STM32WBA Nucleo-64 board (MB1801 and MB1803)

Introduction

NUCLEO-WBA55CG is a wireless and ultra-low-power board embedding a powerful and ultra-low-power radio compliant with the Bluetooth® Low Energy SIG specification v5.4, IEEE 802.15.4-2015 PHY and MAC, supporting Thread®, Matter, and Zigbee®.

The ARDUINO® Uno V3 connectivity support and the ST morpho headers allow the easy expansion of the functionality of the STM32 Nucleo open development platform with a wide choice of specialized shields.

Figure 1. NUCLEO-WBA55CG global view

Picture is not contractual.

1 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 v5.4
  - IEEE 802.15.4-2015 PHY and MAC, supporting Thread®, Matter, and Zigbee®
  - Arm® Cortex®-M33 CPU with Arm® TrustZone®, MPU, DSP, and FPU
  - Integrated PCB antenna
- Mezzanine board (MB1801):
  - Three user LEDs
  - Three user push-buttons and one reset push-button
  - Board connectors:
    - USB Type-C®
    - ARDUINO® Uno V3 expansion connector
    - ST morpho headers for full access to all STM32 I/Os
- Flexible power-supply options: ST-LINK USB V_{BUS} or external sources
- On-board STLINK-V3EC debugger/programmer with USB re-enumeration capability: mass storage, Virtual COM port, and debug port
- 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.

2 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
NUCLEO-WBA55CG	• MB1801(1) • MB1803(2)	STM32WBA55CG

1. *Mezzanine board*
2. *MCU RF board*

2.1 Codification

The meaning of the codification is explained in Table 2.

Table 2. Codification explanation

NUCLEO-XXXYYZT	Description	Example: NUCLEO-WBA55CG
XXX	MCU series in STM32 32-bit Arm Cortex MCUs	STM32WBA series
YY	MCU product line in the series	STM32WBA54/55 product line
Z	STM32 package pin count: • C for 48 pins	48 pins
T	STM32 flash memory size: • G for 1 Mbyte	1 Mbyte

3 Development environment

3.1 System requirements

- Multi-OS support: Windows® 10, Linux® 64-bit, or macOS®
- USB Type-A or USB Type-C® to USB Type-C® cable

Note: macOS® is a trademark of Apple Inc., registered in the U.S. and other countries and regions.
Linux® is a registered trademark of Linus Torvalds.
Windows is a trademark of the Microsoft group of companies.

3.2 Development toolchains

- IAR Systems® - IAR Embedded Workbench®(1)
- Keil® - MDK-ARM(1)
- STMicroelectronics - STM32CubeIDE

1. *On Windows® only.*

3.3 Demonstration software

The demonstration software, included in the STM32Cube MCU Package corresponding to the on-board 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*.

4 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 Ω 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

5 Safety recommendations

5.1 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.

5.2 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, 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. Avoid operating the board close to water or at a high humidity level.
- Do not operate the board if dirty or dusty.

6 Quick start

This section describes how to start development quickly using NUCLEO-WBA55CG.

To use the product, you must accept the evaluation product license agreement from the www.st.com/epla webpage.

Before the first use, make sure that no damage occurred to the board during shipment:

- All socketed components must be firmly secured in their sockets.
- Nothing must be loose in the board blister.

The Nucleo board is an easy-to-use development kit to evaluate quickly and start development with an STM32 microcontroller in a UFQFPN48 package.

6.1 Getting started

Follow the sequence below to configure the STM32WBA55CG board and launch the demonstration application (refer to Figure 3 and Figure 5 for component location):

1. Check jumper positions on board: JP2 ON, JP1 on 5V_STLK [1-2].
2. Check that switch SW1 is on the 3V3 power supply.
3. Install the ST BLE Toolbox mobile application on a Bluetooth® Low Energy compatible mobile device from the App Store or Google Play.
4. Connect the Nucleo board to a PC with a USB Type-A or USB Type-C® to USB Type-C® cable through the CN15 USB connector (5V_STLK). Once connected the green LED (LD2) lights up. Refer to the user manual *STLINK-V3MODS and STLINK-V3MINI debugger/programmer tiny probes for STM32 microcontrollers* (UM2502) available at *www.st.com*.
5. Use the ST BLE Toolbox mobile application to detect the STM32WBA P2P server (P2PSRV) and connect it. The smartphone application displays the service and characteristics of the device.
6. Pushing the button (B1) on the board toggles the alarm on the smartphone display. On the smartphone, push the lamp to switch ON/OFF the Nucleo board blue LED (LD1).

7 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 and Figure 5 help users locate these features on the NUCLEO-WBA55CG board. The mechanical dimensions of the STM32WBA55CG product are shown in Figure 6.

Figure 2. Hardware block diagram

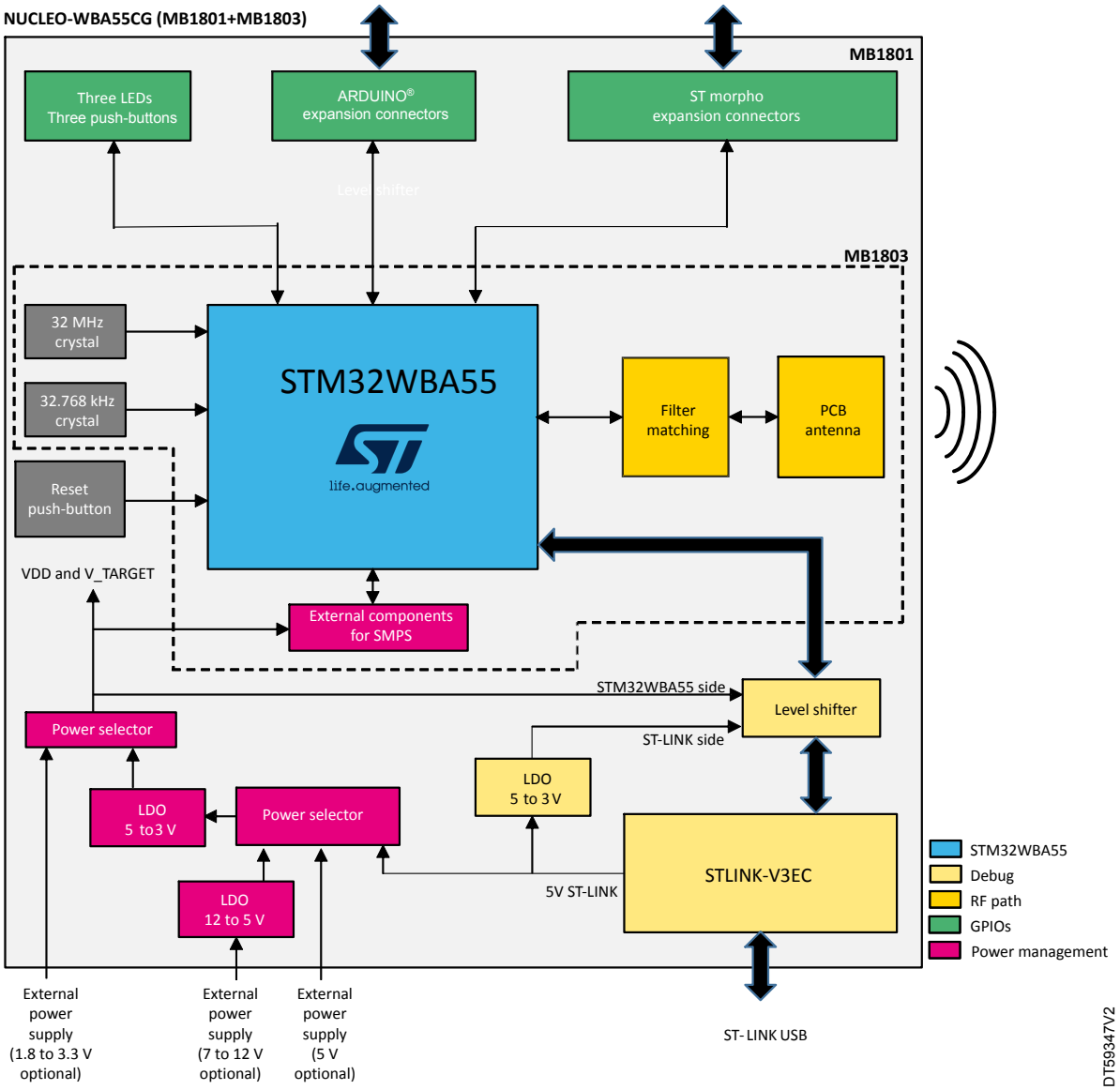


Figure 3. NUCLEO-WBA55CG PCB top view

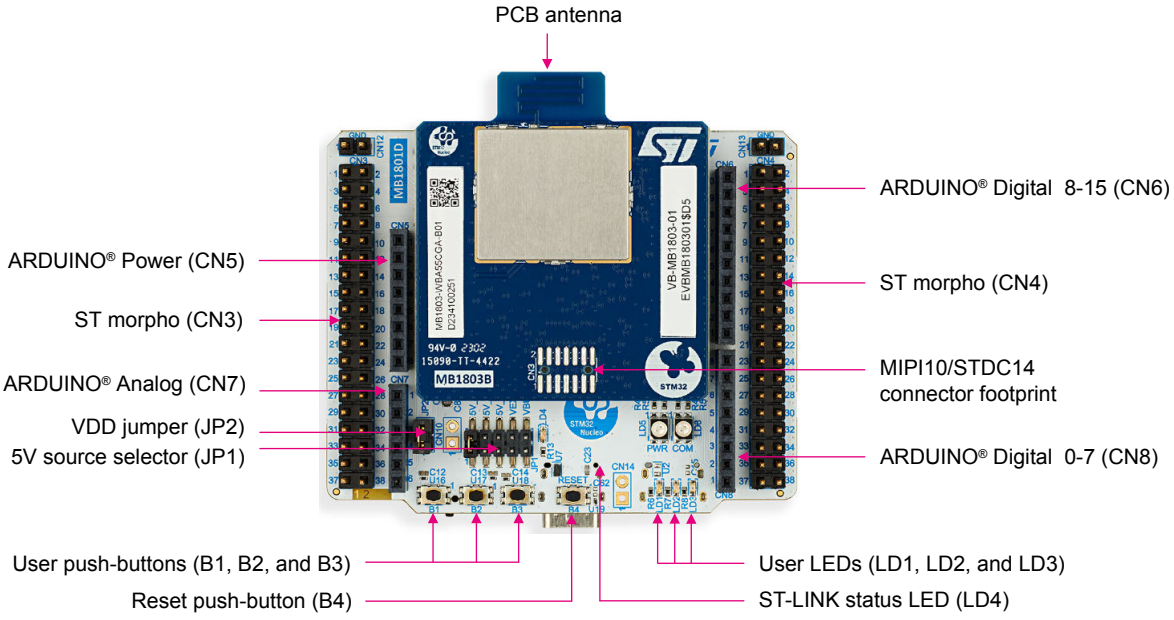


Figure 4. NUCLEO-WBA55CG PCB details of the MCU RF board

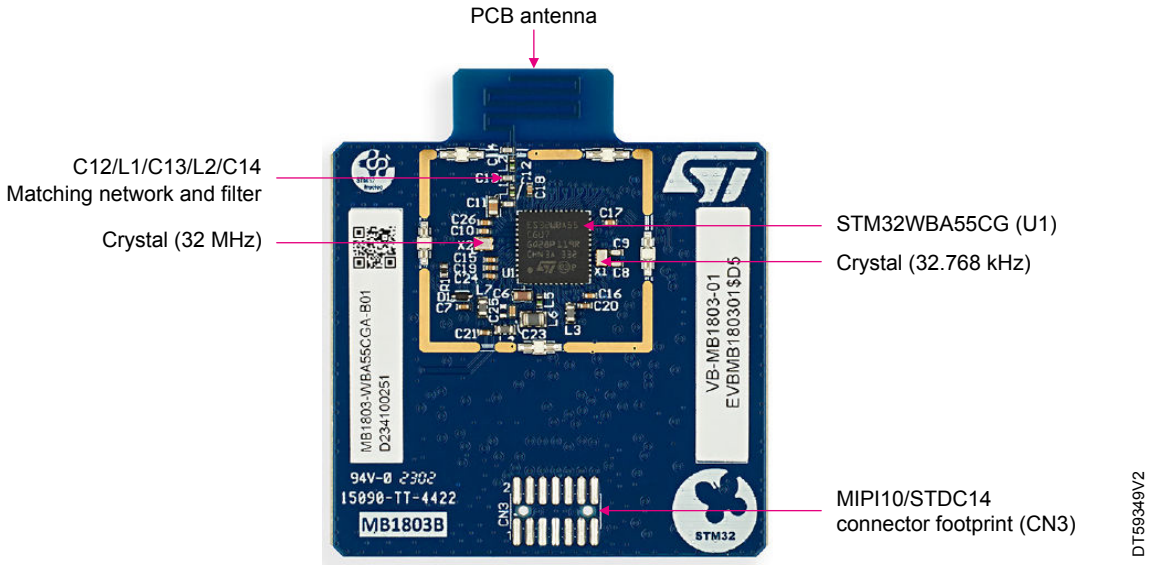


Figure 5. NUCLEO-WBA55CG PCB bottom view

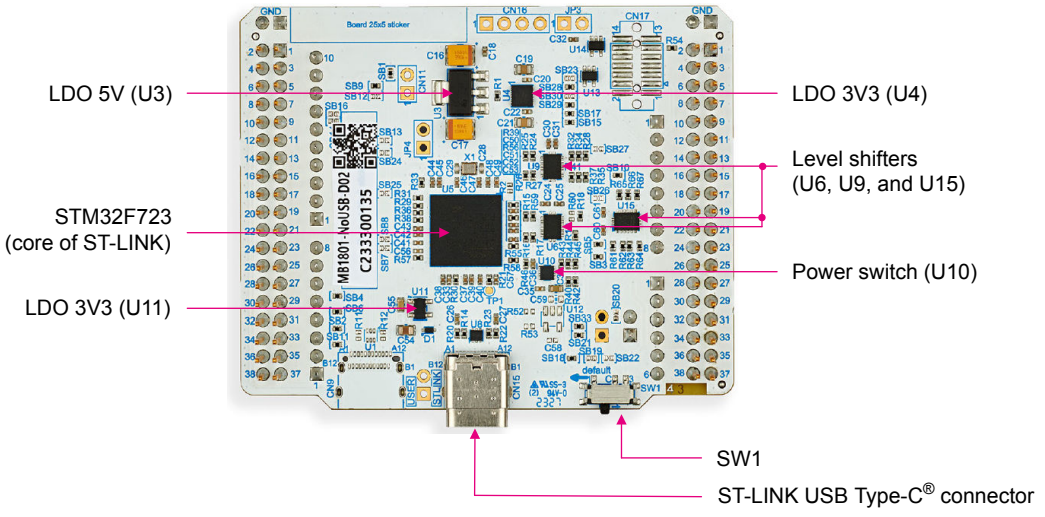


Figure 6. NUCLEO-WBA55CG (MB1801D) mechanical dimensions (in millimeters)

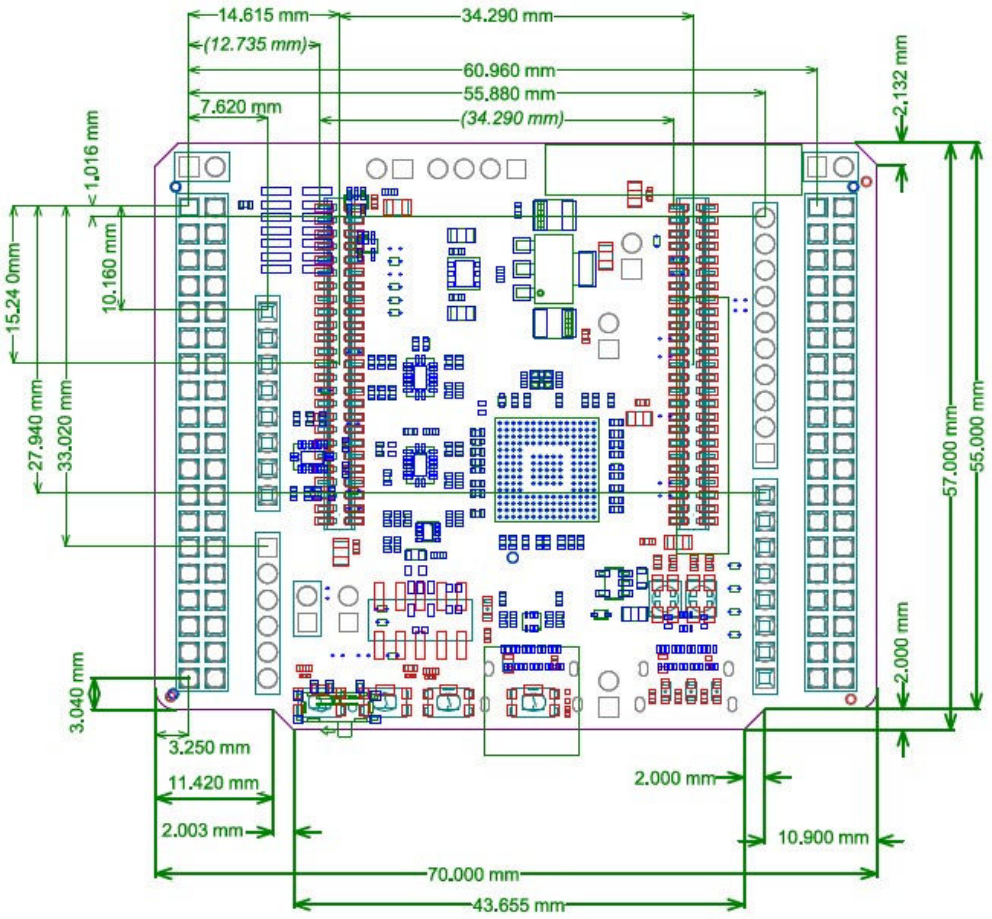
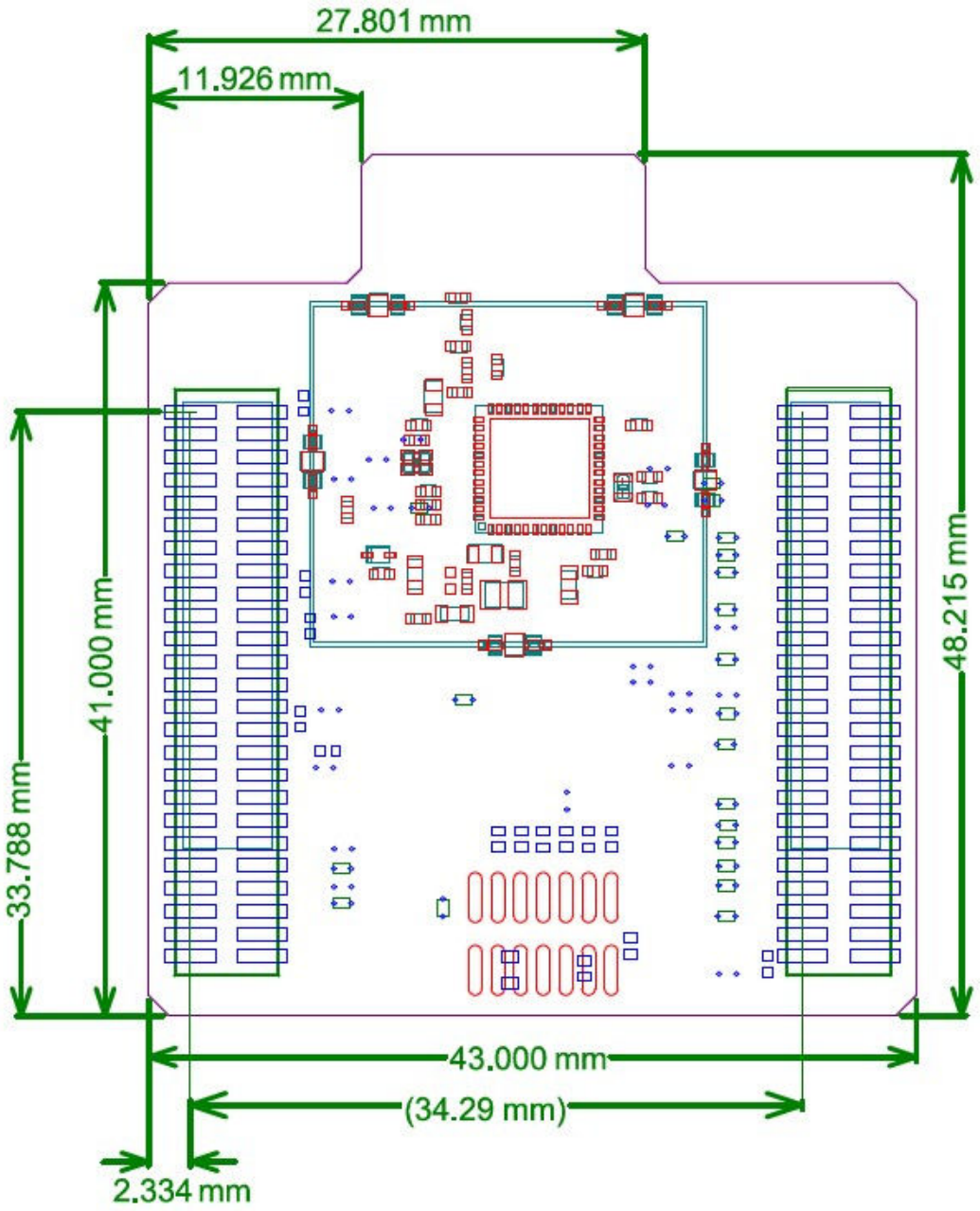


Figure 7. **NUCLEO-WBA55CG (MB1803B) mechanical dimensions (in millimeters)**



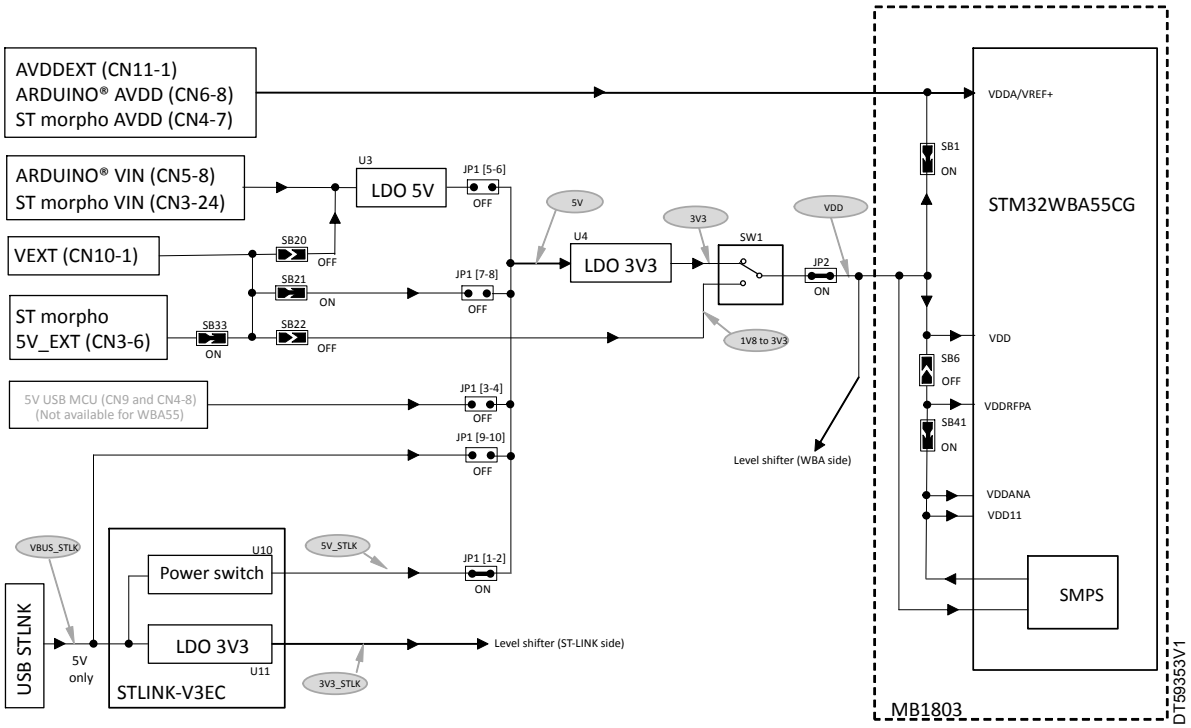
7.1 Power supply

7.1.1 General description

By default, the STM32WBA55CG embedded on this Nucleo board is supplied by 3V3 but the board proposes a lot of possibilities to supply the module. In fact, at first, the 3V3 can come from ST-LINK USB, ARDUINO®, or ST morpho connectors. Moreover, STM32WBA55CG can be supplied by an external source (between 1.8 and 3.3 V). Thanks to level shifters, debugging by embedded ST-LINK is always possible even if the supply voltage of the target is different than 3V3 (ST-LINK supply). Figure 8 shows the power tree. Moreover, this figure also shows the default state of the jumpers and the solder bridges.

Note: In general, the product must be supplied by a voltage source or auxiliary equipment that complies with EN 62368-1:2014+A11:2017 or the standard that replaces it.

Figure 8. STM32WBA55CG power tree



7.1.2 7 to 12 V power supply

A 7 to 12 V DC power source can power NUCLEO-WBA55CG. There are three accesses for this type of level:

- Pin VIN of the ARDUINO® connector (CN5-8). It is possible to apply until +12 V on this pin or use an ARDUINO® shield, which can deliver this type of voltage on the VIN pin
- Pin VIN of the ST morpho connector (CN3-24). It is possible to apply until +12 V on this pin like for the ARDUINO® connection
- External input (VEXT, CN10). Be careful, in this case, the states of the jumpers and solder bridge are very important. Verify these states in Table 4.

These sources are connected to a linear low-drop voltage regulator (U3). The output of this regulator (5 V) is a potential source of the 5V signal (refer to details in the next section).

7.1.3 5 V power supply

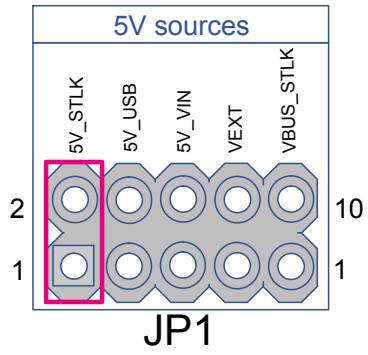
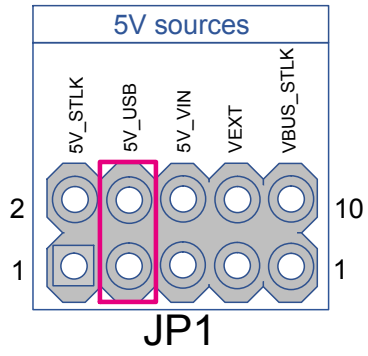
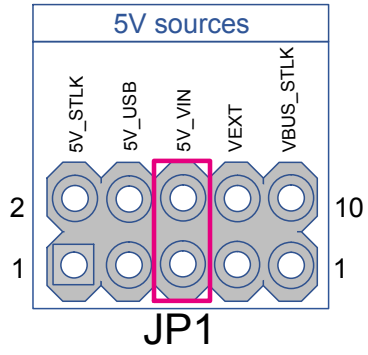
A 5 V DC power source can power NUCLEO-WBA55CG. The 5 V can come from several connectors:

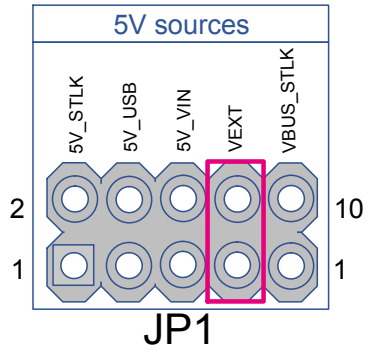
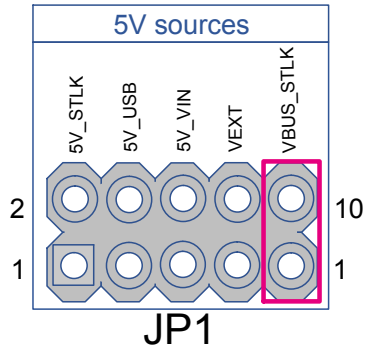
- External input (VEXT, CN10). Be careful, in this case, the states of the jumpers and solder bridge are very important. Refer to Table 4.
- 5V_EXT from ST morpho connector (CN3-6 of MB1801)
- VIN (7-12 V) input through the voltage regulator (U3). Refer to Section 7.1.2: 7 to 12 V power supply.
- USB ST-LINK can supply the board directly (VBUS_STLK) or through the monitoring of STLINK-V3EC.

The jumper (JP1) allows selecting the 5V source. Table 4 shows the configuration to apply the selected source.

Depending on the current needed on the devices connected to the USB port, and the board itself, power limitations can prevent the system from working as expected. The user must ensure that NUCLEO-WBA55CG is supplied with the correct power source depending on the current needed.

Table 4. Power supply selector (JP1) description

Jumper/solder bridge	Setting	Configuration
JP1 5V supply source selector		**Default setting** NUCLEO-WBA55CG is supplied through the USB Type-C® receptacle (CN15) (USB_STLNK). ST-LINK controls this source. It enables this 5V after the startup of STLINK-V3EC if all the conditions are fulfilled.
		Not available on variant MB1801-NoUSB.
		NUCLEO-WBA55CG is supplied through pin 8 of the ARDUINO® connector (CN5) or pin 24 of the ST morpho connector (CN3) or CN10 (refer to the configuration details in the present Power supply section).

Jumper/solder bridge	Setting	Configuration
JP1 5V supply source selector		NUCLEO-WBA55CG is supplied through CN10 or through pin 6 of the ST morpho connector (CN3). Refer to the configuration details in the present Power supply section.
		NUCLEO-WBA55CG is supplied through the CN15 USB Type-C® receptacle (USB_STLNK) without any control from STLINK-V3EC.

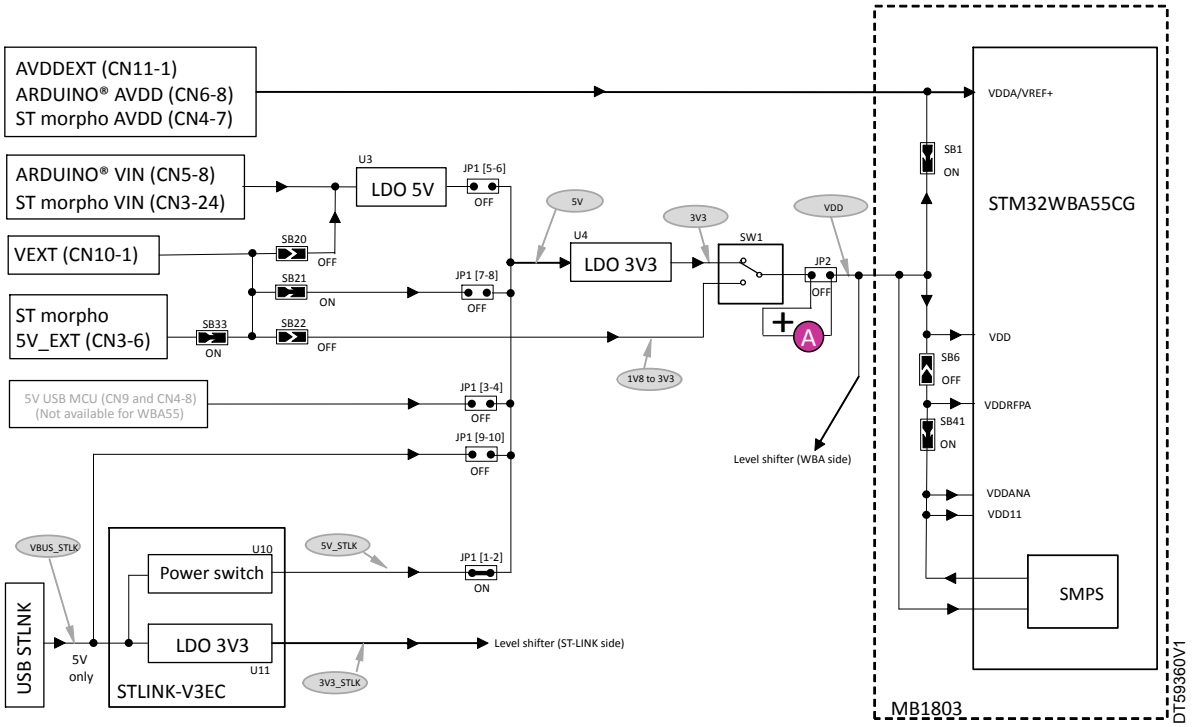
When 5V_STLK is used, JP1 is set to [1-2]. The sequence is specific. In the beginning, only STLINK-V3EC is supplied. If the USB enumeration succeeds, the 5V_STLK power is enabled by asserting the PWR_EN signal from STLINK-V3EC. This pin is connected to a power switch (U10), which supplies the rest of the board. This power switch also features a current limitation to protect the PC in case of currents exceeding 300 mA.

7.1.4 Current measurement

As the device has low-power features, it can be interesting to measure the current consumed by NUCLEO-WBA55CG. To do this measurement easily, there are two possibilities:

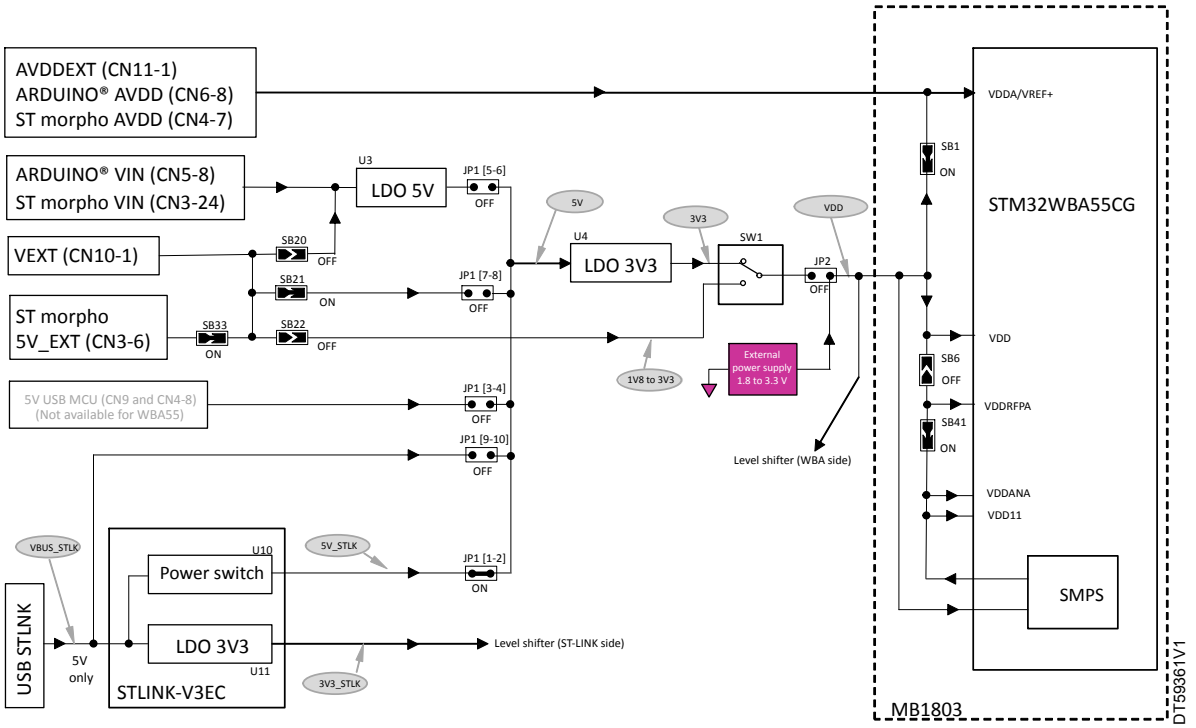
1. Measure the supply current of the SoC using an ammeter in place of the jumper (JP2). In this case, all supply sources can be used except the AVDD coming from the ARDUINO® connector. AVDD input must not be used during this measurement and SB1 must be ON. Figure 9 shows the configuration.

Figure 9. Current measurement with an ammeter



2. Use an external power supply with current measurement capability. In this case, the jumper (JP2) must be removed and the supply connected to pin 2 of JP2 (refer to Figure 10). The supply voltage must be between 1V8 and 3V3. AVDD input (CN1-8) must not be used during this measurement.

Figure 10. Current measurement with an external power supply

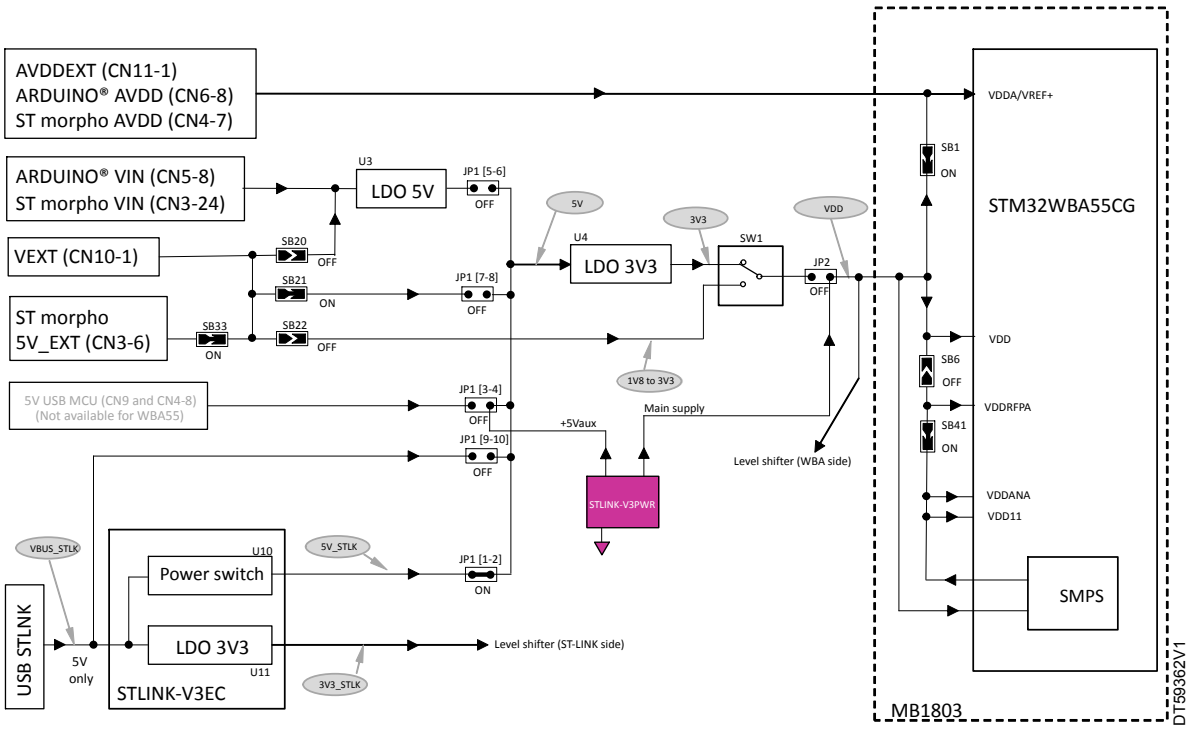


Caution: As explained above, the supply voltage VDD must be between 1.8 and 3.3 V. The limit of 3.3 V is due to level shifters (when STM32WBA55CG can support 3.6 V).

3. If it is necessary to do power consumption measurement during debugging, STMicroelectronics has an interesting solution. It is possible to use STLINK-V3PWR. This product allows two sources of supply: a first for the current measurement on the STM32WBA55CG, and a second for the rest of the board, such as LEDs. Like in the previous case, the jumper (JP2) must be removed, and the main supply for the current measurement is connected to pin 2 of JP2 (refer to Figure 11). For the second source (+5V), remove the jumper on JP1 and connect this source to the top side (pin 1, 3, 5, 7, or 9 of JP1).

The supply voltage must be between 1.8 and 3.3 V. AVDD input must not be used, and SB1 must be ON during this measurement.

Figure 11. Current measurement with STLINK-V3PWR

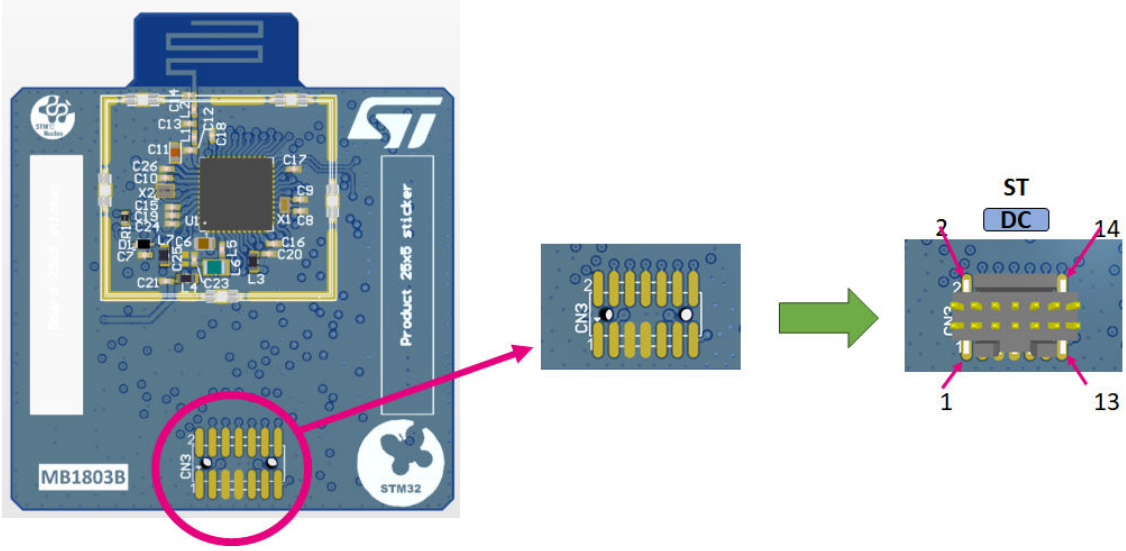


The details above concern the supply of the board by STLINK-V3PWR. Now, the debug feature of these tools also needs some modification.

By default, MB1803 is delivered without the possibility of debugging by an external tool. Nevertheless, as explained in Section 7.12, it is possible to solder a MIPI10 or STDC14 connector on the CN3 footprint. In our case, to use STLINK-V3PWR, an STDC14 is soldered on the CN3 footprint of the MB1803. Refer to Figure 12. The reference of the STDC14 connector is FTSH-107-01-L-DV-K (SAMTEC).

Caution: By default, this connector is not assembled because it prohibits the use of an ARDUINO® shield. The height of the connector is not compatible with the plug of the ARDUINO® shield. Moreover, it is always possible to plug an ST morpho shield on the bottom side of MB1801.

Figure 12. **CN3 assembly for STLINK-V3PWR**



It is also necessary to add some components on the bottom side of MB1803. Table 5 explains the values of the components and Figure 13 shows the location of these components.

Table 5. **Components to add to support the STLINK-V3PWR configuration**

Designator	Value	Package	Part number example
R2, R3, R4, R5, R6, R7, R8, R9	47 Ω 1%	0402	YAGEO: RC0402FR-0747RL
C22	1 µF/16 V	0603	YAGEO: CC0603KRX5R7BB105

Figure 13. **Components to add to support the STLINK-V3PWR configuration**

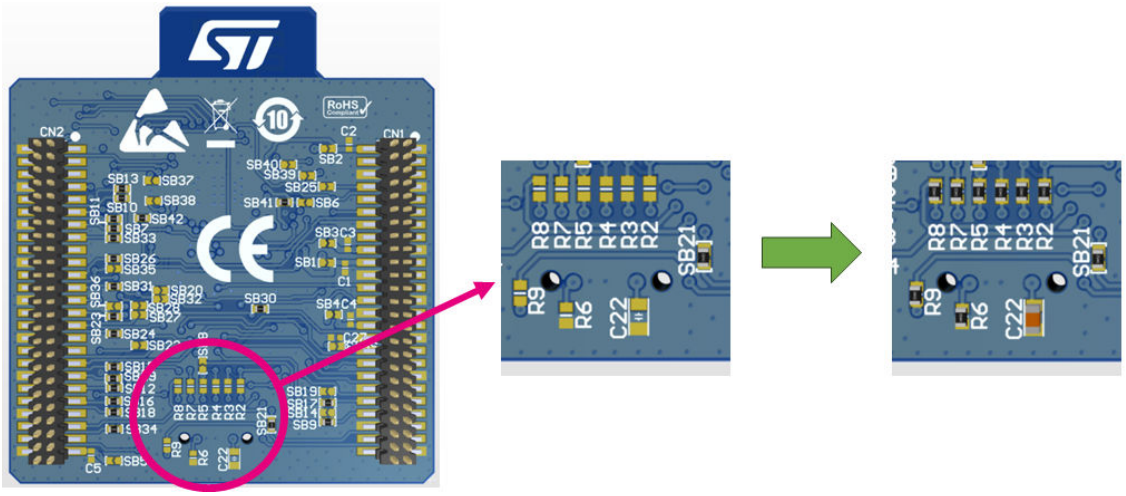
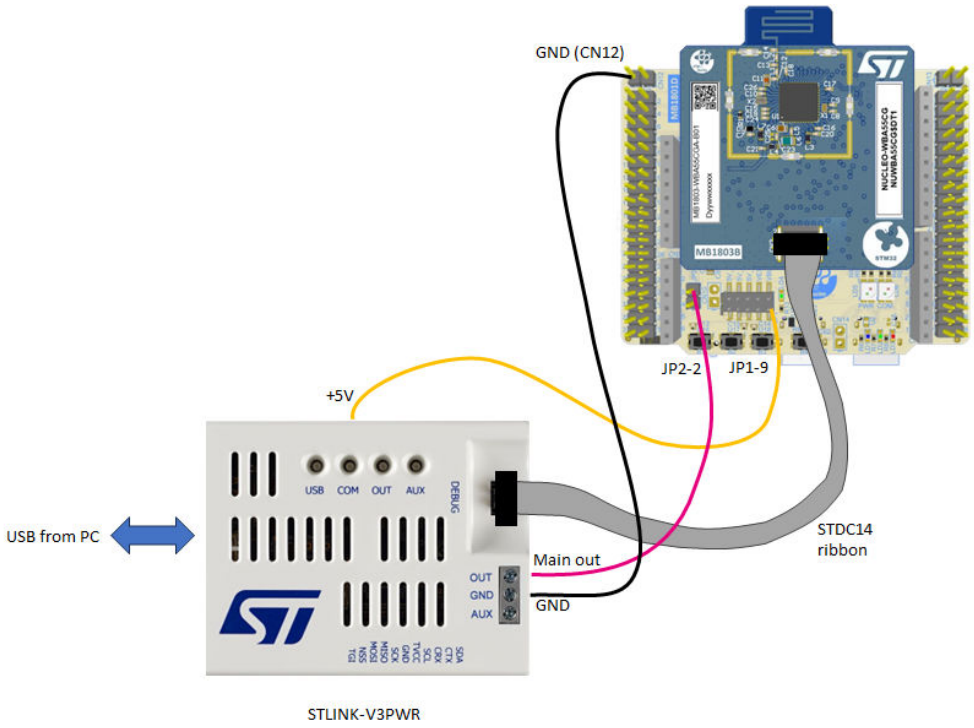


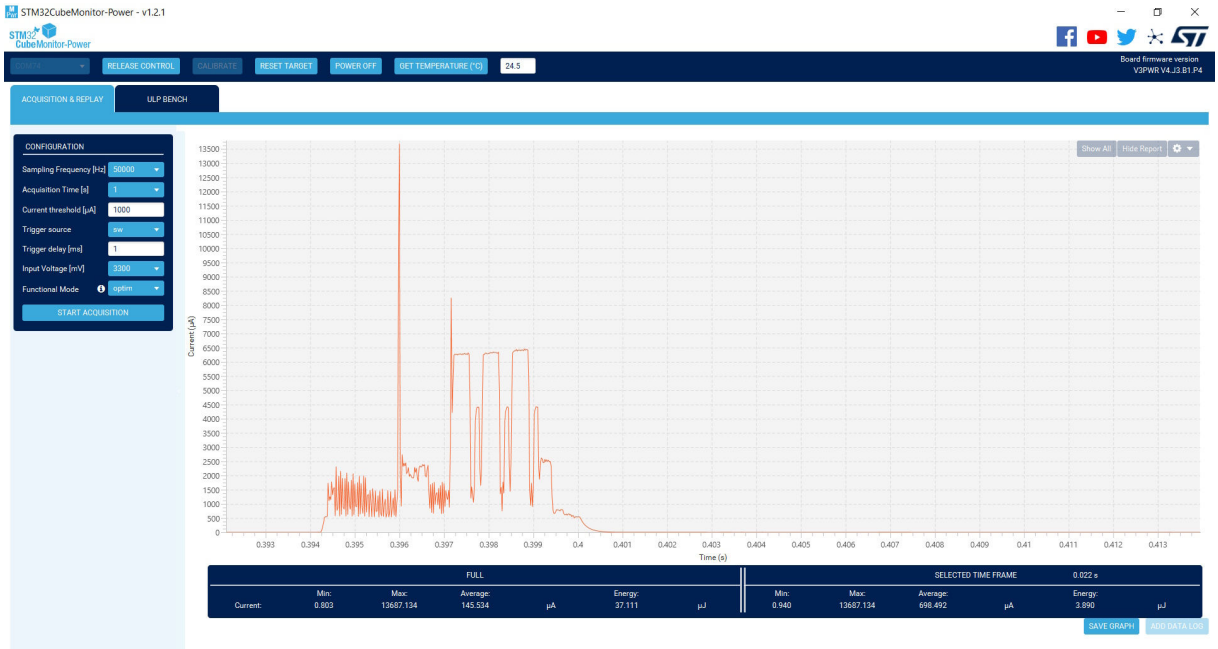
Figure 14. Configuration for current measurement with STLINK-V3PWR



Caution: With this configuration, the second Virtual COM port (VCP2) is not available from STLINK-V3PWR. Only VCP1 can be used. VCP1 is directly connected by the STDC14 ribbon (pins 13 and 14 on STDC14).

After connection, download STM32CubeMonitor-Power from the *www.st.com* website and install it. This software allows doing easily dynamic current measurements. Figure 15 shows an example of a current measurement (firmware: “Heart Rate” from the STM32CubeWBA firmware package).

Figure 15. Example of current measurement with an external STLINK-V3PWR



For more details on using STLINK-V3PWR, a dedicated page is available on the *www.st.com* website.

7.2 Clock sources

7.2.1 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.

7.2.2 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.

7.3 Reset sources

The reset signal of NUCLEO-WBA55CG is active LOW. The internal PU forces the RST signal to a high level.

The sources of reset are:

- Reset push-button (B4)
- Embedded STLINK-V3EC
- ARDUINO® connector (CN5 pin 3), reset from the ARDUINO® board
- ST morpho connector (CN3 pin 14)

7.4 Embedded STLINK-V3EC

The STLINK-V3EC programming and debugging tool is integrated into NUCLEO-WBA55CG.

The features supported on the STLINK-V3EC are:

- USB 2.0 high-speed interface
- Probe firmware update through USB
- JTAG communication support up to 21 MHz
- SWD and SWV communication support up to 24 MHz
- 3.0 to 3.6 V application voltage support and 5 V tolerant inputs
- Virtual COM port (VCP) up to 16 Mbps
- Optional drag-and-drop flash memory programming binary files
- Multipath bridge USB to SPI/UART/I^2C/CAN/GPIOs

For detailed information about the STLINK-V3EC capabilities such as LED management, drivers, and firmware, refer to the technical note *Overview of ST-LINK derivatives* (TN1235) at *www.st.com*.

For information about the debugging and programming features of STLINK-V3EC, refer to the user manual *STLINK-V3SET debugger/programmer for STM8 and STM32* (UM2448) at *www.st.com*.

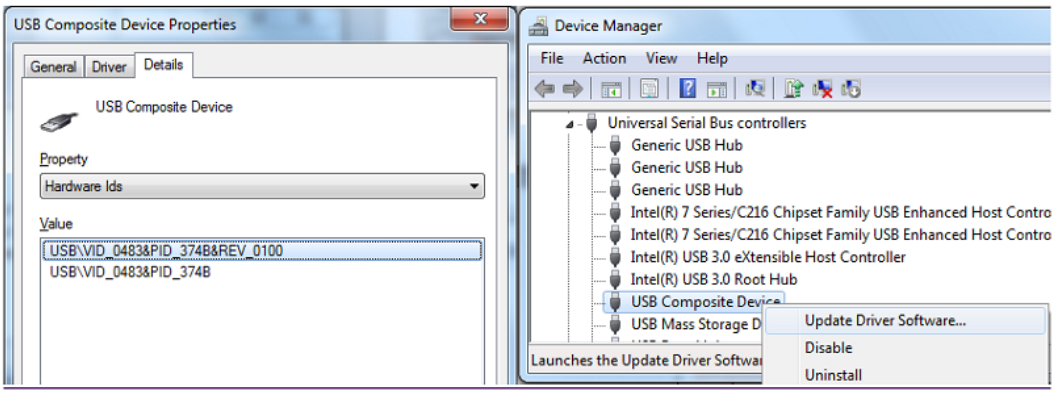
7.4.1 Drivers

STLINK-V3EC requires a dedicated USB driver, which, for Windows 7® and Windows 8® is available from *www.st.com*. For Windows 10®, it is not necessary to install the driver. ST-LINK is automatically identified.

In case the NUCLEO-WBA55CG board is connected to the PC before the driver is installed, some board interfaces might be declared as *Unknown* in the PC device manager. In this case, the user must install the dedicated driver files and update the driver of the connected device from the device manager, as shown in Figure 16. USB composite device.

Note: It is preferable to use the USB Composite Device to handle a full recovery.

Figure 16. **USB composite device**



7.4.2 STLINK-V3EC firmware upgrade

STLINK-V3EC embeds a firmware mechanism for the in-place upgrade through the USB port. As the firmware might evolve during the lifetime of the STLINK-V3EC product (for example new functionalities, bug fixes, support for new microcontroller families), visiting the *www.st.com* website is recommended before starting to use the NUCLEO-WBA55CG board, then periodically to stay up-to-date with the latest firmware version.

For detailed information on the ST-LINK USB drivers, refer to the technical note *Overview of ST-LINK derivatives* (TN1235) at *www.st.com*.

7.4.3 STLINK-V3EC USB connector (CN15)

The main function of this connector is the access to STLINK-V3EC embedded on the NUCLEO-WBA55CG for the debugging as explained above. It allows supplying the board (refer to Section 7.1: Power supply). The connector is a standard USB Type-C® connector.

Table 6. **STLINK-V3EC USB Type-C® connector (CN15)**

Pin	Pin name	Signal name	Function
A4, A9, B4, B9	VBUS	VBUS_STLK	VBUS power
A7, B7	DM	STLK_USB_N	DM
A6, B6	DP	STLK_USB_P	DP
A5	CC1	-	Configuration Channel-
B5	CC2	-	Configuration Channel-
A1, A12, B1, B12	GND	GND	GND

7.4.4 Virtual COM port USART1

STLINK-V3EC offers a USB Virtual COM port bridge. This feature allows access to the USART1 of NUCLEO-WBA55CG by the USB_STLNK connector. By default, this USART1 interface of NUCLEO-WBA55CG is connected to the VCP1 of the STLINK-V3EC MCU (STM32F723IE).

Access is possible on the CN3 connector of the mezzanine board (MB1801). Both signals Tx and Rx are available, and two solder bridges, SB3 and SB5, allow disconnecting the UART coming from the SoC. By default, VCP1 is connected to the USART1 of NUCLEO-WBA55CG.

Table 7. **VCP1 interface pinout description**

STM32WBA55CG	CN3	STM32F723
USART1 Rx (PA8/pin 5)	Pin 35 (GPIO23)	STLINK_TX: PG14/pin A7
USART1 Tx (PB12/pin 4)	Pin 37 (GPIO24)	STLINK_RX: PG9/pin C10

7.4.5 Virtual COM port LPUART1 (VCP2)

It is possible to replace the mass storage interface with a second Virtual COM port. To do so, the two solder bridges SB7 and SB8 (Tx and Rx on MB1801) must be ON. It is also necessary to do a firmware upgrade through STM32CubeProgrammer (refer to the technical note *Overview of ST-LINK derivatives* (TN1235) at *www.st.com*.

The access is possible on the CN3 and CN4 connectors of the mezzanine board (MB1801). All signals (Tx, Rx, RTS, and CTS) are available, and solder bridges allow disconnecting the UART coming from the SoC. Depending on the use case, for RTS and CTS there are several choices of connections. By default, VCP2 is not connected to the STM32WBA55CG.

Table 8. VCP2 interface pinout description

STM32WBA55CG	CN3 and CN4	STM32F723	Solder bridges
LPUART1_RX (PA10 pin 46)	CN4 pin 37 (GPIO55)	STLINK_TX: PC10 pin B14	On MB1801: SB7 ON
LPUART1_TX (PB5 pin 21)	CN4 pin 35 (GPIO54)	STLINK_RX: PB11 pin R13	On MB1801: SB8 ON
LPUART1_CTS (PA0 pin13) (PB15 pin33)	CN4 pin16 (GPIO 38) CN4 pin26 (GPIO 46)	STLINK_RTS: PD12 pin N13	On MB1801: SB25 ON On MB1803: SB8 ON and SB9 OFF (PA0) or SB32 ON and SB31 OFF (PB15)
LPUART1_RTS (PB9 pin14)	CN3 pin2 (GPIO 2)	STLINK-CTS: PD11 pin N14	On MB1801: SB23 ON On MB1803: SB25 ON and SB23 OFF

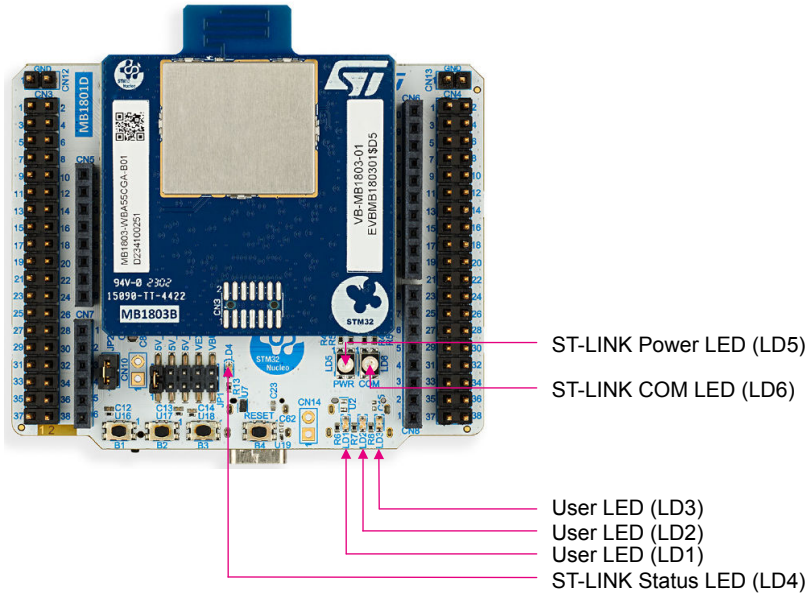
7.4.6 Level shifter

NUCLEO-WBA55CG has a system for supplying STM32WBA55CG with a different voltage than the ST-LINK. The ST-LINK is always supplied by 3V3 sources. By default, the STM32WBA55CG is supplied by the same voltage value as ST-LINK, but it is possible to supply the SoC with another value. It accepts voltage between 1.8 and 3.3 V trust to a specific component (level shifter). This level shifter ensures the voltage conversion between ST-LINK and the SoC. It drives SWD and UART signals connected to the VCP1 or VCP2 on the ST-LINK.

7.5 LEDs

Four LEDs on the top side of the Nucleo board help the user during the application development.

Figure 17. LEDs location



- LD1: This blue LED is available for user application.
- LD2: This green LED is available for user application.
- LD3: This red LED is available for user application.
- LD4: This LED turns green when a 5V source is available (to select the 5V source, refer to Section 7.1.3: 5 V power supply).
- LD5: This LED gives information about the STLINK-V3EC target power.
- LD6: This LED blinks during communication with the PC.

For detailed information about the STLINK-V3EC LEDs, refer to the technical note *Overview of ST-LINK derivatives* (TN1235) at *www.st.com*.

Table 9. LED designator, color, and I/O configuration

LED designator	Color	I/O
LD1	Blue	PB4/GPIO30
LD2	Green	PA9/GPIO14
LD3	Red	PB8/GPIO57

7.6 Push-buttons

7.6.1 Description

NUCLEO-WBA55CG provides two types of buttons:

- USER1 push-button (B1)
- USER2 push-button (B2)
- USER2 push-button (B3)
- Reset push-button (B4), used to reset the Nucleo board.

Figure 18. Push-button location

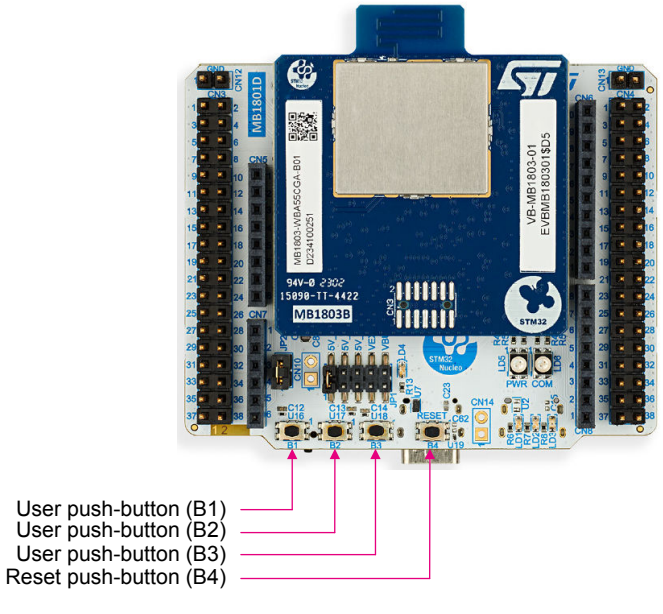


Table 10. Push-button designator and I/O configuration

Push-button designator	I/O
B1	PC13/GPIO56
B2	PB6/GPIO51
B3	PB7/GPIO53

7.6.2 Reset push-button

B4 is dedicated to the hardware reset of the Nucleo board.

7.6.3 User push-buttons

There are three push-buttons available for the user application. They are connected to PB6, PB7, and PC13. It is possible to use with GPIO reading or to wake up the device (only B1).

Table 11. I/O configuration for the physical user interface

Name	I/O	Wake-Up available
USER1 push-button (B1)	PC13/GPIO56	WKUP1
USER2 push-button (B2)	PB6/GPIO51	WKUP3
USER3 push-button (B3)	PB7/GPIO53	WKUP5

7.7 RF I/O stage

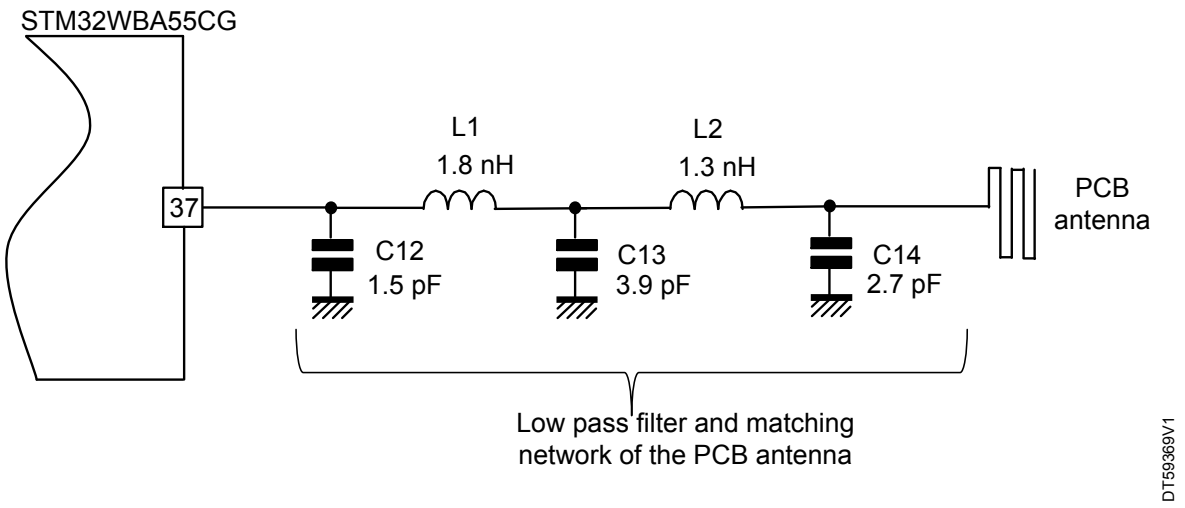
Due to FCC/ISED constraints, the antenna cannot be removable. So, the board is proposed by default with a PCB antenna. This antenna is described in the application note *Guidelines for meander design using low-cost PCB antennae with 2.4 GHz radio for STM32WB/WB0 MCUs* (AN5129) available at *www.st.com*. Between the STM32WBA55CG 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 STM32WBA55CG is optimized for this 50-Ω impedance. This facilitates the design of the external part.

Therefore, the low-pass filter is designed with a 50-Ω impedance on the SoC side and the antenna impedance on the other side. For simplicity, the antenna bandwidth is not considered. 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 requirements of certification bodies such as FCC, ISED, RED, and MIC.

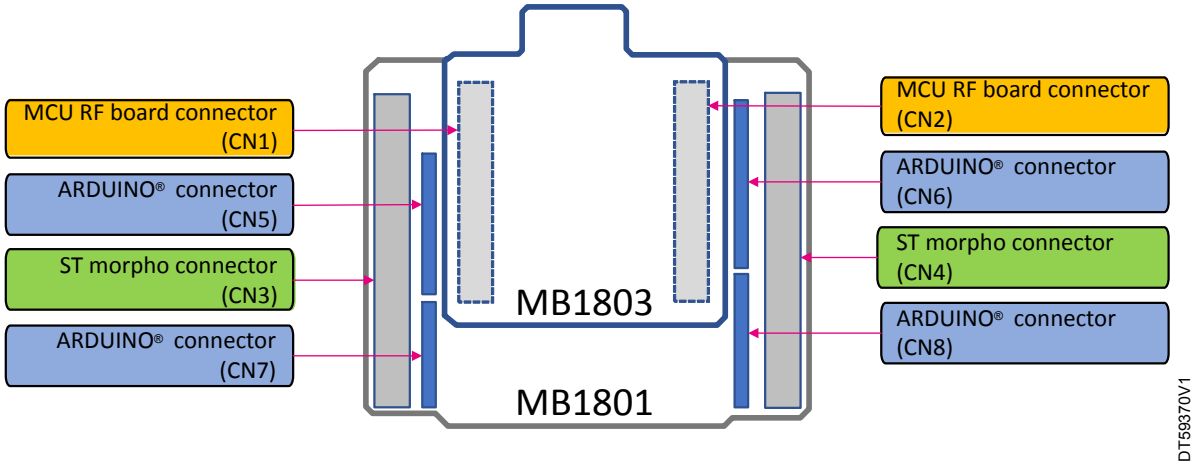
This network is built with five components C12, L1, C13, L2, and C14. This guarantees a comfortable margin in all cases. The study considers component drift (accuracy and temperature), PCB drift, and STM32WBA55CG variation. Of course, depending on the component manufacturer and the specification of the PCB, these component values can change after mandatory optimization.

Figure 19. RF I/O stage



7.8 Connector naming

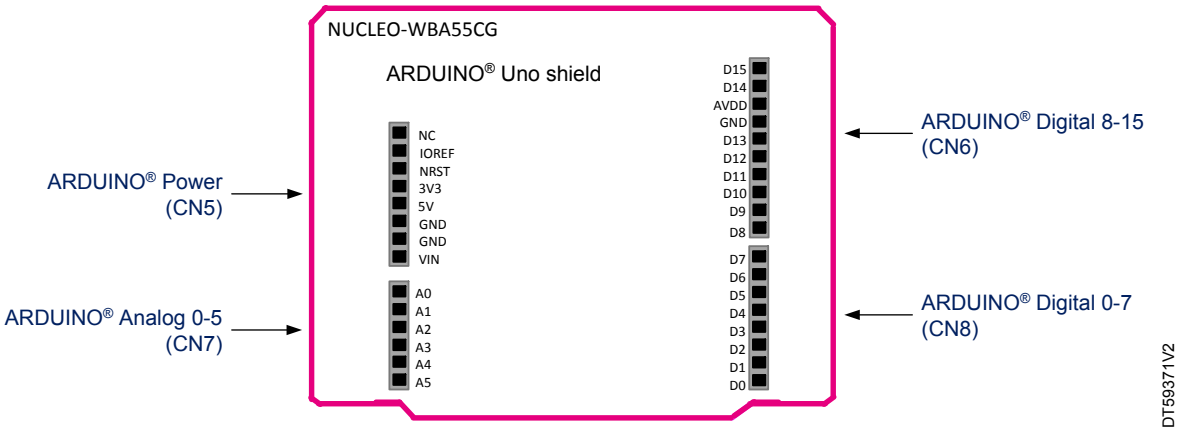
Figure 20. **Connector location and naming**



7.9 ARDUINO® interface and pinout

On the bottom side of the board, there is an ARDUINO® Uno V3 extension socket. It is built around four standard connectors (CN5, CN6, CN7, and CN8). Most shields designed for ARDUINO® can fit with the Discovery kits to offer flexibility in small form factor applications.

Figure 21. **ARDUINO® Uno connectors and ARDUINO® shield location**



Operating voltage

The ARDUINO® Uno V3 connectors support 5 V, 3.3 V, and VDD for I/O compatibility.

Caution: Do not supply 3.3 or 5 V from the ARDUINO® shield. Supplying 3.3 or 5 V from the ARDUINO® shield might damage the Nucleo board.
Furthermore, if it is necessary to supply the Nucleo board by the ARDUINO® connector, a dedicated pin is available. VIN allows supplying the board directly. To use this feature, refer to Section 7.1.2: 7 to 12 V power supply.

Figure 20 shows the position of the ARDUINO® shield when it is plugged into NUCLEO-WBA55CG. The pinout shown in Figure 22 corresponds to standard ARDUINO® naming. To see the correspondence with the STM32, refer to Table 12.

Figure 22. ARDUINO® connector pinout

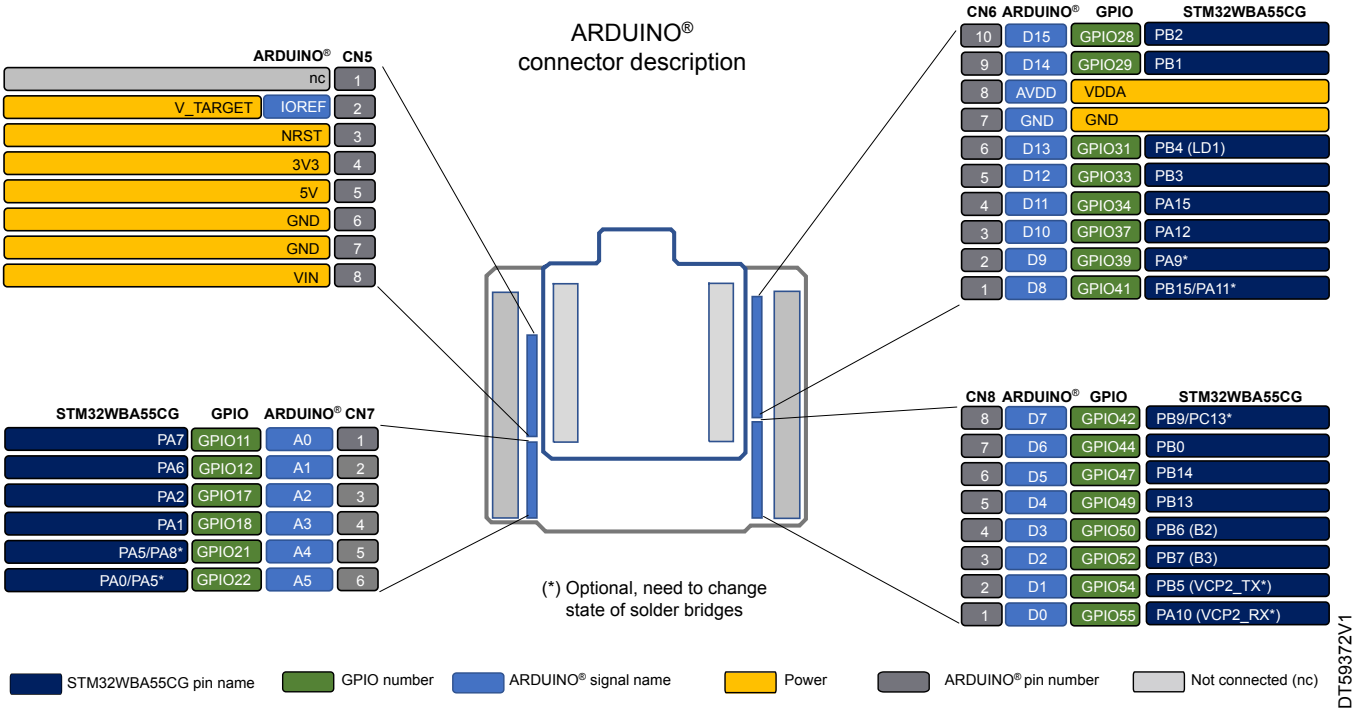


Table 12. Pinout of the ARDUINO® connectors

Connector	Pin number	Signal name	STM32 port	Comment
CN5	1	NC	-	NC (reserved for tests)
	2	3V3 (IOREF)	-	IOREF 3V3
	3	NRST	NRST	NRST
	4	3V3	-	3V3
	5	5V	-	5V
	6	GND	-	GND
	7	GND	-	GND
	8	VIN	-	External supply input (+12 V)
CN7	1	A0	PA7	ADC1_IN2
	2	A1	PA6	ADC1_IN3
	3	A2	PA2	ADC1_IN7
	4	A3	PA1	ADC1_IN8
	5	A4	PA5/PA8(1)	ADC1_IN4/ADC1_IN1(1)
	6	A5	PA0/PA5(1)	ADC1_IN9/ADC1_IN4(1)
CN8	1	ARD_D0	PA10(1)	LPUART1_RX(1)
	2	ARD_D1	PB5(1)	LPUART1_TX(1)
	3	ARD_D2	PB7	GPIO/TIM1_CH4N
	4	ARD_D3	PB6	GPIO/TIM2_CH1
	5	ARD_D4	PA11	GPIO/TIM1_CH1
	6	ARD_D5	PB14	GPIO/TIM3_CH3
	7	ARD_D6	PB0	GPIO/TIM1_CH3N
	8	ARD_D7	PB9/PC13(1)	GPIO/TIM1_CH3N/ TIM1_BKIN2
CN6	1	ARD_D8	PB15/PA11(1)	GPIO/TIM1_CH1(1)
	2	ARD_D9	PA9(1)	GPIO/TIM3_CH2
	3	ARD_D10	PA12	SPI1_NSS
	4	ARD_D11	PA15	SPI1_MOSI
	5	ARD_D12	PB3	SPI1_MISO
	6	ARD_D13	PB4	SPI1_SCK/TIM1_CH3
	7	GND	-	GND
	8	AVDD	-	VDDA
	9	ARD_D14	PB1	I2C1_SDA/I2C3_SDA
	10	ARD_D15	PB2	I2C1_SCL/I2C3_SCL

1. *Optional, need to change the state of solder bridges.*

7.10 ST morpho interface and pinout

The ST morpho connectors (CN3 and CN4) are male pin headers accessible on both sides of the board. All signals and power pins of the MCU are available on the ST morpho connectors. An oscilloscope, logical analyzer, or voltmeter can also probe these connectors.

Figure 23. ST morpho connector pinout

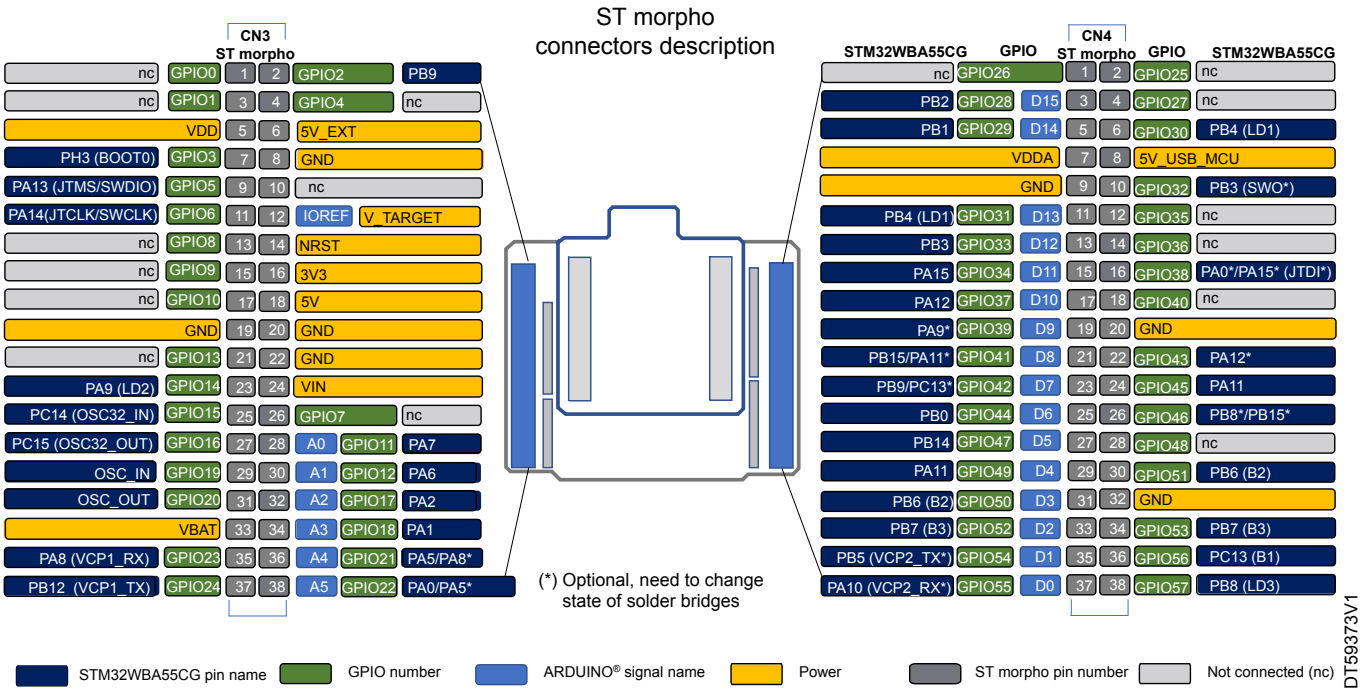


Table 13. ST morpho connector pinout

CN3				CN4			
Pin number	STM32WBA55CG pin name	Pin number	STM32WBA55CG pin name	Pin number	STM32WBA55CG pin name	Pin number	STM32WBA55CG pin name
1	NC	2	PB9	1	NC	2	NC
3	NC	4	NC	3	PB2	4	NC
5	VDD	6	5V_EXT	5	PB1	6	NC
7	BOOT0	8	GND	7	VDDA	8	5V_USB_MCU(2)
9	PA13	10	5V_INT	9	GND	10	PB3/SWO(1)
11	PA14	12	IOREF	11	PB4	12	NC
13	NC	14	NRST	13	PB3	14	NC
15	NC	16	3V3	15	PA15	16	PA0(1)/PA15(1)/ JTDI(1)
17	NC	18	5V	17	PA12	18	NC
19	GND	20	GND	19	PA9(1)	20	GND
21	NC	22	GND	21	PB15/PA11(1)	22	PA12(1)
23	PA9	24	VIN	23	PB9/PC13(1)	24	PA11
25	PC14	26	NC	25	PB0	26	PB8(1)/PB15(1)
27	PC15	28	PA7	27	PB14	28	NC
29	OSC_IN	30	PA6	29	PA11	30	PB6
31	OSC_OUT	32	PA2	31	PB6	32	GND
33	VBAT	34	PA1	33	PB7	34	PB7
35	PA8	36	PA5/PA8(1)	35	PB5	36	PC13
37	PB12	38	PA0/PA5(1)	37	PA10	38	PB8

1. *Optional, need to change the state of solder bridges.*
2. *Not available on NUCLEO-WBA55CG (MB1801-NoUSB mezzanine board variant)*

7.11 MCU RF board interface and pinout

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.

Figure 24. MCU RF board connector pinout

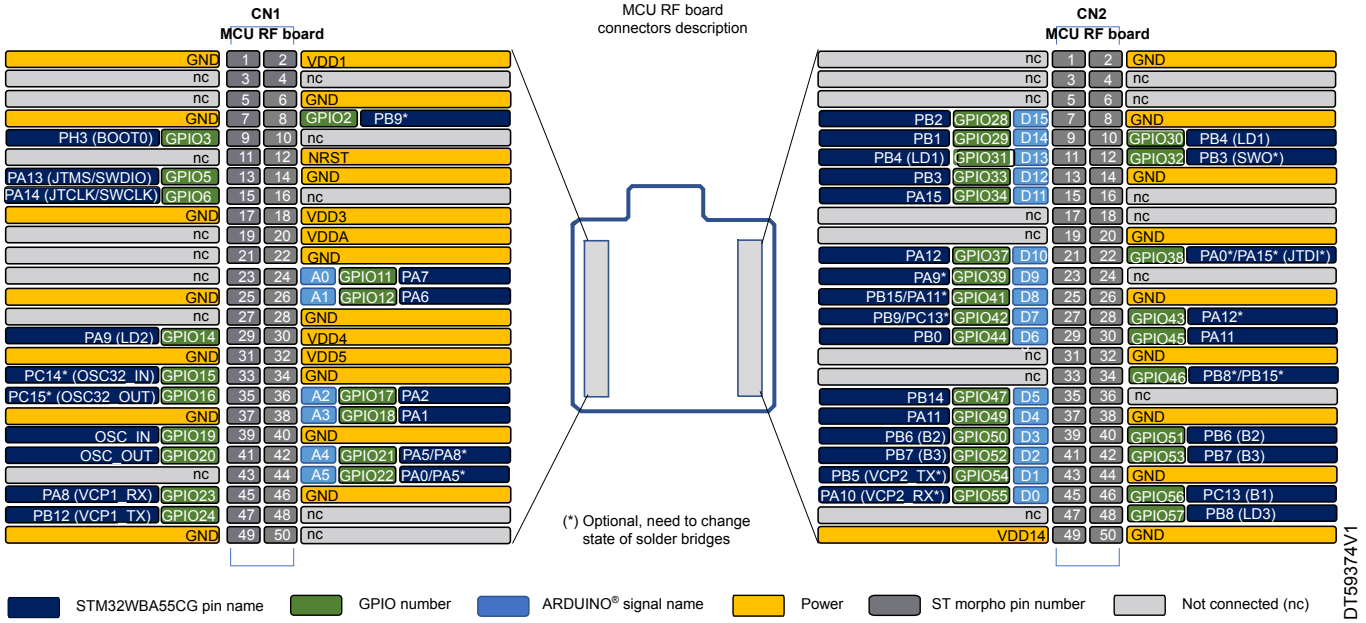


Table 14. MCU RF board connector pinout

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(1)
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(1)/PA15(1)/ JTDI(1)
23	NC	24	PA7	23	PA9(1)	24	NC
25	GND	26	PA6	25	PB15/PA11(1)	26	GND
27	NC	28	GND	27	PB9/PC13(1)	28	PA12(1)
29	PA9	30	VDD4	29	PB0	30	PA11
31	GND	32	VDD5	31	NC	32	GND
33	PC14(1)	34	GND	33	NC	34	PB8(1)/PB15(1)
35	PC15(1)	36	PA2	35	PB14	36	NC
37	GND	38	PA1	37	PA11	38	GND
39	OSC_IN(1)	40	GND	39	PB6	40	PB6
41	OSC_OUT(1)	42	PA5/PA8(1)	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	VDD14	50	GND

1. *Optional, need to change the state of solder bridges.*

7.12 MIPI10/STDC14 connector

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 assembled. If some features are not available on STLINK-V3EC embedded on the MB1801, it is possible to solder a MIPI10 or STDC14 connector. This enables the use of an external debugger. Nevertheless, it is necessary to disconnect the SWD (SB15 and SB17 OFF on the MB1801).

Examples of connectors compatible with this footprint:

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

This description uses the standard name of the MIPI10 and STDC14 connectors. On the NUCLEO-WBA55CG T_VCP corresponding to T_VCP1 on STDC14 (T_VCP_TX is T_VCP1_TX and T_VCP_RX is T_VCP1_RX).

Figure 25. Pinout of the MIPI10/STDC14 connector (CN3 of the MCU RF board)

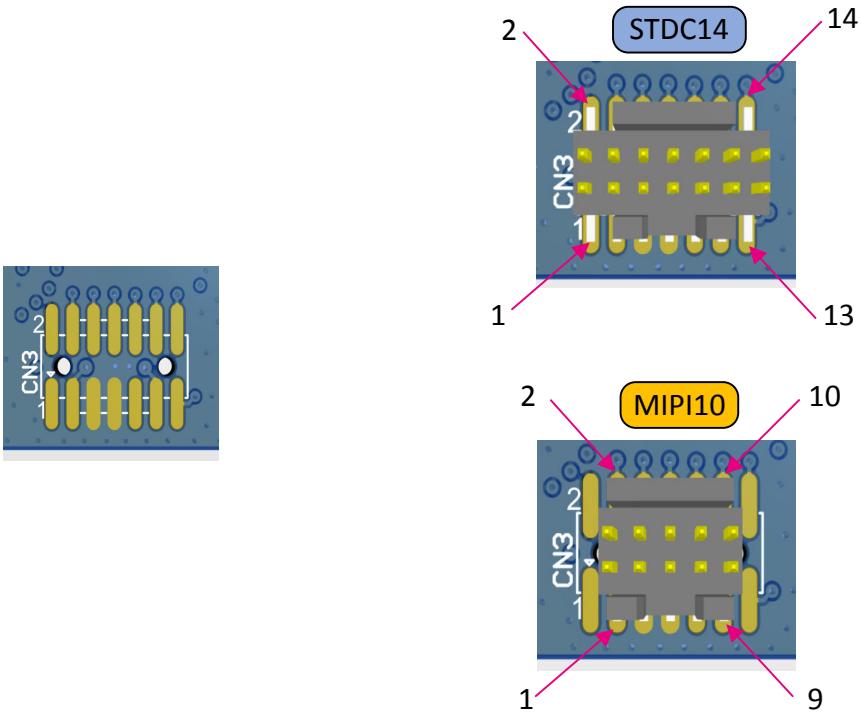


Table 15. Pinout of the MIPI10/STDC14 connector (CN3 of the MCU RF board)

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/NC(4)	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

1. *Do not connect to the target.*
2. *Input for STLINK-V3*
3. *SWO is optional, required only for Serial Wire Viewer (SWV)*
4. *NC means it is not required for the SWD connection.*

8 NUCLEO-WBA55CG product information

8.1 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:

  MBxxxx-Variant-yzz
  syywwxxxxx

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-yzz"*, 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 prior to 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* website).
- Next to the evaluation tool ordering part number that is stuck, or 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.

8.2 NUCLEO-WBA55CG product history

Table 16. Product history

Order code	Product identification	Product details	Product change description	Product limitations
NUCLEO-WBA55CG	NUWBA55CG$DT1	MCU: STM32WBA55CGU6 silicon revision "B"	Initial revision	No limitation
		MCU errata sheet: *STM32WBA5x device errata* (ES0592)		
		Boards: • MB1801-NoUSB-D02 (mezzanine board) • MB1803-WBA55CGA-B01 (MCU RF board)		

8.3 Board revision history

Table 17. Board revision history

Board reference	Board variant and revision	Board change description	Board limitations
MB1801 (mezzanine board)	NoUSB-D02	Initial revision	No limitation
MB1803 (MCU RF board)	WBA55CGA-B01	Initial revision	No limitation

9 Federal Communications Commission (FCC) and ISED Canada Compliance Statements

9.1 FCC Compliance Statement

Identification of products: NUCLEO-WBA55CG

Contains FCC ID: YCP-MB180300

Part 15.19

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, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Part 15.21

Any changes or modifications to this equipment not expressly approved by STMicroelectronics may cause harmful interference and void the user's authority to operate this equipment.

Part 15.105

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception which can be determined by turning the equipment off and on, the user is encouraged to try to correct interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Note: Use only shielded cables.

To satisfy FCC RF exposure requirements, a separation distance of 20 cm 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 collocated or operating in conjunction with any other antenna or transmitter.

Responsible party (in the USA)

Francesco Doddo
STMicroelectronics, Inc.
200 Summit Drive | Suite 405 | Burlington, MA 01803
USA
Telephone: +1 781-472-9634

9.2 ISED Compliance Statement

Identification of products: NUCLEO-WBA55CG
Contains IC ID: 8976A-MB180300

Identification du produit : NUCLEO-WBA55CG
Contient sous-ensemble certifié IC : 8976A-MB180300

Compliance Statement

Notice: This device complies with ISED Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

ISED Canada ICES-003 Compliance Label: CAN ICES-3 (B) / NMB-3 (B).

Déclaration de conformité

Avis: Le présent appareil est conforme aux CNR d'ISDE Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Étiquette de conformité à la NMB-003 d'ISDE Canada : CAN ICES-3 (B) / NMB-3 (B).

RF exposure statement

This device complies with ISED radiation exposure limits set forth for general population. This device must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Le présent appareil est conforme aux niveaux limites d’exigences d’exposition RF aux personnes définies par ISDE. L’appareil doit être installé afin d’offrir une distance de séparation d’au moins 20 cm avec les personnes et ne doit pas être installé à proximité ou être utilisé en conjonction avec une autre antenne ou un autre émetteur.

10 RED Compliance Statement

Simplified EU declaration of conformity

Hereby, STMicroelectronics declares that the radio equipment type "NUCLEO-WBA55CG" is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address: *www.st.com*.

Déclaration de conformité UE simplifiée

STMicroelectronics déclare que l'équipement radioélectrique du type "NUCLEO-WBA55CG" est conforme à la directive 2014/53/UE.

Le texte complet de la déclaration de conformité UE est disponible à l'adresse internet suivante: *www.st.com*.

11 UKCA Compliance Statement

SIMPLIFIED UK DECLARATION OF CONFORMITY

Hereby, the manufacturer STMicroelectronics, declares that the radio equipment type “NUCLEO-WBA55CG” is in compliance 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*.

Revision history

Table 18. **Document revision history**

Date	Revision	Changes
02-Apr-2024	1	Initial release.
04-Jun-2024	2	Updated document title, Features, Hardware block diagram, NUCLEO-WBA55CG PCB details of the MCU RF board, and ARDUINO® connector pinout figures, and Pinout of the MIPI10/STDC14 connector (CN3 of the MCU RF board) table. Added LED designator, color, and I/O configuration and Push-button designator and I/O configuration tables.

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