

STMicroelectronics MB1803B-01 Wireless and Ultra Low Power Board



# STMicroelectronics MB1803B-01 Wireless and Ultra Low Power Board User Manual

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**STMicroelectronics MB1803B-01 Wireless and Ultra Low Power Board**



## Product Information

### Specifications

- 1 Mbyte of flash memory and 128 Kbytes of SRAM in a UFQFPN48 package
- PCB antenna on MCU RF board (MB1803)
- Comprehensive free software libraries and examples available with the STM32CubeWBA MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded
- Arm and TrustZone are registered trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

## Product Usage Instructions

### Development Environment

STMicroelectronics – STM32CubeIDE is recommended for development.

### Demonstration Software

- The demonstration software preloaded in the STM32 flash memory allows easy demonstration of device peripherals in standalone mode.
- The latest versions can be downloaded from [www.st.com](http://www.st.com).

### Conventions

Refer to Table 3 for ON and OFF settings conventions in the document.

### Safety Recommendations

This product is suitable for users with basic electronics or embedded software development knowledge such as engineers, technicians, or students. Not suitable for children.

## Handling the Board

- The connection pins on the board might be sharp and handled with care to avoid injury.
- Handle the board in an ESD-proof environment to avoid damaging static-sensitive devices.
- Avoid touching electric connections on the board while powered to prevent component damage.

## FAQ

**Q: Where can I find additional information about ordering the NUCLEO-WBA55CG board?**

- **A:** Refer to Table 1 and additional information from the datasheet and reference manual of the target microcontroller.

**Q: What are the key features of the product?**

- **A:** The product features 1 Mbyte of flash memory, 128 Kbytes of SRAM, PCB antenna, free software libraries, and support for various IDEs.

## Introduction

- MB1801B-01 is a wireless and ultra-low-power board embedding a powerful and ultra-low-power radio compliant with the Bluetooth® Low Energy SIG specification v5.3, IEEE 802.15.4-2015 PHY, and MAC, supporting Thread, Chip, and Zigbee®.

Figure 1 NUCLEO-WBA55CG global view



## Features

- Ultra-low-power wireless STM32WBA55CG microcontroller based on the Arm® Cortex®-M33 core, featuring 1 Mbyte of flash memory and 128 Kbytes of SRAM in a UFQFPN48 package
- MCU RF board (MB1803):
- 2.4 GHz RF transceiver supporting Bluetooth® specification v5.3
- IEEE 802.15.4-2015 PHY and MAC, supporting Thread, Chip and Zigbee®
- Arm® Cortex® M33 CPU with Arm® TrustZone®, MPU, DSP, and FPU – Integrated PCB antenna
- Comprehensive free software libraries and examples available with the STM32CubeWBA MCU Package
- Support of a wide choice of Integrated Development Environments (IDEs) including IAR Embedded Workbench®, MDK-ARM, and STM32CubeIDE
- **Note:** Arm and TrustZone are registered trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

## Ordering information

To order the NUCLEO-WBA55CG board, refer to Table 1. Additional information is available from the datasheet and reference manual of the target microcontroller.

**Table 1. List of available products**

Order code	Board reference	Target STM32
MB1803B-01	MB1803	STM32WBA55CG

## Codification

The meaning of the codification is explained in Table 2.

**Table 2. Codification explanation**

NUCLEO-WBXXYYRZ	Description	Example: NUCLEO-WBA55CG
XX	MCU series in STM32 32-bit Arm Cortex MCUs	STM32WBA series
YY	MCU product line in the series	STM32WBA55 product line
R	STM32 package pin count: <ul style="list-style-type: none"> <li>• C for 48 pins</li> </ul>	48 pins
Z	STM32 flash memory size: <ul style="list-style-type: none"> <li>• G for 1 Mbyte</li> </ul>	1 Mbyte

## Development environment

### Development toolchains

- IAR Systems® – IAR Embedded Workbench®(1)

- Keil® – MDK-ARM(1)
- STMicroelectronics – STM32CubeIDE
- On Windows® only.

## Demonstration software

- The demonstration software, included in the STM32Cube MCU Package corresponding to the onboard microcontroller, is preloaded in the STM32 flash memory for easy demonstration of the device peripherals in standalone mode.
- The latest versions of the demonstration source code and associated documentation can be downloaded from [www.st.com](http://www.st.com).

## Conventions

Table 3 provides the conventions used for the ON and OFF settings in the present document.

**Table 3. ON/OFF convention**

Convention	Definition
Jumper JPx ON	Jumper fitted
Jumper JPx OFF	Jumper not fitted
Jumper JPx [1-2]	Jumper fitted between Pin 1 and Pin 2
Solder bridge SBx ON	SBx connections closed by 0 $\Omega$ resistor
Solder bridge SBx OFF	SBx connections left open
Resistor Rx ON	Resistor soldered
Resistor Rx OFF	Resistor not soldered
Capacitor Cx ON	Capacitor soldered
Capacitor Cx OFF	Capacitor not soldered

## Safety recommendations

### Targeted audience

- This product targets users with at least basic electronics or embedded software development knowledge like engineers, technicians, or students.
- This board is not a toy and is not suited for use by children.

### Handling the board

- This product contains a bare printed circuit board and as with all products of this type, the user must be careful about the following points:
- The connection pins on the board might be sharp. Be careful when handling the board to avoid hurting yourself

- This board contains static-sensitive devices. To avoid damaging it, please handle the board in an ESD-proof environment.
- While powered, do not touch the electric connections on the board with your fingers or anything conductive.
- The board operates at voltage levels that are not dangerous, but components could be damaged when shorted.
- Do not put any liquid on the board and avoid operating the board close to water or at a high humidity level.
- Do not operate the board if dirty or dusty.

## Hardware layout and configuration

- NUCLEO-WBA55CG is designed around the STM32WBA55CG. The design includes a mezzanine board and an MCU RF board.
- The hardware block diagram in Figure 2 illustrates the connection between STM32WBA55CG and peripherals (ARDUINO® Uno V3 connectors, ST morpho connector, and embedded ST-LINK).
- Figure 3 helps users locate these features on the MB1803B-01 board. The mechanical dimensions of the NUCLEO-WBA55CG product are shown in Figure 4.

Figure 2 Hardware block diagram

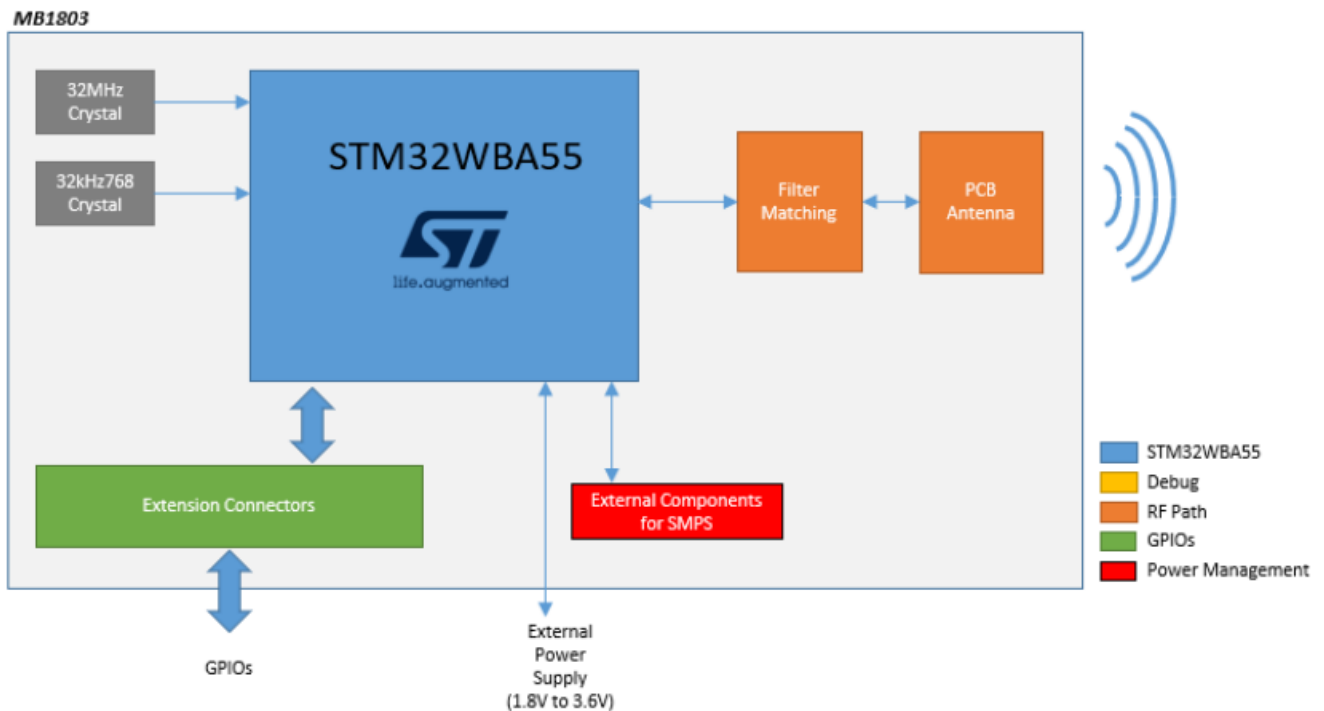
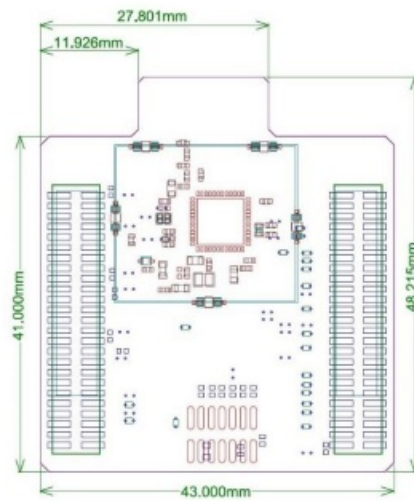


Figure 3 NUCLEO-WBA55CG PCB details of the MCU RF board (MB1803)



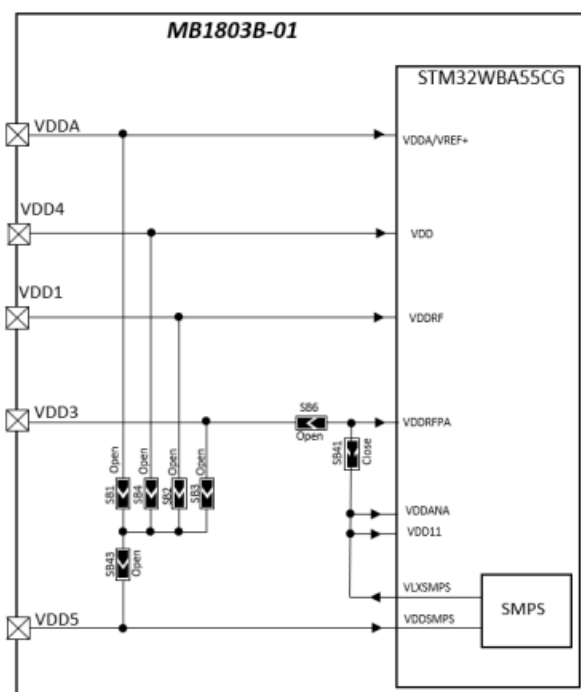
Figure 4 NUCLEO-WBA55CG (MB1803B) mechanical dimensions (in millimeters)



## Power supply

The STM32WBA55CG can be supplied by an external source (between 1.8 and 3.3 V). This figure also shows the default state of the jumpers and the solder bridges.

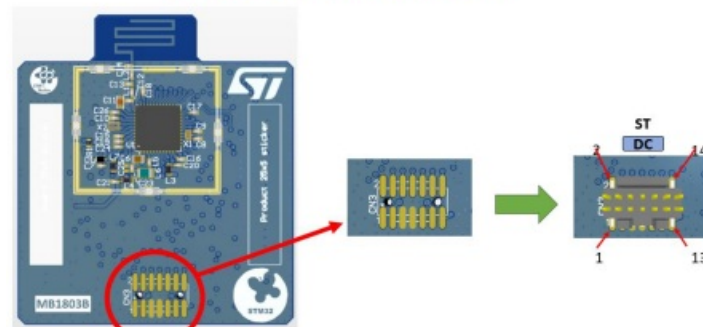
Figure 5 MB1803B-01 power tree



## Debug

- By default, the debug connector is not assembled on the MB1803B-01. If necessary, the connector should be soldered. In this way, it allows you to select the type of connector STDC14 or MIPI10.
- The footprint is compatible with both connectors.

Figure 6 CN3 assembly for debug connector

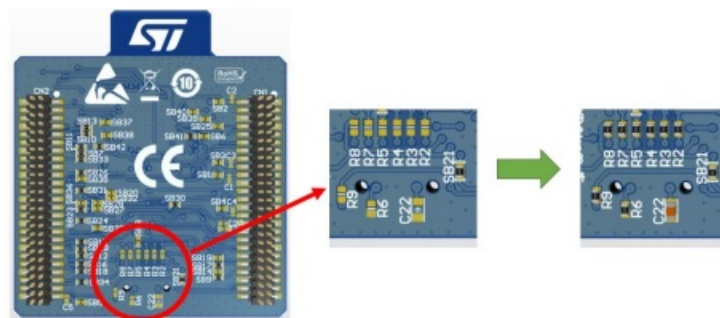


- It is also necessary to add some components on the bottom side of the MB1803.
- On the table, there are the values of the components and the figure shows the location of these components.

Table 4. Components to add to support STLin-V3PWR config

Designator	Value	Package	Example of Part Number
R2, R3, R4, R5, R6, R7, R8, R9	47R 1%	0402	YAGEO: RC0402FR-0747RL
C22	1uF/16V	0603	YAGEO: CC0603KRX5R7BB105

Figure 73 Components to add for STLink-V3PWR



## Clock sources

### HSE clock references

- The accuracy of the high-speed clock (HSE) of the MCU RF board is committed to a 32 MHz crystal oscillator.
- The HSE oscillator is trimmed during board manufacturing.

### LSE clock references

- The accuracy of the low-speed clock (LSE) of the MCU RF board is committed to a 32.768 kHz crystal oscillator.



## Reset sources

- The reset signal of MB1803B 01 is active LOW. The internal PU forces the RST signal to a high level.
- The Hardware reset is accessible on pin 12 of the CN1 connector.

## RF I/O stage

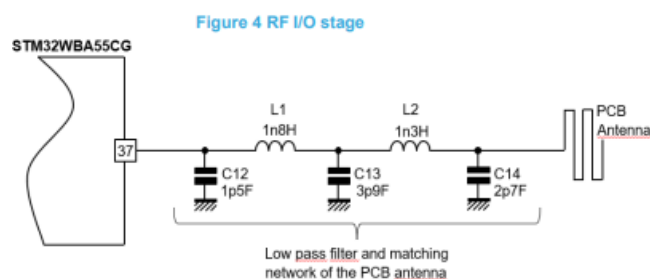
- Due to FCC/ISED constraints, the antenna cannot be removable. So, the board is proposed by default with a PCB antenna. This antenna is described on AN5129 available on the ST website. Between the STM32WBA55 and the antenna, there is a passive network. This network has two functions: makes a low pass filter and matches the impedance of the PCB antenna. Both functions are merged to reduce the number of components.
- The output stage of the STM32WBA55 was optimized for this impedance of 50 ohms. That allows to facilitate the design of the external part.
- Therefore, the low pass filter was studied with an impedance of 50 ohms for the SoC side and with the antenna impedance for the other side. To simplify, the bandwidth of the antenna was not taken into account.
- Parts of harmonics are filtered internally but for silicone size and cost, they are not completely suppressed. The low pass filter is to reduce the level of the harmonic to satisfy the certifications requirements (FCC, ISED, RED, MIC,...).

Table 8 shows the level of the harmonic expected worst case at the output of the STM32WBA55 without a filter. That allows us to determine the attenuation of the filter vs. frequency.

**Table 8. Harmonic level on the STM32WBA55 without external filter (TX mode@+10dBm)**

Harmonic indice	Harmonic Level
H2	-28 dBm
H3	-45 dBm
H4	-54 dBm
H5	-78 dBm
H6	-66 dBm

- This network is built with 5 components C12, L1, C13, L2, and C14. That guaranteed a comfortable margin in all cases.
- The study takes into account, the drift of the components (accuracy and temperature), the drift due to the PCB, and the variation of the STM32WBA55.
- Of course, depending on the component manufacturer and the specification of the PCB, these component values can change after mandatory optimization.



## MCU RF board interface and pinout

### Description

The ST-MCU RF board connectors (CN1 and CN2) are accessible on the top side of the board. They are used to plug the MCU RF board into the mezzanine board.

### Board pinout

Figure 5 Pinout of the MCU RF board connectors

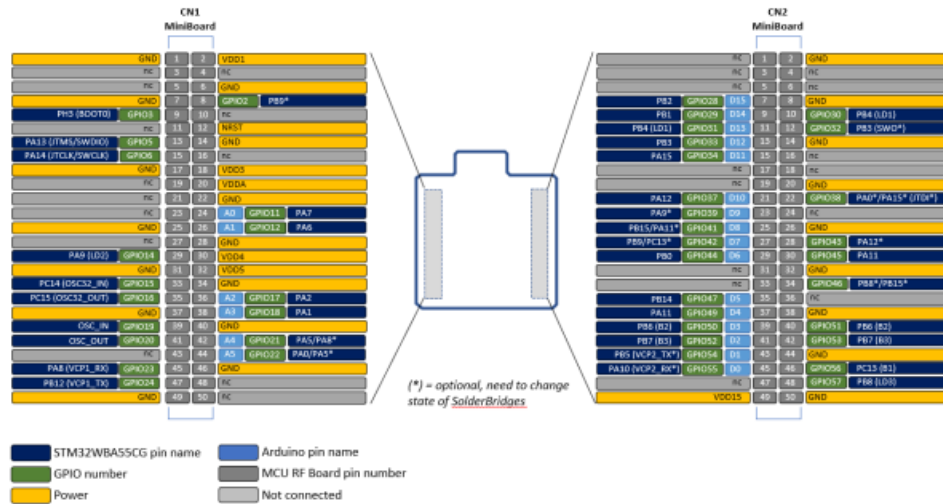


Table 11. Pinout of the MCU RF board connectors

CN1				CN2			
Pin number	STM32WBA55CG pin name	Pin number	STM32WBA55CG pin name	Pin number	STM32WBA55CG pin name	Pin number	STM32WBA55CG pin name
1	GND	2	VDD1	1	NC	2	GND
3	NC	4	NC	3	NC	4	NC
5	NC	6	GND	5	NC	6	NC
7	GND	8	PB9(1)	7	PB2	8	GND
9	BOOT0	10	NC	9	PB1	10	PB4
11	NC	12	NRST	11	PB4	12	PB3/SWO <sup>(1)</sup>
13	PA13	14	GND	13	PB3	14	GND
15	PA14	16	NC	15	PA15	16	NC
17	GND	18	VDD3	17	NC	18	NC
19	NC	20	VDDA	19	NC	20	GND

21	NC	22	GND	21	PA12	22	PA0 <sup>(1)</sup> /PA15 <sup>(1)</sup> /JT DI <sup>(1)</sup>
23	NC	24	PA7	23	PA9(1)	24	NC
25	GND	26	PA6	25	PB15/PA11 <sup>(1)</sup>	26	GND
27	NC	28	GND	27	PB9/PC13 <sup>(1)</sup>	28	PA12 <sup>(1)</sup>
29	PA9	30	VDD4	29	PB0	30	PA11
31	GND	32	VDD5	31	NC	32	GND
33	PC14	34	GND	33	NC	34	PB8(1)/PB15(1)
35	PC15	36	PA2	35	PB14	36	NC
37	GND	38	PA1	37	PA11	38	GND
39	OSC_IN	40	GND	39	PB6	40	PB6
41	OSC_OUT	42	PA5/PA8 <sup>(1)</sup>	41	PB7	42	PB7
43	NC	44	PA0/PA5(1)	43	PB5	44	GND
45	PA8	46	GND	45	PA10	46	PC13
47	PB12	48	NC	47	NC	48	PB8
49	GND	50	NC	49	VDD15	50	GND

Optional, need to change the state of solder bridges.

## MIPI10/STDC14 connector pinout

### Description

- On the MCU RF Board, there is a footprint for direct debugging. This footprint is compatible with MIPI10 and STDC14 connectors. STDC14 is an extension of the MIPI10 connector.
- By default, on this footprint (CN3), the connector is not assembly. If some features are not available on the STlinkV3EC embedded on MB1801, it's possible to solder a MIPI10 or STDC14 connector.
- That allows to use of an external debugger, Nevertheless, it will be necessary to disconnect the SWD (open SB15 and SB17 on the MB1801).

### Example of connector compatible with this footprint:

- **MIPI10** : FTSH-105-01-L-DV-K (SAMTEC)
- **STDC14** : FTSH-107-01-L-DV-K (SAMTEC)

MIPI10/STDC14 pinout

Figure 6 Pinout of the MIPI10/STDC14 connector (CN3 of the MCU RF board)

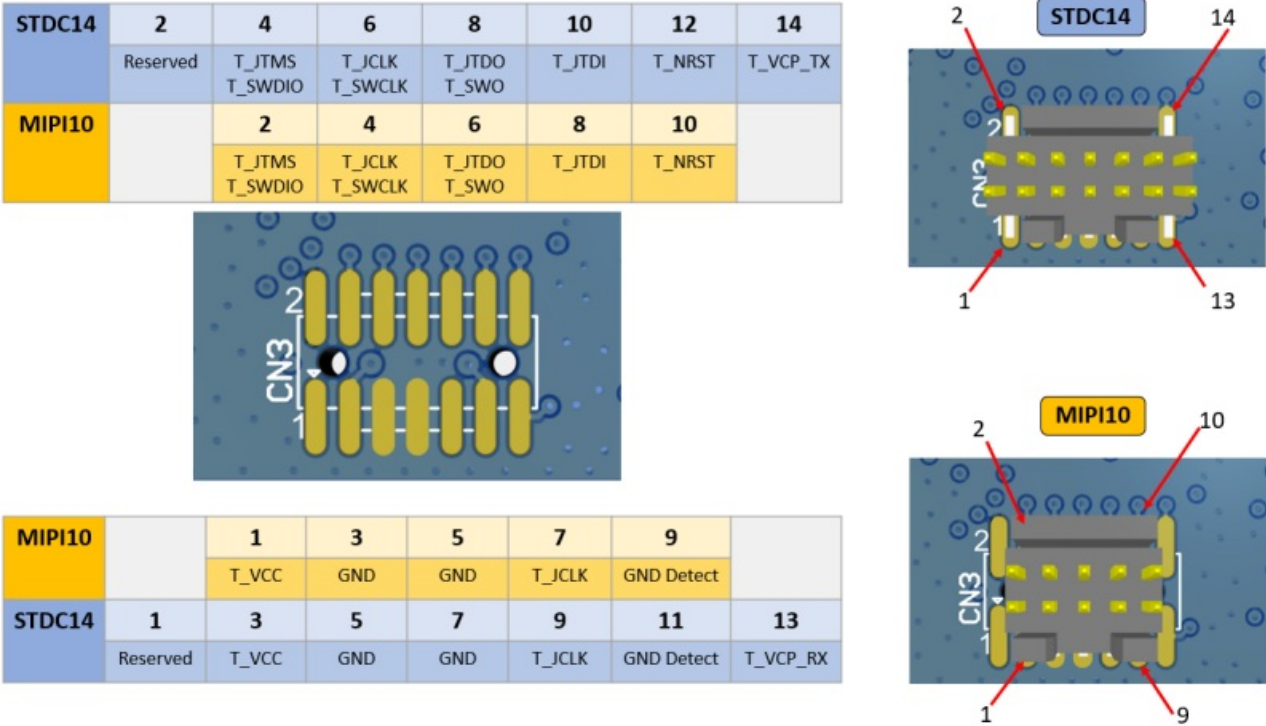


Table 12. Pinout of the MIPI10/STDC14 connector (CN3 of the MCU RF board)

STDC14 pin #	MIPI10 pin #	Pin description	Type
1	—	Reserved(1)	—
2	—	Reserved(1)	—
3	1	T_VCC(2)	I
4	2	T_JTMS/T_SWDIO	I/O
5	3	GND	S
6	4	T_JCLK/T_SWCLK	O
7	5	GND	S
8	6	T_JTDO/T_SWO(3)	I
9	7	T_JCLK	O
10	8	T_JTDI/NC(4)	O
11	9	GNDDetect	O
12	10	T_NRST	O
13	—	T_VCP_RX	O
14	—	T_VCP_TX	I

MB1801B-01 product information

## Product marking

- The stickers located on the top or bottom side of all PCBs provide product information:
- **First sticker:** product order code and product identification, generally placed on the main board featuring the target device.

### Example:

- Product order code Product identification
- **Second sticker:** board reference with revision and serial number, available on each PCB. Example:



- On the first sticker, the first line provides the product order code, and the second line the product identification.
- On the second sticker, the first line has the following format: “MBxxxx-Variant-yyz”, where “MBxxxx” is the board reference, “Variant” (optional) identifies the mounting variant when several exist, “y” is the PCB revision, and “ZZ” is the assembly revision, for example, B01. The second line shows the board serial number used for traceability.
- Parts marked as “ES” or “E” are not yet qualified and therefore not approved for use in production. ST is not responsible for any consequences resulting from such use. In no event will ST be liable for the customer using any of these engineering samples in production. ST’s Quality department must be contacted before any decision to use these engineering samples to run a qualification activity.

### ES” or “E” marking examples of location:

- On the targeted STM32 that is soldered on the board (for an illustration of STM32 marking, refer to the STM32 datasheet Package information paragraph at the [www.st.com](http://www.st.com) website).
- Next to the evaluation tool order the part number that is stuck or the silk-screen printed on the board.
- Some boards feature a specific STM32 device version, which allows the operation of any bundled commercial stack/library available. This STM32 device shows a “U” marking option at the end of the standard part number and is not available for sales.
- To use the same commercial stack in their applications, the developers might need to purchase a part number specific to this stack/library. The price of those part numbers includes the stack/library royalties.

## MB1801B-01 product history

**Table 13. Product History**

Order code	Product identification	Product details	Product change description	Product limitations
MB1803B-01	MB1801B-01	MCU: STM32WBA55CGU6  silicon revision “Z”	Initial revision	No limitation
		MCU errata sheet: <i>STM32WBA55xx device errata</i> (ES0592)		
		Boards: MB1803-WBA55CG-B01		

## Boards revision history

**Table 14. Board revision history**

Board reference	Board variant and revision	Board change description	Board limitations
MB1803 (MCU RF board)	MB1803-WBA55CG-B01	Initial revision	No limitation

## Federal Communications Commission (FCC) and ISED Canada

### FCC Compliance Statement

Changes or modifications not expressly approved by STMicroelectronics could void the user’s authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference,
2. this device must accept any interference received, including interference that may cause undesired operation.

### FCC ID: YCP-MB180300

Model name: MB1803B-01

Applicable FCC rules: This module has been approved under FCC part 15C 15.247 in the frequency range 2400-2483.5MHz. This modular transmitter is only FCC-authorized for this specific rule part.

### Specific operational use conditions:

- The module is limited to OEM installation ONLY.
- Limited module procedures do not apply to this application.
- Trace antenna design does not apply to this application.

**Radio Frequency (RF) Exposure Compliance of Radio communication:** To satisfy FCC RF Exposure requirements, a separation distance of 20cm or more should be maintained between the antenna of this device

and persons during operation.

To ensure compliance, operation at a closer distance than this is not recommended. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

- **List of antenna type approved:** Not applicable (Antenna is printed on the PCB module)
- **End Product Labeling:** if the host is marketed so that end users do not have straight forward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module shall be added:

**Contains Transmitter Module FCC ID:** YCP-MB180300" or "Contains FCC ID: YCP-MB180300" must be used.

**Additional testing requirements:**

- If testing of the host product with this transmitter installed and operating is necessary (to verify that the host product meets all the applicable FCC rules), a test mode for this specific module is available upon request to STMicroelectronics.
- The host product manufacturer is responsible for compliance with any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. (For example, Part 15 Subpart B)

**ISED Compliance Statement**

**IC:** 8976A- MB180300

**Product Marketing Name:** MB1803B

**HVIN:** MB1803B-01

This device contains license-exempt transmitter(s)/receivers(s) that comply with Innovation, Science, and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

**Applicable ISED-CANADA rules:** This module has been approved under RSS-247 in the frequency range 2400-2483.5MHz. This modular transmitter is only ISED-authorized for this specific rule part.

**Specific operational use conditions:**

- The module is limited to OEM installation ONLY.
- If other parameters (power setting) other than the type documented in the filing, a class 2 permissive change must be filed with ISED-CANADA.
- Limited module procedures do not apply to this application.  
Trace antenna design does not apply to this application.
- **Radio Frequency (RF) Exposure Compliance of Radio communication:** To satisfy ISED-Canada RF Exposure requirements, a separation distance of 20cm or more should be maintained between the antenna of

this device and persons during operation. To ensure compliance, operation at a closer distance than this is not recommended. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

- **This radio transmitter IC:** 8976A-MB180300 has been approved by Innovation, Science and Economic Development Canada to operate with the PCB antenna printed on the module.

#### List of antenna type approved: Not applicable

- End Product Labeling: If the IC number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains IC: 8976A-MB180300”

#### Additional testing requirements:

- If testing of the host product with this transmitter installed and operating is necessary (to verify that the host product meets all the applicable ISED-Canada rules), a test mode for this specific module is available upon request to STMicroelectronics.
- The host product manufacturer is responsible for compliance with any other ISED rules that apply to the host not covered by the modular transmitter grant of certification. (For example, ICES-003)

#### RED Compliance Statement

Simplified UE compliance statement Hereby, STMicroelectronics declares that the radio equipment type “ MB1803B-01” complies with Directive 2014/53/EU.

#### UKCA Compliance Statement

#### SIMPLIFIED UK DECLARATION OF CONFORMITY

Hereby, the manufacturer STMicroelectronics, declares that the radio equipment type “MB1803B-01” complies with The UK Radio Equipment Regulations 2017 (UK S.I. 2017 No. 1206).

The full text of the UK declaration of conformity is available at the following internet address: [www.st.com](http://www.st.com)

#### Revision history

**Table 15. Document revision history**

Date	Revision	Changes
13-Dec-2023	1	Initial release.
22-Feb-2024	2	Updated FCC information
29-Feb-2024	3	Updated ISED information


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## Documents / Resources

	<p><a href="#">STMicroelectronics MB1803B-01 Wireless and Ultra Low Power Board</a> [pdf] User Manual MB1803B-01, MB1803B-01 Wireless and Ultra Low Power Board, Wireless and Ultra Low Power Board, Ultra Low Power Board, Low Power Board, Power Board, Board</p>
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## References

- [User Manual](#)

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