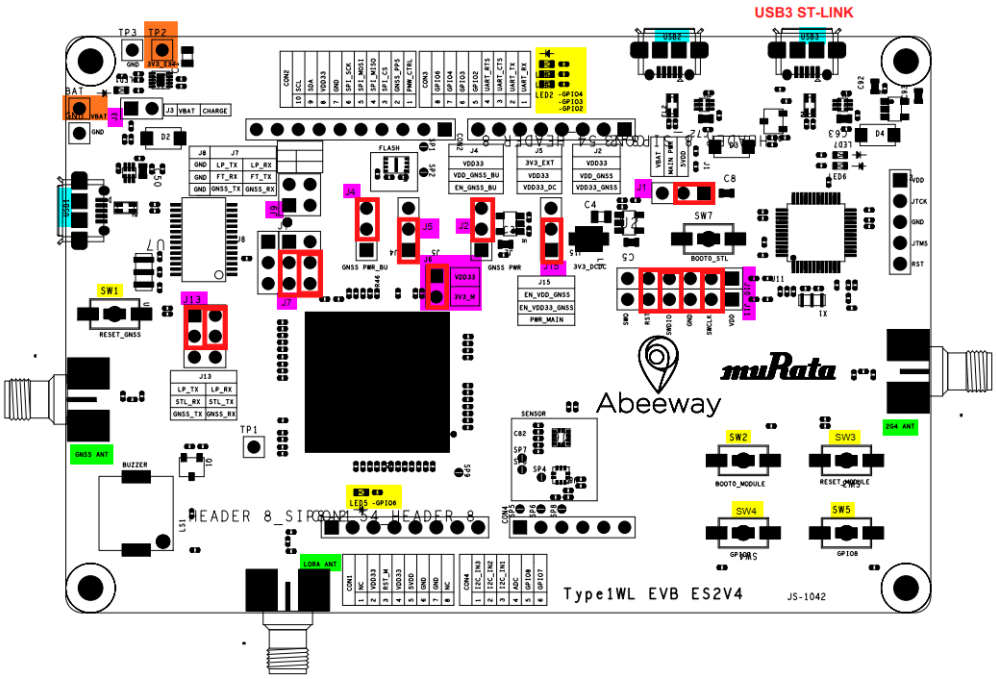


Figure 1: Default EVB setting in red

To interface with the module for debugging and programming, select ST-LINK protocol and click on the “Connect” button on the right-hand side, as shown below:

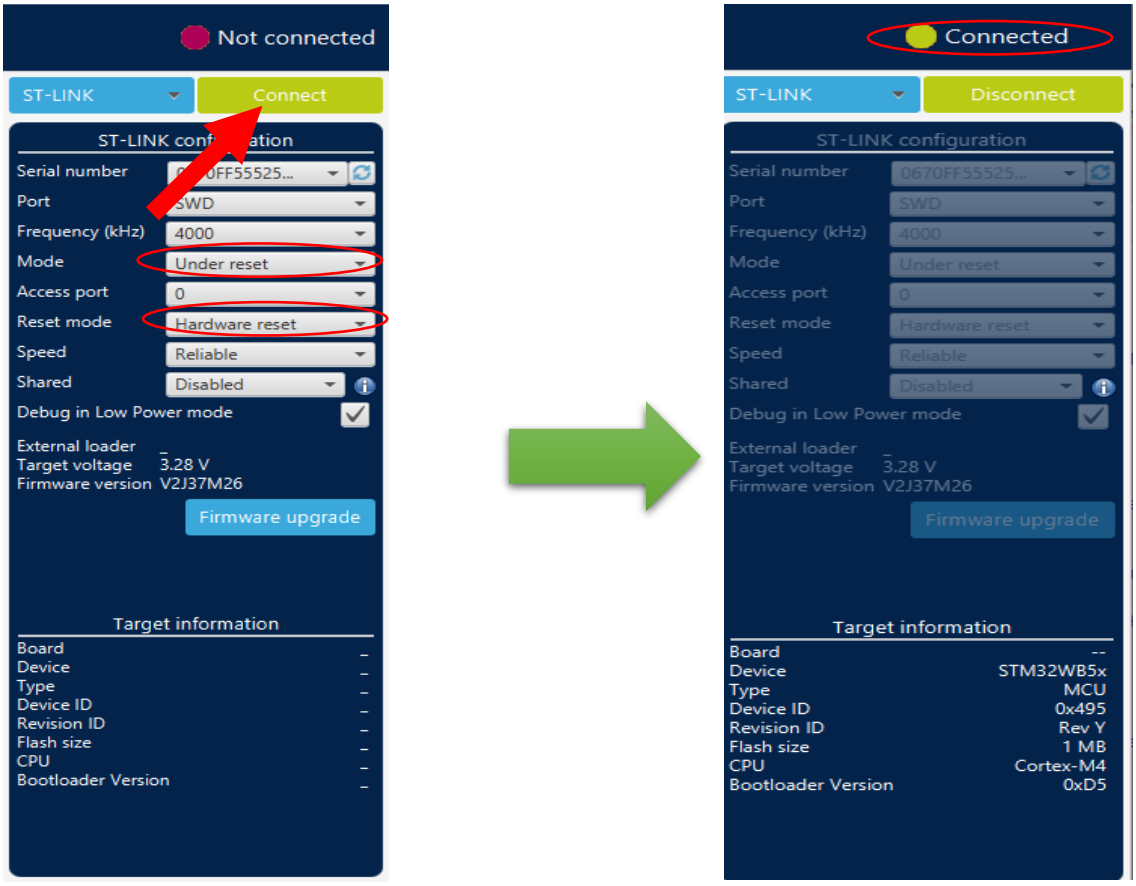


Figure 2: Connect the EVB via the ST-Link

If the software asks for upgrading the firmware of the ST-LINK, accept and upgrade the firmware, then click on the Firmware Upgrade Service icon, version used is shown below:

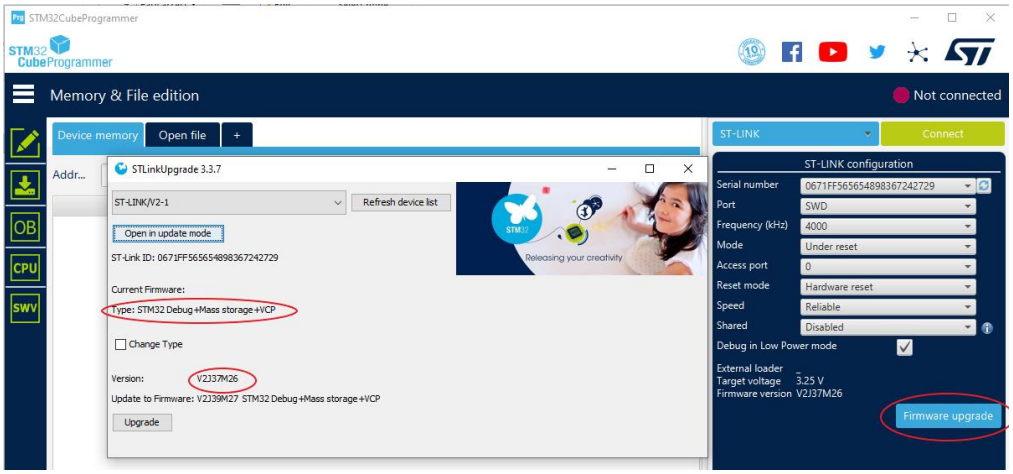


Figure 3: ST-Link update if needed

2.3 Flash BLE stack Firmware upgrade

When ST-Link connected, go to the firmware upgrade services (FUS) interface by clicking on the “radio type button” and initialize the FUS by clicking on Start FUS. See log at the bottom of the windows

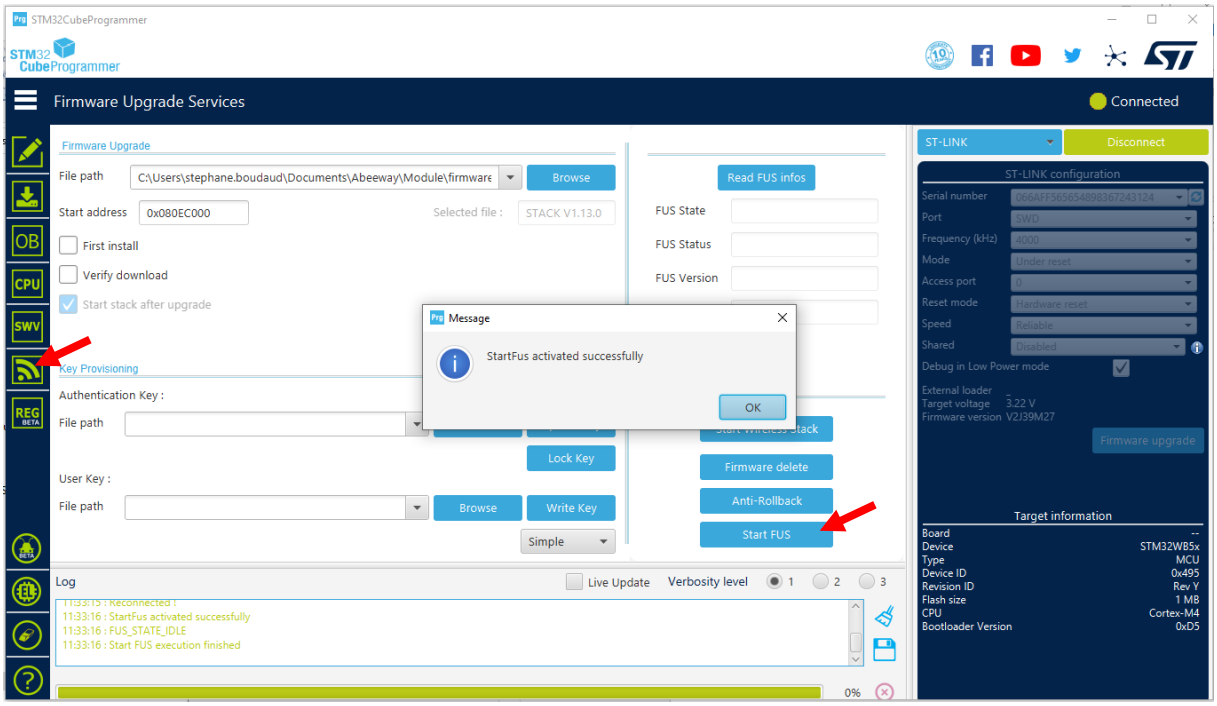


Figure 4: Start the FUS

Read the FUS version by clicking on Read FUS info. The initial version is V1.0.2.0 and the FUS can be updated to version 1.2.0

The FUS can be updated to version 1.2.0.0, by completing the file path with the correct file: stm32wb5x_FUS_fw.bin and set the start address to **0x080EC000** and click on Firmware upgrade.

You can check again the FUS version with Read FUS info.

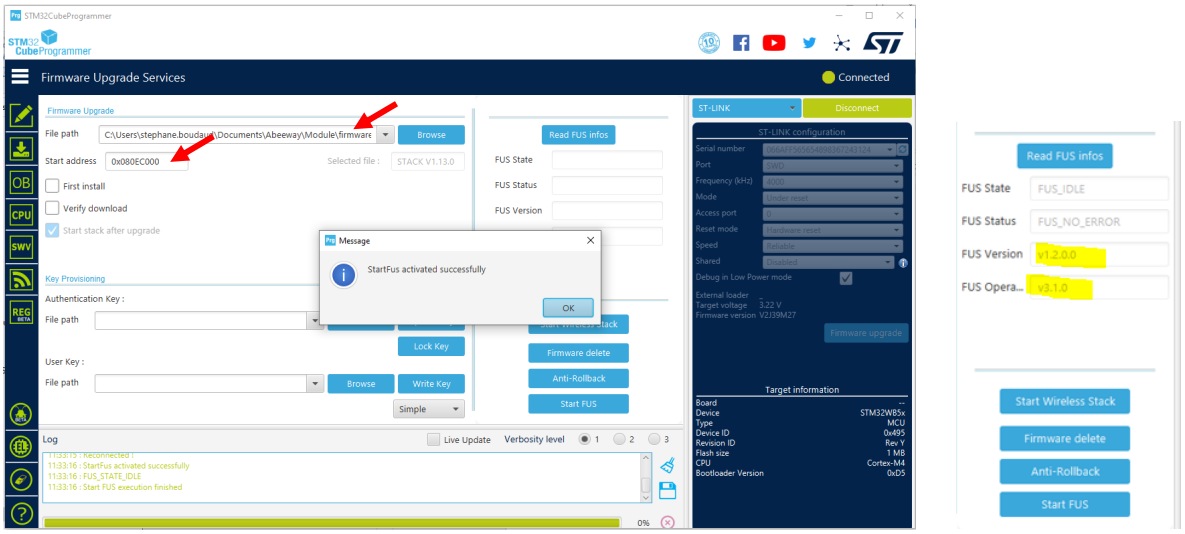


Figure 5: Update FUS to version 1.2.0.0

The Bluetooth® LE Stack can be updated in the same way as the FUS. Complete the path with the file: **stm32wb5x_BLE_Stack_full_fw.bin**, set the start address to **0x080CE000** and click on “First install” checkbox if this is the first time you are installing the stack. Then press Firmware upgrade button.

See section 5 REFERENCES, to see the latest version of the firmware.

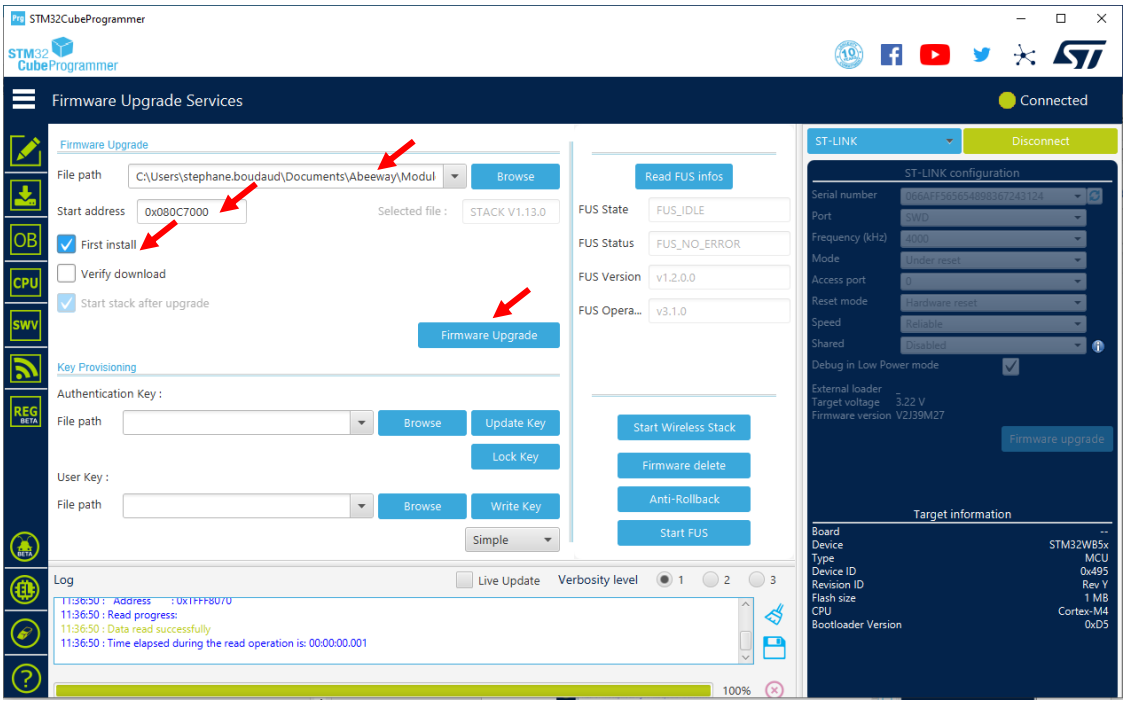


Figure 6: Update the BLE Stack V1.13.0

2.4 Flashing the Bootloader

Now we are going to flash the Bootloader firmware, that will allow us to flash MFG, AT3 or every application firmware with USB interface.

Bootloader FW starts at address ***0x08000000***.

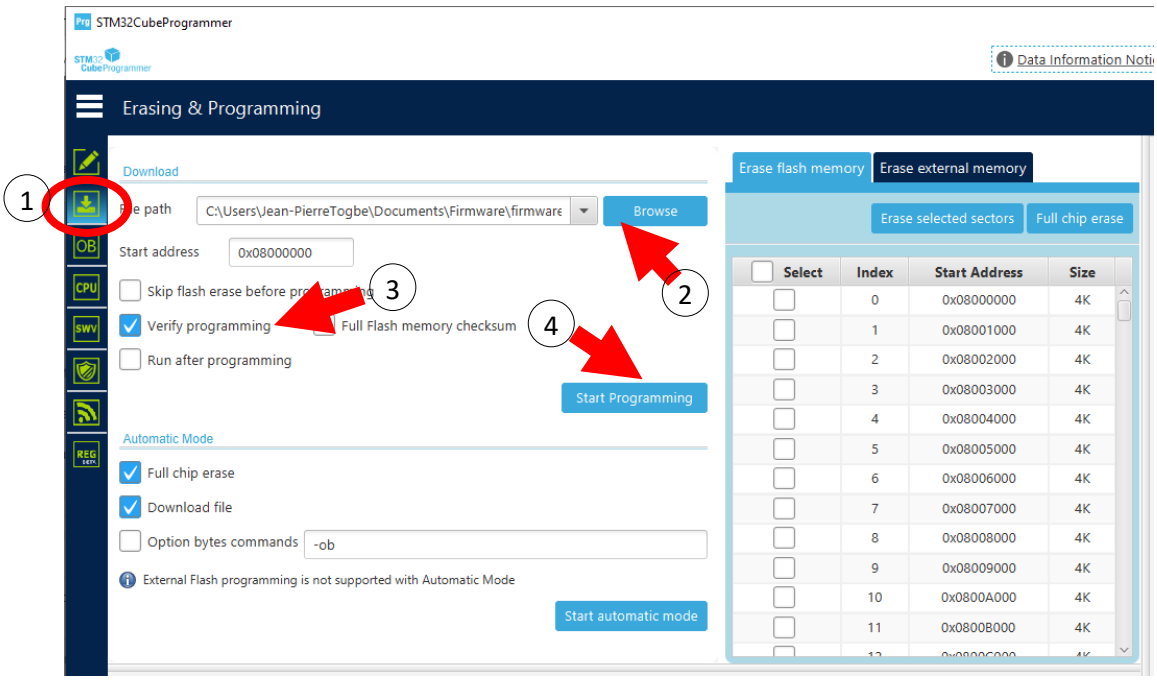


Figure 7: Flashing Bootloader

2.5 Flashing the MFG or AT3

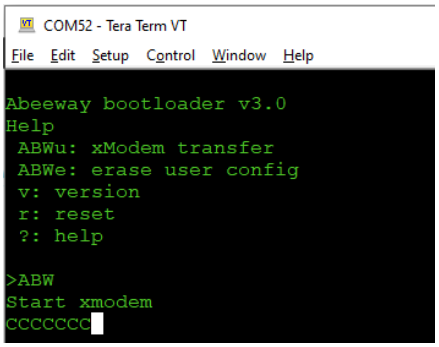
2.5.1 Falsing with USB (USB2 on the EVK board)

Bootloader is accessible via the USB port using a terminal emulator(minicom or Teraterm) set to 57600 baud – 8N1

Bootloader commands:

```
ABWu: xModem transfer
ABWe: erase user config
v: version
r: reset
?: help
```

1. Enter command: ABWe (if flashing a new application FW)
2. Enter command: `ABWu`
3. Start ***mfg.bin*** or ***at3.bin*** transfer with XMODEM to transfer the firmware.
4. Enter command: `r` to reset the device.



2.5.2 Flashing with ST32Programmer

The process of MFG or AT3 FW flashing is the same as the Bootloader FW but the FW starts at address: ***0x08006000.***

2.6 Flashing the application FW

Now we are going to flash the application firmware running on the Arm Core M4 MCU.

To do that, click on the “Erase & Programming icon”.

- Select the file to flash in a .bin or elf format (elf is the preferred format).
- Check the *Verify programming* and *Run after programming* check boxes
- Click the *Start Programming* button

With the Geoloc Module SDK stored in Github project, a default cli-demo application file is provided and can be loaded directly with the STM32CubeProgrammer, filename: aos-app-demo.elf

Note that all application FW starts at address ***0x08000000.***

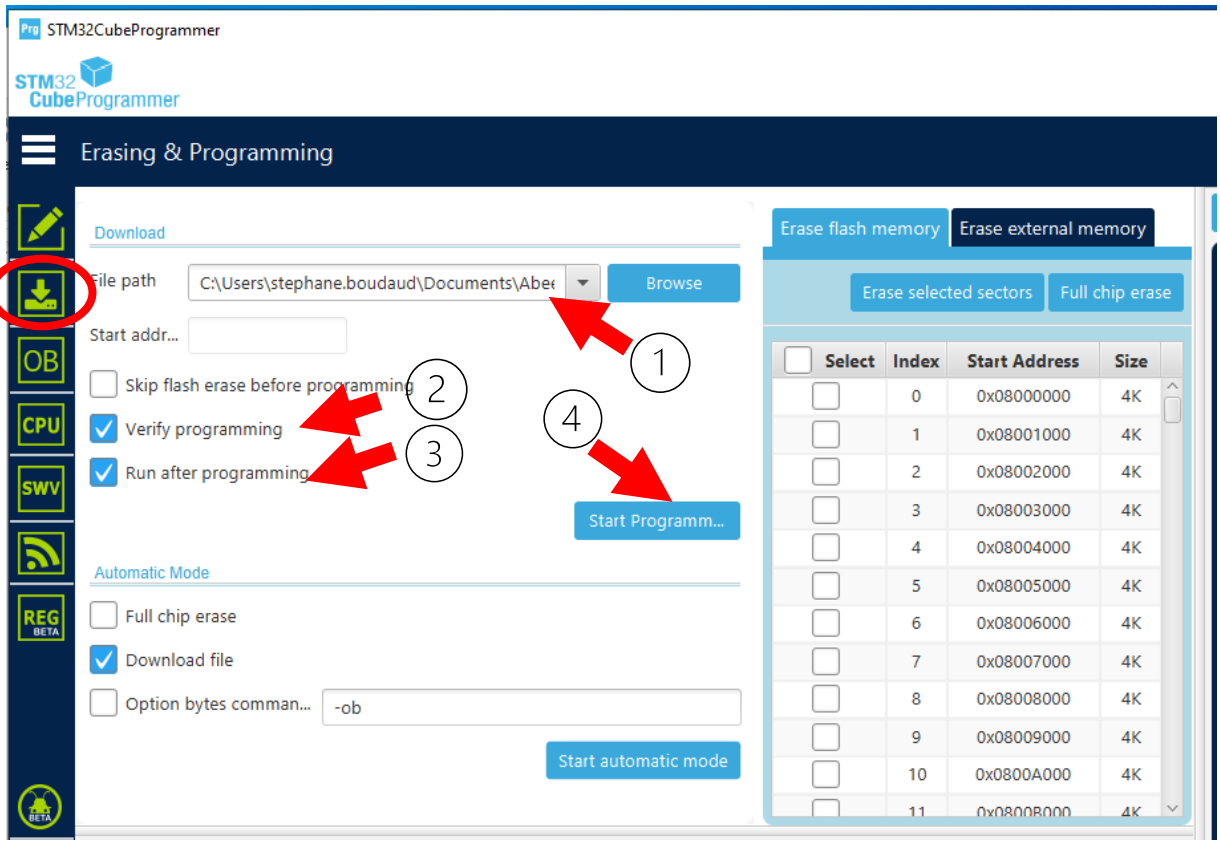


Figure 7: Flashing application Firmware

2.7 Test the CLI-Demo application FW

The demo application is a low power FreeRTOS application, based on the AOS SDK. It is controlled through a command line interface, accessible through the USB-serial controller available on the integrated ST-Link on the Abeeway Evaluation Kit.

A terminal emulator such as TeraTerm for WS or Minicom for Linux can be used and the serial port must be set to 57600 bauds, 8 data bits, no parity, one stop bit (8N1).

Log in with the pin code '123' or '456'. The former provides normal user access, the latter provides super-user access, making different sets of CLI commands available.

The 'help' command is available throughout but typing any invalid command or omitting a command option will usually show the available commands or options. Commands can be abbreviated as long as they remain unambiguous.

```
super> help
                ble             <cmd> BLE commands
                gnss            <cmd> GNSS commands (MT3333)
                gpio            <cmd> GPIO related commands
                help            <cmd> Display help information
                logout          Disconnect the CLI
                lora            <cmd> LoRa related commands
                pwm             <cmd> PWM related commands
```

```
?           Display all helps
settings    <cmd> LoRa settings related commands
system      <cmd> System commands
uart         <cmd> UART commands
wifi        <cmd> WIFI related commands
super>
```

This first application allows to test most sub-systems of the EVK such as: LoRa, GNSS, WIFI scan, BLE, MCU features (ADC, GPIOs, PWM….)

3 FW UPDATE OF THE LR1110

At production, the application FW is loaded with the MFG/ACTT manufacturing FW. Under request, abeeway can provide the MFG/ACTT firmware. This is an application to flash at address 0x8000000. By connecting a terminal emulator such as TeraTerm for WS or Minicom for Linux terminal via USB3 port, the program provides a basic CLI to control and test various parameters of the module. The list of available commands is displayed by entering “help” or “?”

Under lr1110 menu you can:

- Check the LR1110 version with this command: *lr1110 firmware version*

- Update the LR1110 FW in bridge mode. With the command: *lr1110 firmware update bridge <serial interface> <speed>*

  the MCU will push the LR1110 transceiver binary file to LR1110 and then reboot the chip. Parameters are:

  - Serial interface:

0	LPUART (USB3 connector)
2	USB (USB2 connector)

  - Speed:

0	1200 bauds
1	2400 bauds
2	4800 bauds
3	9600 bauds
4	19200 bauds

5	38400 bauds
6	57600 bauds
7	115200 bauds
8	230400 bauds
9	460800 bauds

See section 5 REFERENCES, to see the latest version of the LR1110 firmware.

The steps to take are:

1. Enter command: `lr1110 firmware update bridge 2 8` (using the USB interface – USB2)
2. change Tera Term (or your terminal application. Exp: minicom) speed to 230400 bauds 8N1
3. start ***lr1110_transceiver_0308.bin*** (actual LR1110 version) transfer with XMODEM to transfer the firmware.
4. when done return the speed to 57600 bauds and you can check the FW version (see picture below)

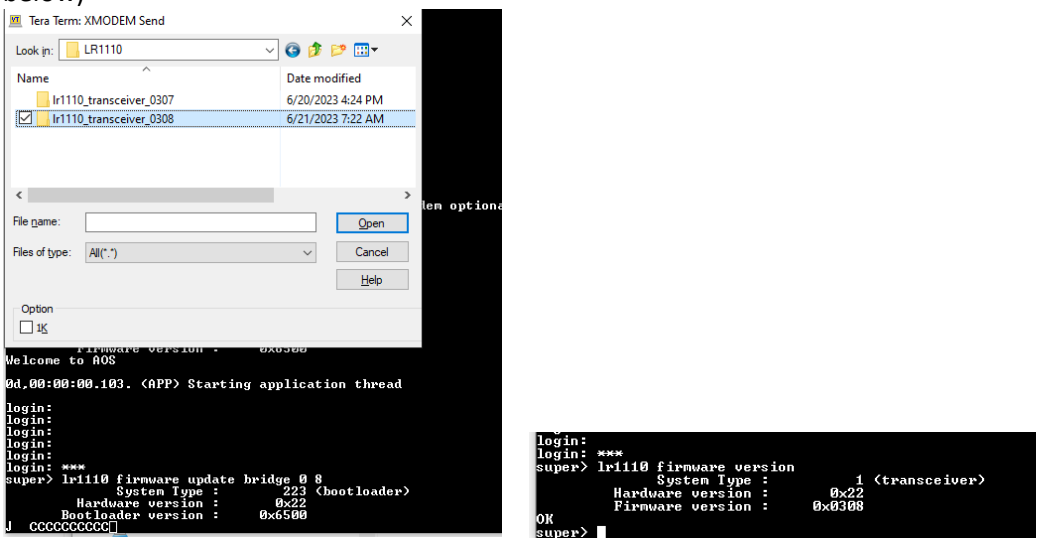


Figure 8: Update LR1110 embedded firmware.

4 FW UPDATE OF THE MT3333 CHIPSET

The GNSS chipset FW is also updated with a proprietary FW to support the AGPS feature as well as the standard GNSS functions of the MT3333.

To flash the MT3333 with the MediaTek tool MTK Flash Tool, the GNSS device must be enabled with the CLI command “gnss on” as shown in figure 10 and supplied (pin 30: VDD_GNSS and pin 32: VDD_GNSS_BU set to 3.3V – Jumpers 2,4,15). Flashing the MT3333 is then possible via the GNSS UART interface accessible from USB1 connector via the FTDI chip and selector J7

The steps to download the MT33xx FW are

- Select the COM port connected to the USB1
- Select the right baud rate (default: 115200)
- Select the download agent (DA) file. Program to receive the firmware and write it to the flash
- Select the firmware to download in the ROM area
- Click download and Go to start downloading
- Download operations are shown with a red bar for DA file and blue bar for ROM file. A green circle is drawn when complete.
- When complete, enable the GNSS chipset with the STM32 via the cli command “gnss open”
- Command “gnss version” can be used to display the ROM FW version

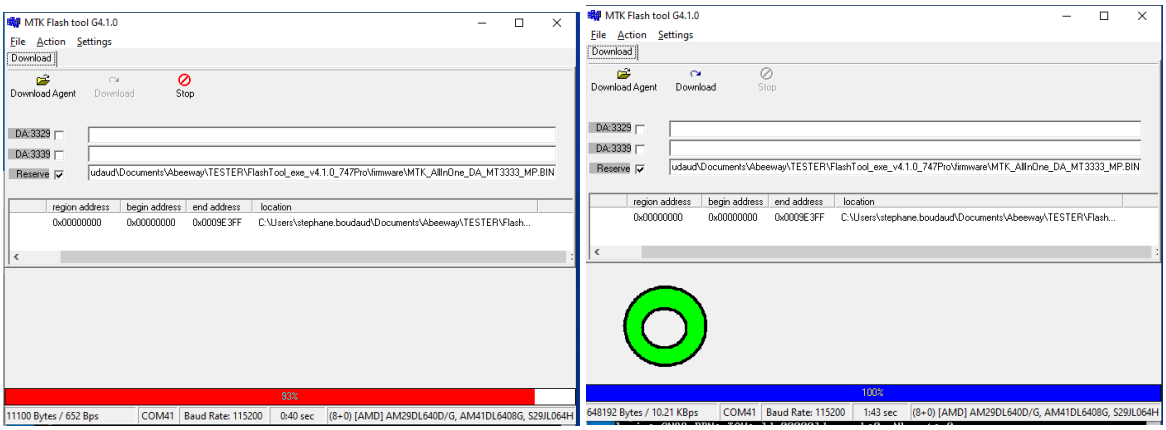


Figure 9: Mediatek tool to flash the MT3333

```
OK
super> gnss on
OK
super>
super>
super> gnss open
OK
super> GNSS callback. Event(4): GNSS ready
GNSS-TRACK-GPS: , Nb sat: 0,
GNSS-TRACK-GLO: , Nb sat: 0,
GNSS-TRACK-GAL: , Nb sat: 0,
GNSS-TRACK-GPS: , Nb sat: 0,
```

Figure 10: Command line to enable the GNSS and after programming, open the UART link between STM32 and MT3333

5 REFERENCES

This section lists firmware used for flashing the Geoloc module and references to documentation

Item	Title/Description	Filename /link	Revision
1	STM32WB Bluetooth LE Hardware Setup https://wiki.stmicroelectronics.cn/stm32mcu/wiki/Connectivity:STM32WB_BLE_Hardware_Setup	n/a	n/a
2	Geolocation Module Overview: datasheet available https://docs.thingpark.com/thingpark-location/B-Feature-Topics/GeolocModule_C/	n/a	n/a
3	Abeeway Geolocation Module Github project: SDK and application FW available https://github.com/Abeeway/abeeway-geolocation-module	n/a	n/a
4	Firmware Update Service binary	stm32wb5x_FUS_fw.bin (24kB)	1.2.0.0
5	Bluetooth LE stack	stm32wb5x_BLE_Stack_full_fw_1.15.0.bin (149kB)	V1.15.0
6	MT3333: Download Agent file	MTK_AllInOne_DA_MT3333_MP.BIN (12kB)	
7	MT3333: Application ROM file	20190417_GENERAL_Module_AXN5.1.7_C33_SDK_11.bin (633kB)	
8	LR1110 driver available in https://github.com/Lora-net/radio_firmware_images/tree/master/lr1110/transceiver Latest used: version 0x0308 to use with driver V2.3.0	lr1110_transceiver_0308.bin(240kB)	0x0308
9	abw-bootloader in bootloader	abw-bootloader-release_v3.0	3.0
10	AT3 firmware		
11	MFG firmware		