Evaluation Kit for the Geoloc Module – User Manual

UM-EVB V2.4

21/08/2022

Revision History

Revision	Date	Author	Description of Changes
1.0	21/05/2021	L. Tombakdjian	Initial Release (V1 board)
2.0	26/11/2021	S. Boudaud	EVB V2 board
2.1	10/01/2022	S. Boudaud	Update EVB (V2 board)
2.2	24/01/2022	S. Boudaud	Update GPIO ID for LEDs (Schematic V2.1)
2.3	26/01/2022	S. Boudaud	EVB (V2.3 board), Inc. dedicated 3V3 LDO for ST Link, New FTD IC for USB1 connector, Update connector name
2.4	21/08/2022	S. Boudaud	EVB V2.4

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1 INTRODUCTION

The Type1WL EVK (version V2.4) is the evaluation kit for the ultra-low power geolocation module co-developed by Murata and Abeeway.

The EVB is a complete development kit so the developers can have a full access to all the functionalities of the module, select various power management schemes, digital interfaces and features like LEDs, buttons, Flash memory and sensors. 3 micro-USB connectors are also available to interface with digital lines (UART, LPUART) and the built-in ST-link V2.

This User Manual explains the various hardware configuration to help you to develop to your end application. The figures below show the block diagram and pictures of the board with the location of the connectors, jumpers, switches…

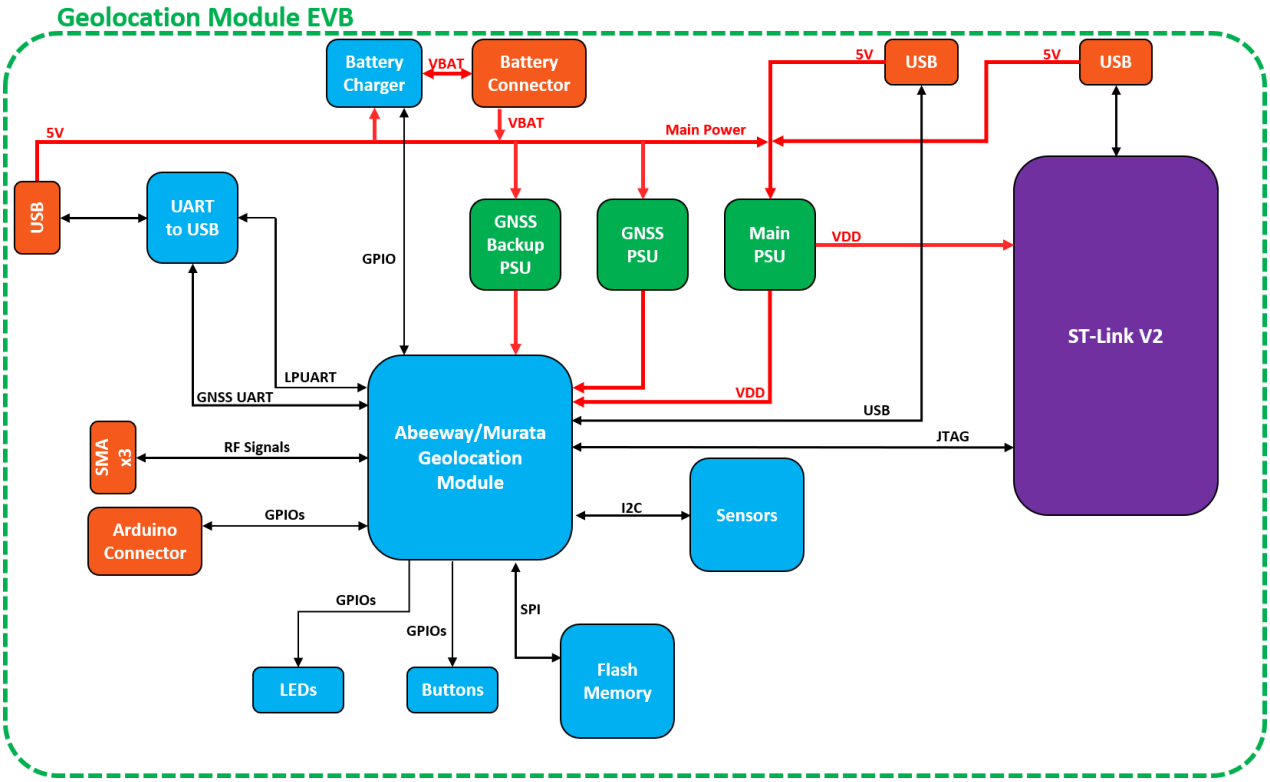


Figure 1: EVB block Diagram

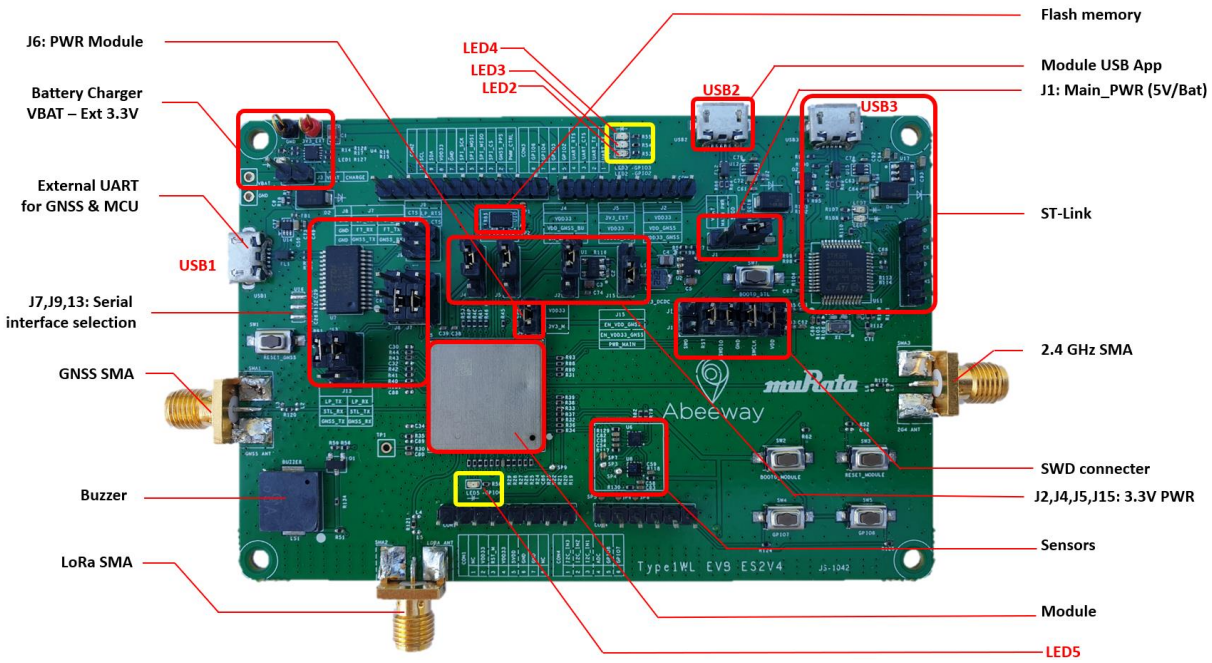


Figure 2: Overview of the EVB 2.4

The set-up above shows the basic board configuration using USB3 for the ST-Link to program the geoloc module, USB2 to interface with the USB port of the module, USB1 to access to the UART/GNSS interface. The board is directly supplied with the 5V USB from the ST-Link interface and the external 3V3 supply.

For FW development, The EVK can be only supplied with the USB connector USB3. 5V USB is supplying the ST-Link and the module supplied with a 3.3V after that 5V is regulated with the embedded DC/DC, Set jumper J5 VDD33_DC - VDD33.

Position of the jumpers are described in the next sections.

Main changes with EVB v2.3 are:

- Fix buzzer circuit
- Fix padring supply of the 2 sensors LISD2DW12 and LPS22HBTR to improve low power down consumption
- Add debug trace output SWO to ST-link
- Improve GNSS supply selection. Backup supply can be directly driven by EN_VDD_GNSS_BU
- Option to connect USB2 5V supply to a MCU interrupt input (GPIO 10) to detect presence of the USB connection
- Remove SW6 to prevent conflict with CHG_INT interrupt input

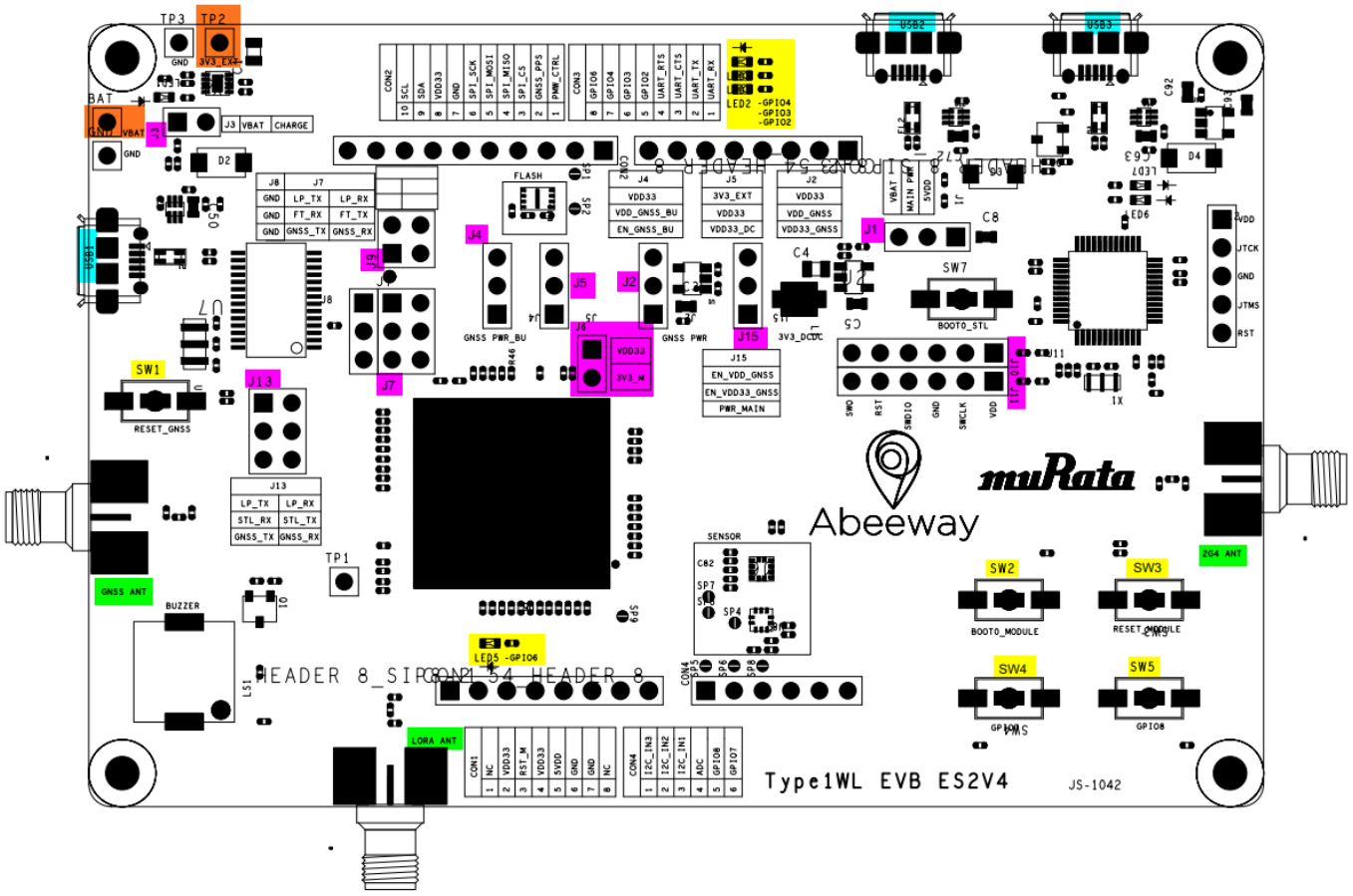


Figure 3: Silkscreen of EVB V2 boarding

SMA, USB connectors, power pin, Jumpers and LED/Switches are highlighted. The minimum setting to supply the module with a USB cable is to have jumpers set on J1, J5 and J6 and J2, J4 and J15 for the MT3333 chipset.

2 POWER OPTIONS

2.1 Powering-up the MCU/LR1110

The EVB comes with multiples means to power the Geolocation Module:

- 5V: USB supply, regulated to 3.3V with a DC/DC regulator
- 3V3_EXT: dedicated DC supply source
- VBAT: External battery supply (primary bat.) or a LI-PO battery attached to an embedded charger with the 5V USB supply.

To select which power sources and voltage regulator to use, we added 2.54mm header pins and jumpers.

To power up the MCU, first jumper to select is the main power source (connector J1). It can be:

- USB (any USB port will work)

- Battery (VBAT) or external power source (2,7V – 5,5V DC). (See section Battery to use the Li-Po charger)

Then you need to select the VDD33 power source that goes to the Module (connector J5).

Two positions are allowed, the center pin is the output to main voltage for most IC (Module, sensors, etc):

- 3V3 EXT, to connect power from external generator (Top left connector).
- DCDC33, to connect power from the DC-DC voltage regulator.

This header enables the user to measure power consumption of the Geolocation Module plus its peripherals.

To power the Geolocation Module, one last header must be connected (connector J6). Only one position is possible: on or off. This jumper enables the user to **measure the power consumption of the Module only (STM32WB + LR1110)**.

2.2 Powering Up the GNSS (modified in EVK V2.4)

In this module we have a high precision GNSS IC supplied with 2 supply pins:

- VDD_GNSS, the main power for GNSS IC (pad n°30). For best GNSS performance, this supply must be stable and noiseless. VDD_GNSS is controlled by jumpers J2 and J15 to be connected either from VDD33 or the output of a LDO always ON or controlled by the GPIO EN_VDD_GNSS (Jumper 15)
- VDD_GNSS_BU, The Backup or “keep alive” power (pad n°32) (7uA) supplied via jumper J4 from VDD33 or the GPIO pin EN_VDD_GNS_BU

3 PROGRAMING AND DEBUGGING

3.1 ST-Link

To be able to program and debug the module without external devices, a ST-Link v2 is built-in the EVB. The ST-Link uses JTAG protocol directly connected to the Microcontroller (MCU) inside the module, which is a STM32WB55. A Boot0 button (SW7) is mounted on the board if one wants to reprogram it.

To use it, simply connect a computer with ST drivers enabled to the ST-Link USB on the board (USB3, top-right corner, see fig. 2)

The SWD (Serial Wire Debug) interface is also available via the ST-Link. To use the built-in debugger, you must connect the 4-pin dupont header across J10 and J11.

From EVB V2.3, the ST-Link has its own supply and should not be connected to the main 3.3V (VDD33). In EVB v2.4, the ST Link debug output SWO is available for trace support and connected to port PA10 of the ST Link MCU

In EZVB

The 5-pin dupont header J12 can also be connected externally for debug.

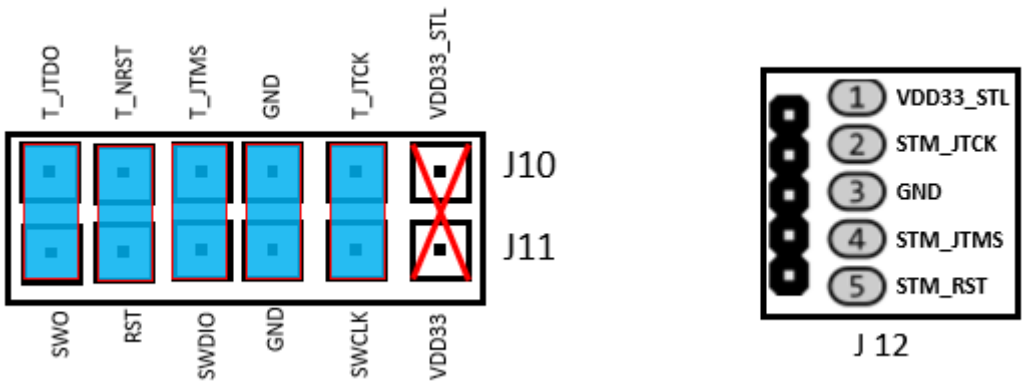


Figure 4: Serial Debug Interface Connector

3.2 UART interface

The module has two UART (Universal Asynchronous Receiver Transmitter) interfaces: one connected to the GNSS IC and the Low-Power UART. The GNSS UART serves as a programming method for the GNSS IC as well as a debug interface.

Both UARTs are accessible to USB 1 connector via the FTDI chip and are selected with header J7.

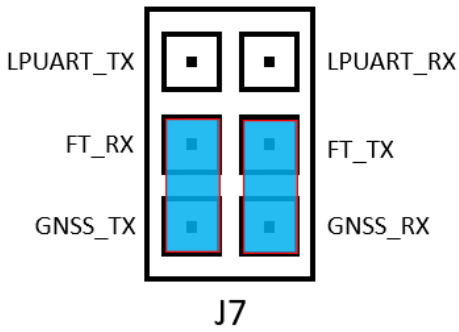
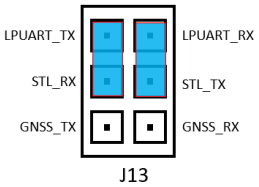


Figure 5 is a representation of J7 header with two jumpers that connects the GNSS UART to the onboarded FTDI in the EVB.

The Flow control CTS and RTS of the LPUART can also be connected to the FTDI chip with header J9

Figure 5: J7 jumper connections to control USB1

J13 allows to redirect either the LPUART or the GNSS UART to the ST-Link.



In the figure 6, the connections are set to redirect the LPUART of the MCU to the ST-Link. If this option is chosen, then J7 connector should not be connected to LPUART.

Figure 6: Example connection of MCU LPUART to ST-Link

3.3 USB Interface

The USB ports of the geoloc module is directly available from micro-USB connector USB2. IN EVK v2.4, the 5V supply is connected to a resistive divider and the interrupt input I2C_INT3. This feature allows the MCU to detect if the USB 2 is connected. The 2nd interrupt output of the accelerometer LISD2W cannot be used in this case.

4 PERIPHERALS AND SENSORS

4.1 I²C sensors

Two I²C sensors are present on the EVB: a pressure sensor (LPS22HB) and an accelerometer (LIS2DW12). These sensors are connected by the external I²C bus of the module and powered by two GPIO of the module (I2C_POWER1, pin 6 and I2C_POWER2 (GPIO1), pin 7). The interruptions of the two sensors are also connected to the module, I2C_INT1 (LPS22HB interruption) is connected to I2C_INT1 pin 3 of the module. I2C_INT2 and I2C_INT3 (LIS2DW12 interruptions) are connected to pin 65 and 64 of the module.

Note: If the I2C interface is set, the sensors must be powered down to prevent extra consumption

4.2 SPI Peripherals

A flash memory (W25Q16) is connected to the external SPI bus of the module. This IC is powered by the power source selected on connector J5.

4.3 Battery

As seen earlier, a battery can be connected to the EVB on VBAT pin. A voltage measurement circuit has been incorporated on the EVB with a resistive divider. This one is connected to pin 46 of the module, VBAT_SENSE and the resistive divider is connected to ground via the I/O VBAT_GND_CTRL (GPIO5, pin 47).

The EVB also includes a battery charger suitable for the following types of **rechargeable** batteries:

- Li-Ion
- Li-Poly

The charge current is set to 270 mA. To ensure safety please use batteries than can support such charging current.

To enable the charging of the battery, the battery should first be connected and then the connector J3 should be populated. The supply source can come from any USB port.

The battery charger IC (BQ24040) interruption (CHG_INT) is connected to the module through pin 60, GPIO9. An LED is on if the charger is being used.

4.4 Buttons, LEDs and others

5 buttons are on the EVB, SW3 and SW1 are reset button for MCU and GNSS IC. SW2 is a button for the BOOT0 pin of the STM32 MCU.

SW4, SW5 are debug buttons connected to pull down resistors and GPIO7 and GPIO8 respectively. This is a conflict and both operations cannot work simultaneously.

4 debug LEDs are also present on the EVB. These are simple single-color LEDs connected to GPIO2, GPIO3, GPIO4, GPIO6 of the module.

A buzzer is mounted on the EVB and connected to the PWN_CTRL, pin 58 of the module.

A general ADC output is available from connector CON8

The reset of the LoRa modem of the module (LR1110) is connected to a single pin header to be able to reset this specific IC (Close to pin 49 of the geoloc module).

4.5 Arduino style connectors

Connectors that imitate the Arduino standard have been placed on the EVB. It is not an exact copy of it but most of the signals are connected.

For example, GPIO, Power, I²C and SPI are connected which allow the use of sensor shield or other extension that uses these kinds of connections.

For further details see the schematic of the EVB. Note that the GNSS PPS signal is on one pin of these connectors. The PPS signal is a precise clock from the GNSS IC that can be used to synchronize a device.

5 GPIO CONFIGURATION SUMMARY

This table show the specific configuration for EVB v2.3

Pin No	Terminal Name	Type	I/O description for EVB V2
3	I2C_INT1	I	Interrupt input from LPS22HBTR (pressure sensor)
6	I2C_POWER	O	Power Supply for LPS22HBTR (pressure sensor)
7	GPIO1	O	Power Supply for LIS2DW (accelerometer)
8	BOOT0	I	Connected to SW2
12	GPIO2	O	LED 2
22	GPIO3	O	LED 3
29	GPIO4	O	LED 4
46	VBAT_SENSE	AI	Measure Battery Voltage
47	GPIO5	O	Ground resistive divider for Battery measurement
55	GPIO6	O	LED 5

56	GPIO7	I	SW 4
58	PWM_CTRL	O	Buzzer
59	GPIO8	I	SW 5
60	GPIO9	I	CHG_INT (Charger status - see section 4.4)
63	USR_ADC	AI	Analog IO – CON8
64	GPIO10	I	INT2 from LIS2DW or USB2 supply detection
65	I2C_INT2	I	INT1 from LIS2DW

6 CONNECTIVITY

The Geolocation module uses 4 types of radio: LoRa for communication, GNSS to get outdoor positioning, Wi-Fi for Wi-Fi geolocation sniffing and BLE to do geolocation or BLE connectivity.

Those radios are outputted via SMA connectors on the sides of the EVB. Before each SMA connector, there is an impedance matching circuit which is populated only by a 0 Ohm serial resistor.

7 EVALUATION KIT CONTENT

The Geolocation Module Evaluation Kit includes the Evaluation Board EVB, 3 antennas with SMA fixing:

- LoRa antenna 868-915MHz with an efficiency of 70%, Peak gain 0.9dBi
- A 2.4GHz ¼ wavelength whip antenna for BLE /WIFI. Omni-directional, 50ohm impedance
- Passive GNSS antenna

The kit also includes a USB to micro-USB cable and jumpers as shown in figure 2.