

## Getting started with STEVAL-NBIOTV1

### Introduction

STEVAL-NBIOTV1 is an evaluation platform and reference design for asset tracking, smart city applications, and metering. It leverages the ST87M01 narrowband IoT (NB-IoT) and GNSS module for connectivity and location-based services. The platform features the STM32U585AI microcontroller, various sensors (temperature, humidity, pressure, and motion), and a SIM socket for cellular connectivity.

STEVAL-NBIOTV1 supports multiple communication protocols, including UART, I<sup>2</sup>C, and SPI. Additionally, it includes efficient power management and data storage components, and it provides an expansion connector to add other functionalities.

**Figure 1. STEVAL-NBIOTV1 evaluation board**



**Notice:** For dedicated assistance, submit a request through our online support portal at [www.st.com/support](http://www.st.com/support).

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## 1 Precautions for use

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**Warning:** Charge your device with a DC 5 V–500 mA USB charger at a temperature from 10°C to 35°C.

*The kit must be used within the working temperature range. It must never be exposed to excessive heat such as direct sunlight, fire, or heating equipment.*

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**Danger:** Use only USB chargers equipped with short-circuit protections to prevent fire hazard.

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**Danger:** Use only the LiPo battery provided with the kit (HiMax 752535). A replacement of the battery with an incorrect type can defeat a safeguard.

*LiPo batteries can be damaged and even explode if they are short-circuited or overcharge or with an improper usage, such as mechanical crushes, hot oven, or battery cutting.*

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## 2 Getting started

### 2.1 Overview

The **STEVAL-NBIOTV1** is a compact, battery-powered evaluation platform and reference design tailored for asset tracking, smart city applications, and metering.

The **STEVAL-NBIOTV1** integrates multiple key elements: the **ST87M01** ultracompact, low-power NB-IoT industrial module featuring additional ADC, GNSS, and Wi-Fi positioning capabilities, the **STM32U585RI** microcontroller; onboard sensors, and extra memory via a 32 Mbit serial SPI page EEPROM.

This all-in-one integration enables rapid IoT application development without requiring external add-ons or additional hardware.

An example application code is provided to optimize low-power operation and accelerate time-to-market.

Connectivity and location-based services are powered by the **ST87M01** narrowband IoT (NB-IoT) and GNSS module.

Multiple communication interfaces are supported, including UART, I<sup>2</sup>C, and SPI. Efficient power management and data storage components are integrated, and an expansion connector allows easy addition of further functionalities.

Please note, the board does not include an STM32 debugger/programmer; a compatible debugger can be purchased separately. The recommended part numbers are **STLINK-V3MINIE** or, alternatively, **STLINK-V3SET**.

*Note:* The evaluation kit with order code **STEVAL-NBIOTV1** contains the **STV\$NBIOTV1A** board.

### 2.2 Block diagram

**Figure 2. Block diagram**

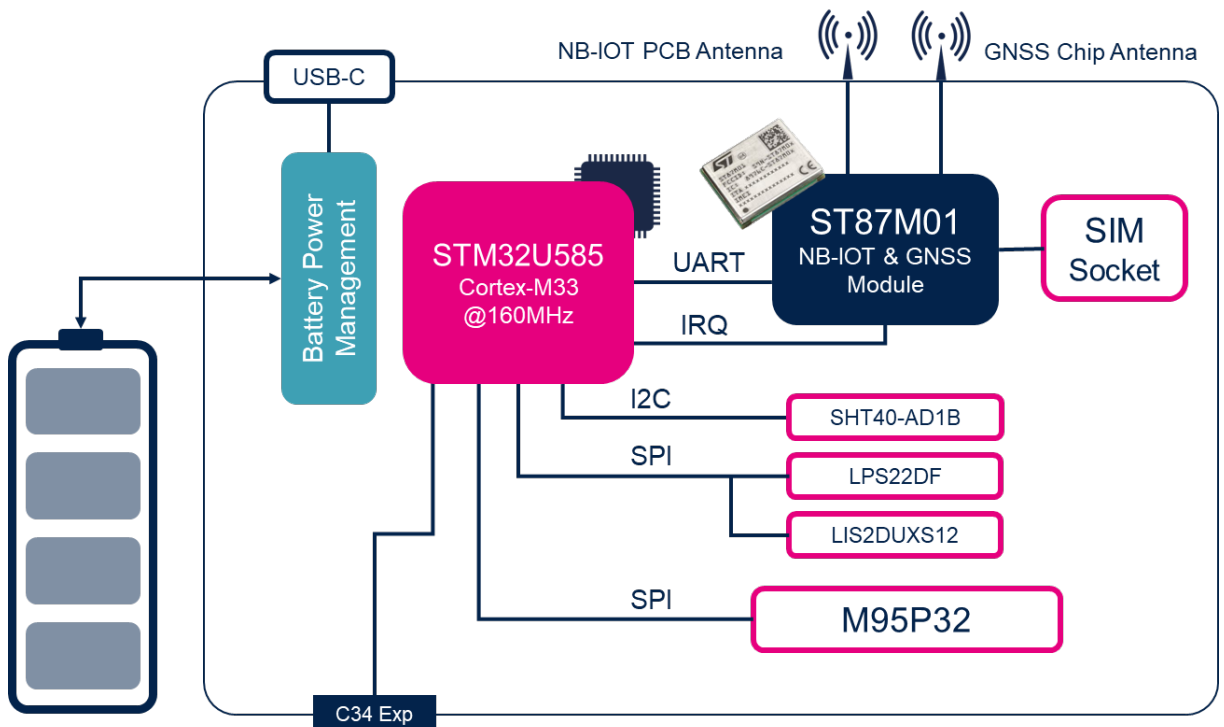
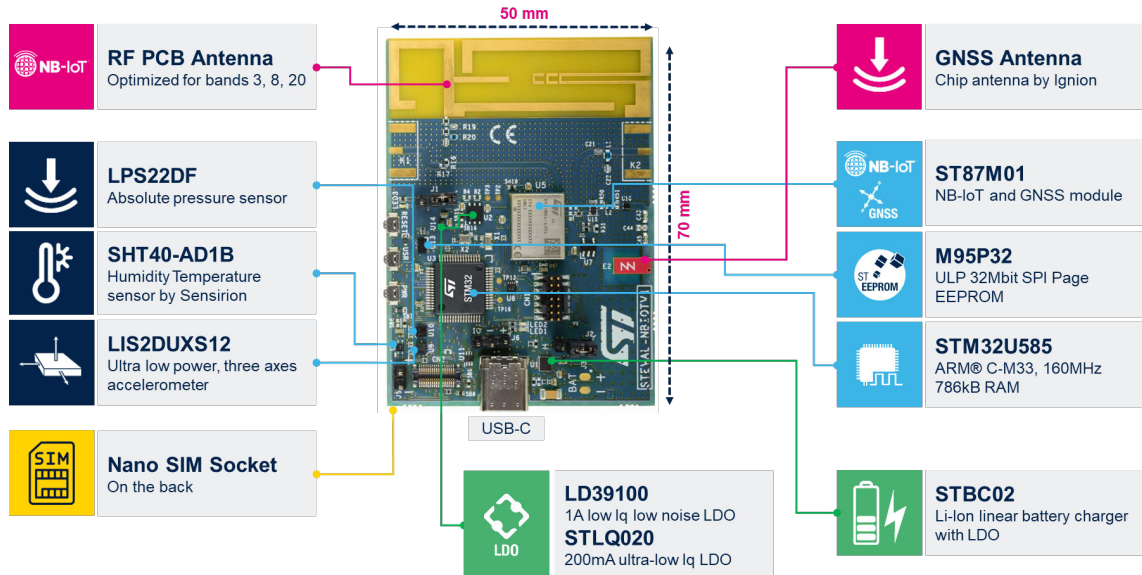


Figure 3. STEVAL-NBIOTV1 board



### 3 Main components

**Figure 4. Board components**


#### 3.1 ST87M01

Ultra compact, low-power NB-IoT industrial module series with GNSS capability.

The **ST87M01** is a high-performance module with ultralow power consumption, NB-IoT (LTE Cat NB2) 3GPP Release 15, and GNSS certified module family.

The ST87M01 module family supports multi-frequency bands with extended multi-regional coverage, enabling almost complete worldwide NB-IoT data communication.

Moreover, the ST87M01 supports additional communication standards, i.e. the GNSS receiver enables support of multiple satellite constellations to address high-accuracy localization applications, the wireless M-BUS mode allows support of a backup/service communication channel typically used in metering communications, and the Wi-Fi positioning feature enables fast, low-consumption location services using nearby 802.11b when used with a third-party geocoding provider.

In addition, the ultra-compact module form factor makes the ST87M01 family the perfect choice for size-critical applications, allowing for miniaturization. In fact, ultra-compactness is a crucial characteristic addressed by the ST87M01 family, which is presented in an LGA package of only 10.6 mm x 12.8 mm with 51 pins.

Furthermore, thanks to its ultralow power consumption and industrial qualification grade over the industrial temperature range, the ST87M01 family represents the best choice for a wide range of IoT applications, ranging from smart grids, energy smart metering, smart city, factory automation, industrial IoT and asset tracking to any smart monitoring application meeting Low Power Wide Area Network (LPWAN) communication requirements.

ST may update the firmware provided with the modules at any time. The pre-loaded version by ST must be checked by the customer before going to production, to verify if a newer version is available. The available version to load may be requested directly from the ST sales office or found at [www.st.com/en/wireless-connectivity/st87m01.html](http://www.st.com/en/wireless-connectivity/st87m01.html).

ST recommends that users regularly check for documentation and the current firmware version available at [www.st.com/en/wireless-connectivity/st87m01.html](http://www.st.com/en/wireless-connectivity/st87m01.html).

Additionally, the ST87M01 family embeds PDU SMS service and internet protocols for NB-IoT products, including TCP/IP, TLS/DTLS, Co-AP, LwM2M, MQTT and HTTP/HTTPS, which enable a broad set of multiple IoT applications.

Lastly, full support of Power Saving Mode (PSM) and Extended Discontinuous Reception (eDRX) mechanisms, along with ultralow power silicon technology adoption and a dedicated interface to wake up module on interrupt basis, allow the ST87M01 family to achieve extra-long battery life on a single-cell primary battery.

The ST87M01 family is designed and qualified according to industrial grade. Each manufactured module is fully tested, traced and satisfies STMicroelectronics' stringent reliability and quality requirements.

## 3.2 STM32U585AI

The STM32U585xx devices belong to an ultra-low-power microcontrollers family (STM32U5 series) based on the high-performance Arm® Cortex®-M33 32-bit RISC core. They operate at a frequency of up to 160 MHz.

The Cortex®-M33 core features a single-precision FPU (floating-point unit), that supports all the Arm® single-precision data-processing instructions and all the data types.

The Cortex®-M33 core also implements a full set of DSP (digital signal processing) instructions and a MPU (memory protection unit) that enhances the application security.

The devices embed high-speed memories (2 Mbytes of flash memory and 786 Kbytes of SRAM), an FSMC (flexible external memory controller) for static memories (for devices with packages of 90 pins and more), two Octo-SPI flash memory interfaces (at least one QuadSPI available on all packages) and an extensive range of enhanced I/Os and peripherals connected to three APB buses, three AHB buses and a 32-bit multi-AHB bus matrix.

The devices offer security foundation compliant with the TBSA (trusted-based security architecture) requirements from Arm®. It embeds the necessary security features to implement a secure boot, secure data storage and secure firmware update. Besides these capabilities, the devices incorporate a secure firmware installation feature that allows the customer to secure the provisioning of the code during its production. A flexible lifecycle is managed thanks to multiple levels of readout protection and debug unlock with password. Firmware hardware isolation is supported thanks to securable peripherals, memories and I/Os, and privilege configuration of peripherals and memories.

The devices feature several protection mechanisms for embedded flash memory and SRAM: readout protection, write protection, secure, and hide protection areas.

The devices embed several peripherals reinforcing security: a fast AES coprocessor, a secure AES coprocessor with DPA resistance and hardware unique key that can be shared by hardware with fast AES, a PKA (public key accelerator) with DPA resistance, an on-the-fly decryption engine for Octo-SPI external memories, a HASH hardware accelerator, and a true random number generator.

The devices offer active tamper detection and protection against transient and environmental perturbation attacks, thanks to several internal monitoring generating secret data erase in case of attack. This helps to fit the PCI requirements for point of sales applications.

The devices offer one fast 14-bit ADC (2.5 Msps), one 12-bit ADC (2.5 Msps), two comparators, two operational amplifiers, two DAC channels, an internal voltage reference buffer, a low-power RTC, four 32-bit general-purpose timers, two 16-bit PWM timers dedicated to motor control, three 16-bit general-purpose timers, two 16-bit basic timers and four 16-bit low-power timers.

The devices support an MDF (multifunction digital filter) with six filters dedicated to the connection of external sigma-delta modulators. Another low-power digital filter dedicated to audio signals is embedded (ADF), with one filter supporting sound-activity detection. The devices embed also a Chrom-ART Accelerator dedicated to graphic applications, and mathematical accelerators (a trigonometric functions accelerator plus a filter mathematical accelerator). In addition, up to 22 capacitive sensing channels are available.

The devices also feature standard and advanced communication interfaces such as: four I<sup>2</sup>Cs, three SPIs, three USARTs, two UARTs, one low-power UART, two SAls, one digital camera interface (DCMI), two SDMMCs, one FDCAN, one USB OTG full-speed, one USB Type-C /USB Power Delivery controller, and one generic synchronous 8-/16-bit PSSI (parallel data input/output slave interface).

The devices operate in the -40 to +85°C (+105°C junction) and -40 to +125°C (+130°C junction) temperature ranges from a 1.71 to 3.6 V power supply.

A comprehensive set of power-saving modes allow the design of low-power applications. Many peripherals (including communication, analog, timers, and audio peripherals) can be functional and autonomous down to Stop mode with direct memory access, thanks to LPBAM support (low-power background autonomous mode).

Some independent power supplies are supported like an analog independent supply input for ADC, DACs, OPAMPs and comparators, a 3.3 V dedicated supply input for USB and up to 14 I/Os that can be supplied independently down to 1.08 V. A VBAT input is available for connecting a backup battery in order to preserve the RTC functionality and to backup 32 32-bit registers and 2-Kbyte SRAM.

The devices offer eight packages from 48 to 169 pins.

### 3.3 LIS2DUXS12

Ultralow power 3-axis smart accelerometer with Qvar, AI, antialiasing filter, and advanced digital features.

The LIS2DUXS12 is a smart, digital, 3-axis linear accelerometer whose MEMS and ASIC have been expressly designed to combine the lowest supply current possible with features such as always-on antialiasing filtering, a finite state machine (FSM) and machine learning core (MLC) with adaptive self-configuration (ASC), and an analog hub / Qvar sensing channel.

The FSM and MLC with ASC deliver outstanding always-on, edge processing capabilities to the LIS2DUXS12, while the analog hub / Qvar sensing channel defines a new degree of system optimization. The LIS2DUXS12 MIPI I3C<sup>®</sup> slave interface and embedded 128-level FIFO buffer complete a set of features that make this accelerometer a reference in terms of system integration from a standpoint of the bill of materials, processing, or power consumption.

The LIS2DUXS12 has user-selectable full scales of  $\pm 2\text{ g}/\pm 4\text{ g}/\pm 8\text{ g}/\pm 16\text{ g}$  and is capable of measuring accelerations with output data rates from 1.6 Hz to 800 Hz.

The device has a dedicated internal engine to process motion and acceleration detection including free-fall, wake-up, single/double/triple-tap recognition, activity/inactivity, and 6D/4D orientation.

The LIS2DUXS12 is available in a small thin plastic, land grid array (LGA) package, and it is guaranteed to operate over an extended temperature range from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

### 3.4 LPS22DF

Low-power and high-precision MEMS nano pressure sensor: absolute digital output barometer from 260 to 1260 hPa.

The LPS22DF is an ultracompact, piezoresistive, absolute pressure sensor that functions as a digital output barometer. The LPS22DF provides lower power consumption, achieving lower pressure noise than its predecessor.

The device comprises a sensing element and an IC interface that communicates over an I<sup>2</sup>C, MIPI I3C<sup>SM</sup>, or SPI interface from the sensing element to the application and supports a wide V<sub>dd</sub> IO range for the digital interfaces as well. The sensing element, which detects absolute pressure, consists of a suspended membrane manufactured using a dedicated process developed by ST.

The LPS22DF is available in a full-mold, holed LGA package (HLGA). It is guaranteed to operate over a temperature range extending from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ . The package is holed to allow external pressure to reach the sensing element.

### 3.5 M95P32

Ultralow power 32-Mbit serial SPI page EEPROM with dual and quad outputs.

The M95P32-I and M95P32-E are manufactured with ST's advanced proprietary NVM technology. They offer byte flexibility, page alterability, high page cycling performance, and ultralow power consumption, equivalent to that of EEPROM technology.

The devices are a 32-Mbit SPI page EEPROM, organized as 8192 programmable pages of 512 bytes each, accessed through an SPI bus with high-performance dual- and quad-SPI outputs.

The devices offer two additional (identification) 512-byte pages:

- The first contains identification data and, upon request, the UID.
- The second can be used to store sensitive application parameters, which can later be permanently locked in read-only mode.

Additional status, configuration, and volatile registers set the desired device configuration, while the safety register provides information on the device status.

The M95P32-I operates with a supply voltage from 1.6 to 3.6 V over an ambient temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ . The M95P32-E offers an extended range of temperature of  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$ . The device supports a clock frequency of up to 80 MHz.

The M95P32-I and M95P32-E offer byte and page write instructions of up to 512 bytes. Write instructions consist in self-timed auto erase and program operations, resulting in flexible data byte management.

The devices also accept page, block, sector, and chip erase commands to set the memory to an erased state.

The memory can then be fast-programmed by 512-byte pages, and further optimized using the page program with buffer load instruction to hide the SPI communication latency.

### 3.6 **STBC02AJR**

Li-Ion linear battery charger with LDO, load switches, and reset generator.

The **STBC02** is a highly integrated power management, embedding a linear battery charger, a 150 mA LDO, 2 SPDT load switches, a smart reset/watchdog block and a protection circuit module (PCM) to prevent the battery from being damaged under fault conditions.

The **STBC02** uses a CC/CV algorithm to charge the battery; the fast charge and the pre-charge current can be both independently programmed using dedicated resistors. The termination current is set by default, being 5% of the programmed fast charge current, but it can also be fixed to different values. Likewise, the battery floating voltage value is programmable and can be set to a value up to 4.45 V.

The **STBC02** also features a charger enable input to stop the charging process anytime.

The **STBC02** is automatically powered off from the connected battery when the IN pin is not connected to a valid power source (battery mode).

A battery under/overtemperature condition can be detected by using an external circuitry (NTC thermistor).

The **STBC02** draws less than 10 nA from the connected battery in shipping mode conditions, so to maximize the battery life during end product shelf life. The device is available in the Flip Chip 30 package.

### 3.7 **LD39100**

Automotive grade 1 A, low quiescent current, and low-noise voltage regulator.

The **LD39100** provides 1 A maximum current with an input voltage range from 1.5 V to 5.5 V and a typical dropout voltage of 200 mV. The device is stable with ceramic capacitors on the input and output.

The ultra-low dropout voltage, low quiescent current and low-noise features make it suitable for low power battery-powered applications. Power supply rejection is 70 dB at low frequency and starts to roll off at 10 kHz.

Enable logic control function puts the **LD39100** in shutdown mode, allowing a total current consumption lower than 1  $\mu$ A. The device also includes short-circuit constant current limiting and thermal protection.

**LD39100** is available also in AEC-Q100 qualified version, in the DFN6 (3x3 mm) with wettable flank package.

### 3.8 **STLQ020**

200 mA ultralow quiescent current LDO.

The **STLQ020** is a 200 mA low-dropout voltage regulator, able to work with an input voltage ranging from 2 V to 5.5 V.

The typical dropout voltage at maximum load is 160 mV.

The ultra-low quiescent current, which is just 0.3  $\mu$ A at no load, extends battery-life of applications requiring very long standby time.

Even though the device intrinsic consumption is ultra-low, **STLQ020** is able to provide fast transient response and good PSRR performance, thanks to its adaptive biasing circuit.

Enable pin puts the **STLQ020** in shutdown mode, reducing total current consumption to 5 nA.

The **STLQ020** is designed to keep the quiescent current under control and at a low value also during dropout operation, helping to extend even more the operating time of battery-powered devices.

It also includes short-circuit constant-current limiting and thermal protection.

Several small package options are available.

### 3.9 **USB connector**

The USB Type-C® connector on the board can be used for both power supply and data transfer (USB device only). Different examples of USB class implementations can be found in STM32 software packages.

## 4 Power management

The board includes a range of power management features that enable ultralow power consumption in final applications.

Different sources can supply the board:

- V\_USB: through the USB Type-C® connector (sink only, 5 V).
- VIN: through the J5 connector (from 4.8 to 5.5 V).

**Important:** Limit the current on this port to 2 A.

- VBAT: lithium-ion polymer battery (3.7 V, 480 mAh). Thanks to the integrated STBC02 battery charger, the battery is automatically recharged when the USB cable is plugged in.

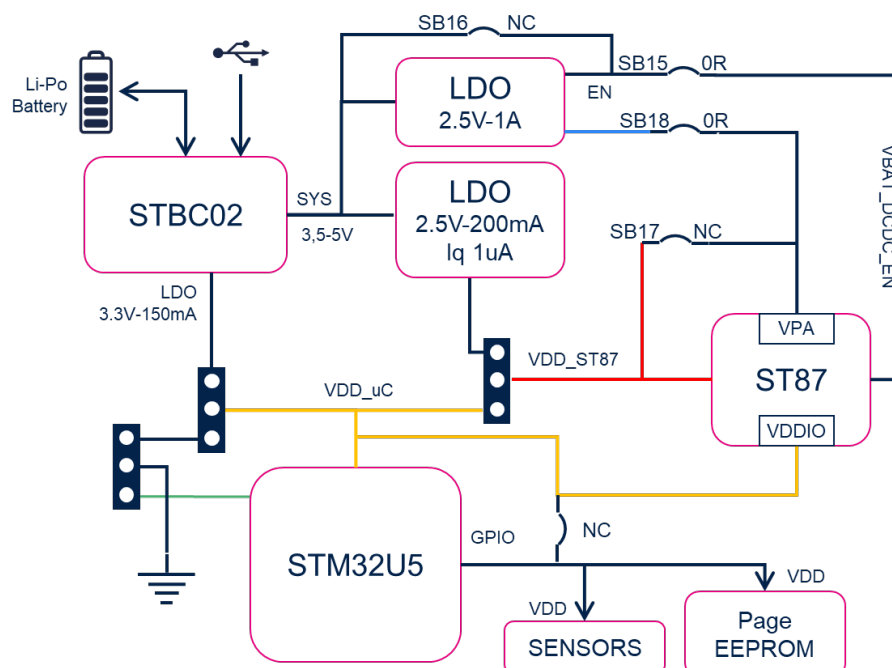
There are different power supply configurations that can be selected by setting jumpers (J1, J2) and solder bridges (SB15/SB16, SB17/SB18) to select different power supply modes:

- Default: power is supplied from the battery, USB, or J5 connector. Two LDOs are used to ensure the best power supply performance.
- Single LDO: power is supplied from the battery, USB, or J5 connector using a single LDO to optimize the bill of materials, therefore reducing cost.
- Direct external power supply: power is supplied directly from the CON3 connector, bypassing the onboard LDOs.

**Table 1. STEVAL-NBIOTV1 power supply - configurations settings**

Power supply configuration	J1	J2	SB15 / SB16	SB17 / SB18	Description
Default	1 - 2	1 - 2	Close / Open	Open / Close	Power supply from Battery, USB or J5. Dual LDO for best power consumption.
Single LDO	OPEN	1 - 2	Open / Close	Close / Close	Power supply from Battery, USB or J5. Single LDO for BOM optimization.
Direct external power supply	2 - 3	2 - 3	-	Close / Open	Direct power supply from CON3 connector. Onboard LDOs are not used.

**Figure 5. STEVAL-NBIOTV1 power supply - block diagram**



## 4.1 Battery connectors

The battery supply voltage (VBAT) may be provided by connecting the 480 mA LiPo battery included in the STEVAL-STWINBX1 kit to the dedicated battery connector (BATT1).

Figure 6. BATT1 connector

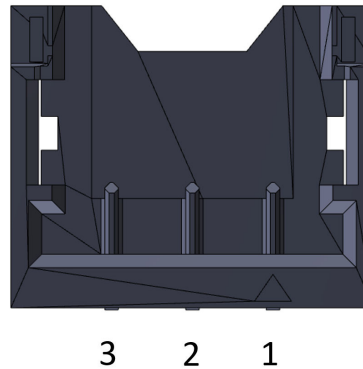


Table 2. BATT1 connector pins and signals

Signal	BATT1 connector
GND	pin 1
BAT_NC	pin 2
VBAT	pin 3

## 4.2 Power On/Off procedure

If the STEVAL-NBIOTV1 core system board is not powered via battery, then the board turns on and off when you connect and disconnect an external supply.

Follow the steps below to power on and off the board when it is powered by a LiPo battery:

1. Push the power (PWR) button for about a second to turn on the board. The wake-up hardware feature of the STBC02 battery charger manages the power on.
2. Push the power button again to turn the board off. STM32 manages the power off feature via software. Thus, the application code running on STM32 needs to detect the push action in order to send the shutdown command to the battery charger to switch the power supply off.

## 4.3 34-pin expansion connector

The STEVAL-NBIOTV1 board also features a high current board-to-FPC/board-to-board (0.4 mm pitch) 34-pin connector. This connector is shared among a few other evaluation kits, such as STEVAL-STWINBX1, and it allows to expanding the platform's functionality.

Table 3. Flexible expansion connector pins

Pin no.	Description	STM32 pin	Signal
1	GND	-	-
2	GND	-	-
3	Not used	-	-
4	VCONN	-	5 V / SYS
5	SPIx_MOSIs	-	-
6	V REG1	-	3V3_Ext
7	USART_CTS	-	-
8	I2Cz_SDA	PB4	I2C3_SDA

Pin no.	Description	STM32 pin	Signal
9	USART_TX	PA9	USART1_TX
10	INT/I2Cz_SMB	PB2	INT_EX
11	USART_RX	PA10	USART1_RX
12	RESET	PC7	-
13	USART_RTS	-	-
14	ADC	PA5	-
15	Not used	-	-
16	PWM	PC6	TIM3_PWM
17	GPIO3_EX	PA4	-
18	GPIO2_EX	PC13	-
19	SPIx_NSS	PC4	SPI1_NSS
20	Not used	-	-
21	SPIx_MOSIp	PA7	SPI1_MOSI
22	GPIO1/SAI1_SCK	-	-
23	SPIx_MISOp	PA6	SPI1_MISO
24	GPIO2/SAI1_FS	-	-
25	SPIx_SCK	PA1	SPI1_SCK
26	GPIO3/SAI1_SD	-	-
27	I2Cz_SCL	PC0	I2C3_SCL
28	GPIO4/SAI1_MCLK	-	-
29	V REG2	-	3V3_Ext
30	SPIx_MISOs	-	-
31	VCONN	-	SYS
32	Not used	-	-
33	GND	-	-
34	GND	-	-

## 5 STM32 programming/debugging

The board does not include an STM32 debugger/programmer. A compatible debugger can be purchased separately. The recommended part number is [STLINK-V3MINIE](#) or, alternatively, [STLINK-V3SET](#).

An STLINK is mandatory to debug, but if the only need is to download a binary to the STM32, it is possible to do it through the USB interface (DFU mode).

### 5.1 How to program STEVAL-NBIOTV1 in USB mode

This is the easiest mode if you just want to download a binary into the board via USB, without the need of any debugging capabilities.

The advantage is that no additional debugger is needed, just a USB Type C™ cable and [STM32CubeProgrammer](#) installed on your PC.

To enter the "Firmware upgrade" mode, follow the procedure below.

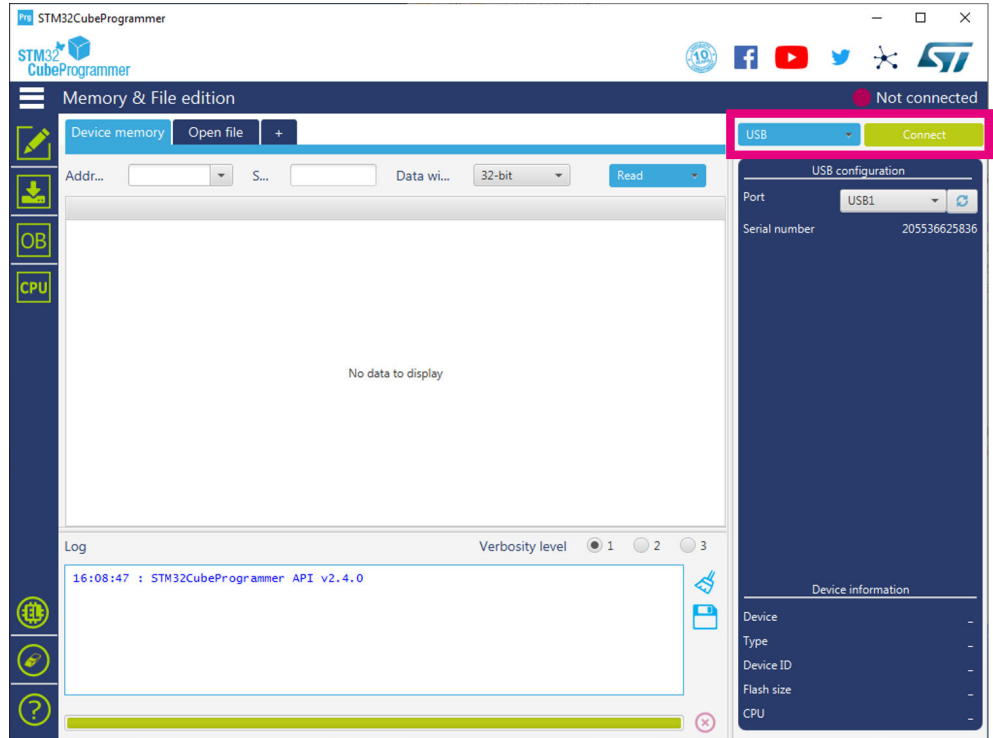
- Step 1.** Plug the board.
- Step 2.** Press the RESET button and, while keeping the button pressed, press the USER button.
- Step 3.** Release the RESET button and then release the USER button.  
The board starts in the DFU mode and should be automatically recognized by the PC.

**Step 4.** You can upgrade the firmware by following the steps below:

**Step 4a.** Open STM32CubeProgrammer.

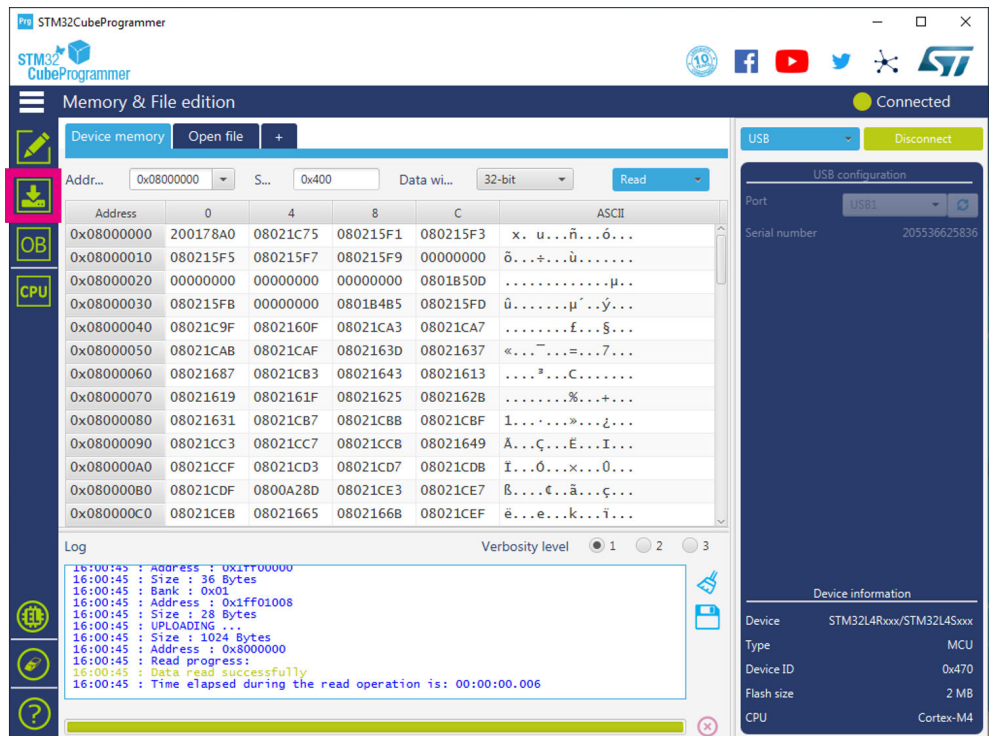
**Step 4b.** Select [USB] on the top-right corner.

**Figure 7. STM32CubeProgrammer - USB mode selection**



**Step 4c.** Click on [Connect].

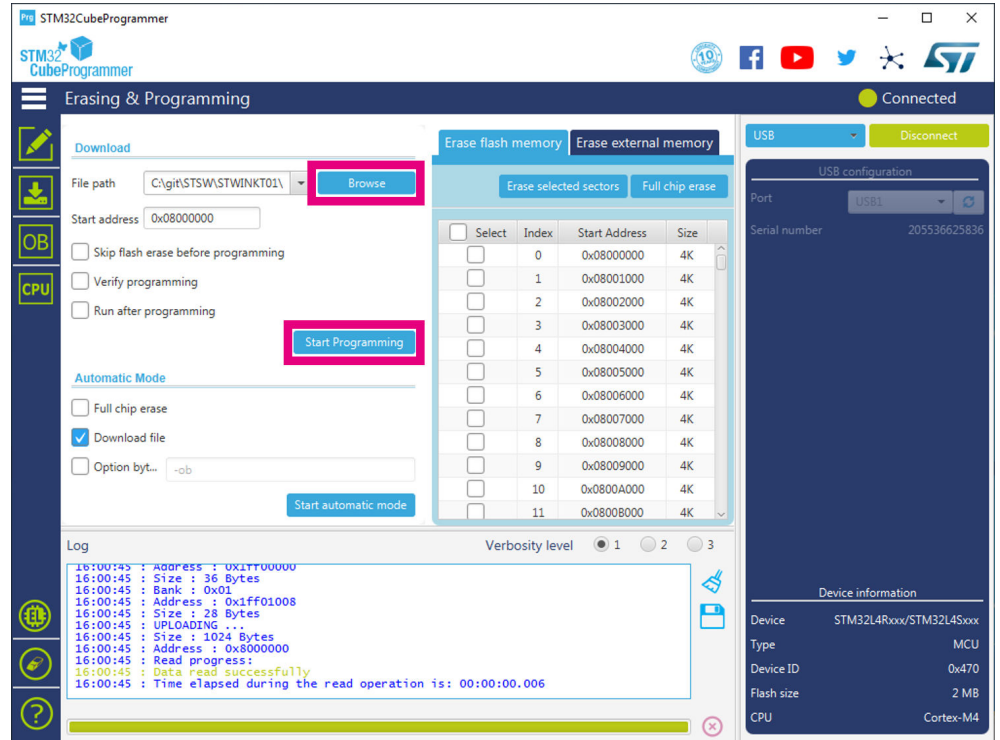
**Figure 8. STM32CubeProgrammer - connection**



**Step 4d.** Go to the [Erasing & Programming] tab.

- Step 4e. Search for the new .bin or .hex binary file to be flashed into the board.
- Step 4f. Click on [Start Programming].

Figure 9. STM32CubeProgrammer - programming



## 5.2 How to program STEVAL-NBIOTV1 with an external debugger

The STEVAL-NBIOTV1 programming connector (STDC14) is natively compatible with the STLINK-V3 debugger family (STLINK-V3SET or STLINK-V3MINIE).

*Note:* STLINK-V3 programmers are not included in the kit.

A set of preconfigured software examples can be found here: [STSW-ST87M01APP](#).

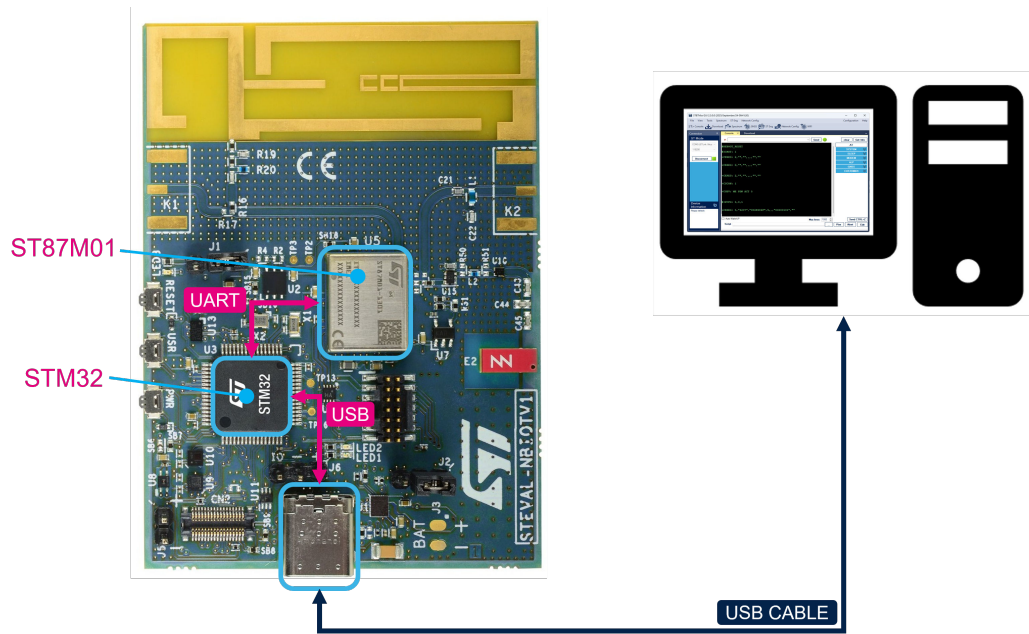
Once hardware connections are in place, you can either download one of the sample application binaries provided using STM32CubeProgrammer or recompile and flash memory one of the provided projects with STM32CubeIDE.

## 6 Default application

STM32U585AI is programmed by default with a simple firmware that acts as a bridge between the module's serial interface and the board's USB. The STM32U585AI firmware forwards any byte received from the PC via USB to the module, and vice versa.

This setup enables the user to interact directly with the radio module using either the provided ST87Mxx graphical user interface (STSW-ST87MGUI) or any generic serial terminal software to manually send AT commands to the module.

Figure 10. Default application block diagram



## 7 RF Specifications

### Cellular Radio Access Technology

- LTE Cat NB2, 3GPP Release 15
- LTE FDD Certified Frequency Bands B1, B3, B5, B8, B20, B28 selected for GCF certification

### Transmit Power:

- Class-3: +23 dBm

### Data Transmission

- Single-Tone: DL: 26 kbps, UL: 16 kbps
- Multi-Tone: DL: 26 kbps, UL: 66 kbps
- Extended TBS and 2 HARQ (Cat NB2): DL: 127 kbps, UL: 159 kbps

### LTE network-based positioning support

- Optional A-GNSS: GPS, Galileo, optimized concurrent mode
- Optional Wi-Fi positioning for IEEE 802.11b hot spots

### Typical Power Supply range

- VIO: 1.8 V to 3.3 V
- VPMU\_x/VDCDC/VPA: 2.2 to 3.0 V
- Industrial grade: -40°C to +85°C

8 PCB

Figure 11. STEVAL-NBIOTV1 (front)

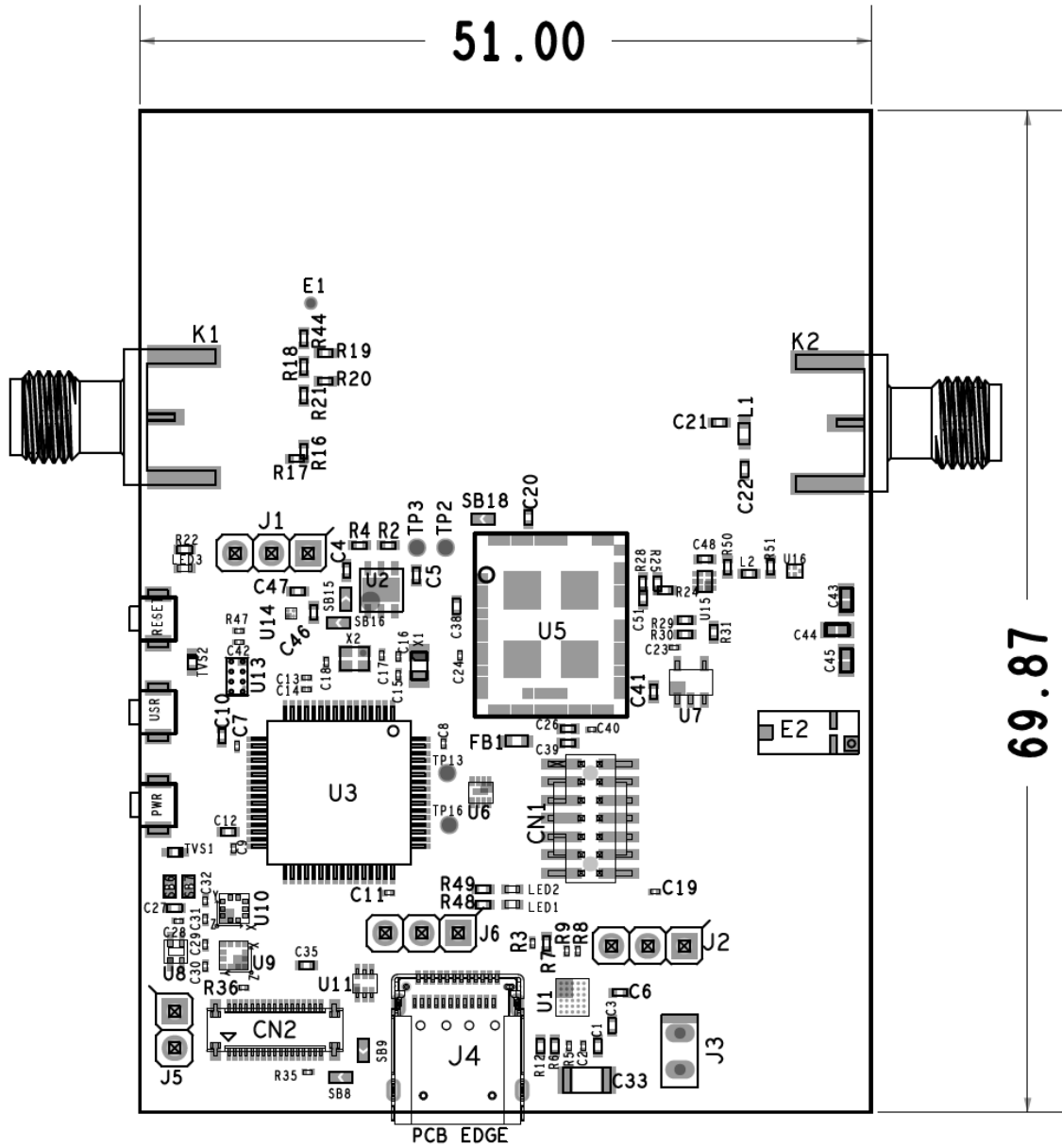
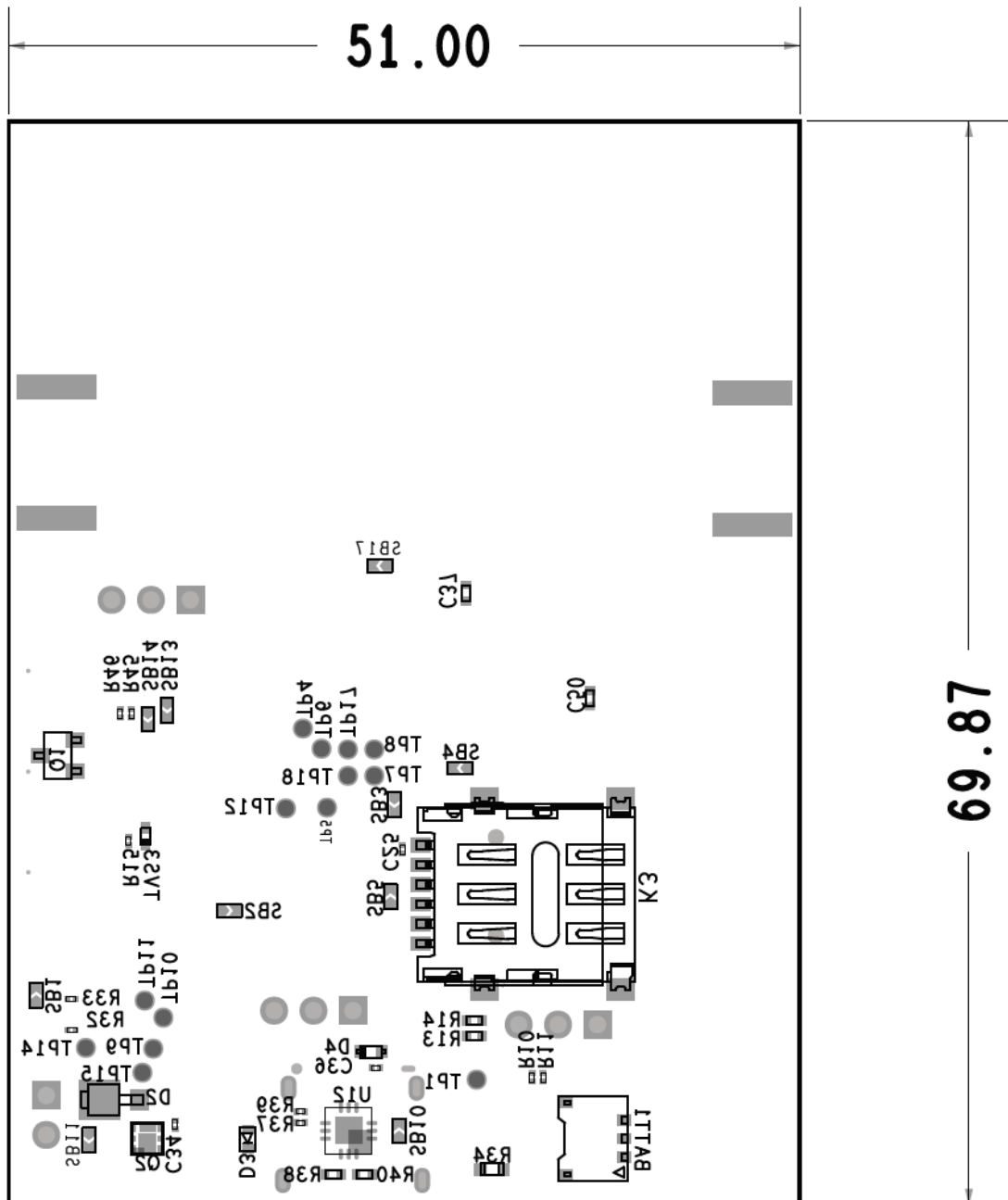


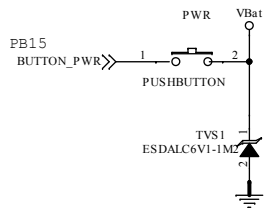
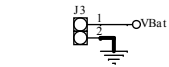
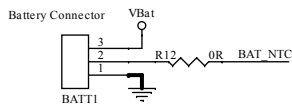
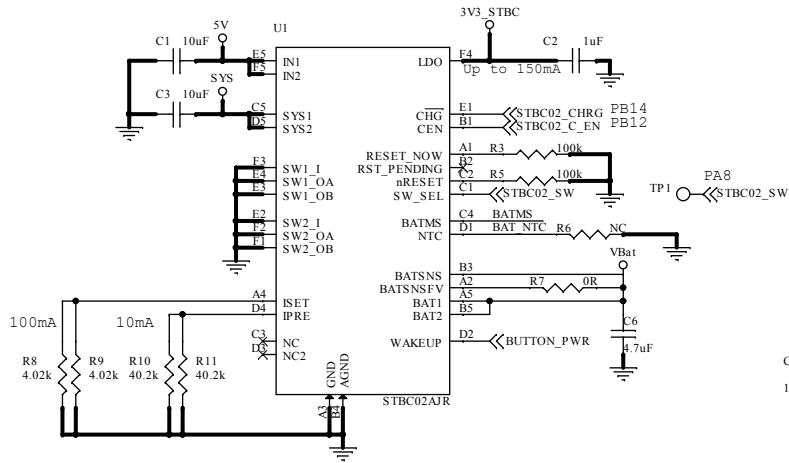
Figure 12. STEVAL-NBIOTV1 (back)



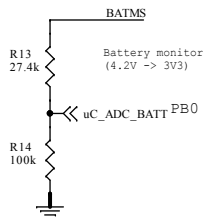
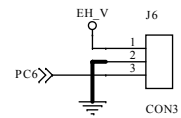
# 9 Schematic diagrams

Figure 13. STEVAL-NBIOTV1 circuit schematic (1 of 5)

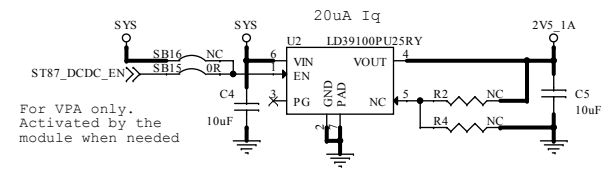
## Battery management



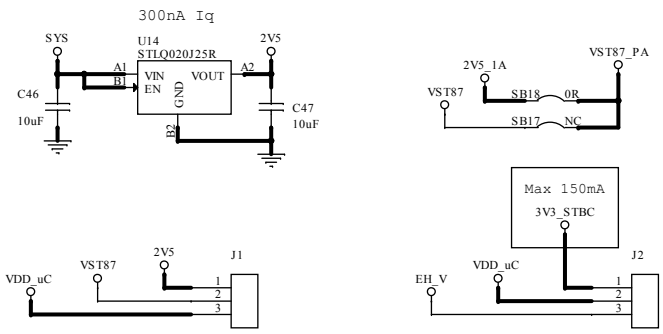
## Direct External P. Supply



## 2V5 LDO (1A)



## 2V5 LDO (200mA)



P. Supply config	J1	J2	SB15/SB16	SB17/SB18	Description
Default	1-2	1-2	Close/Open	Open/Close	Power supply from Battery/USB/J5. Dual LDO for best power supply performance.
Single LDO	OPEN	1-2	Open/Close	Close/Close	Power supply from Battery/USB/J5. Single LDO for BOM optimization.
Direct external power supply	2-3	2-3	-/-	Close/Open	Direct power supply from CON3 connector. Onboard LDOs are not used.

Other configurations are not recommended. Use at your own risk.



Figure 14. STEVAL-NBIOTV1 circuit schematic (2 of 5)

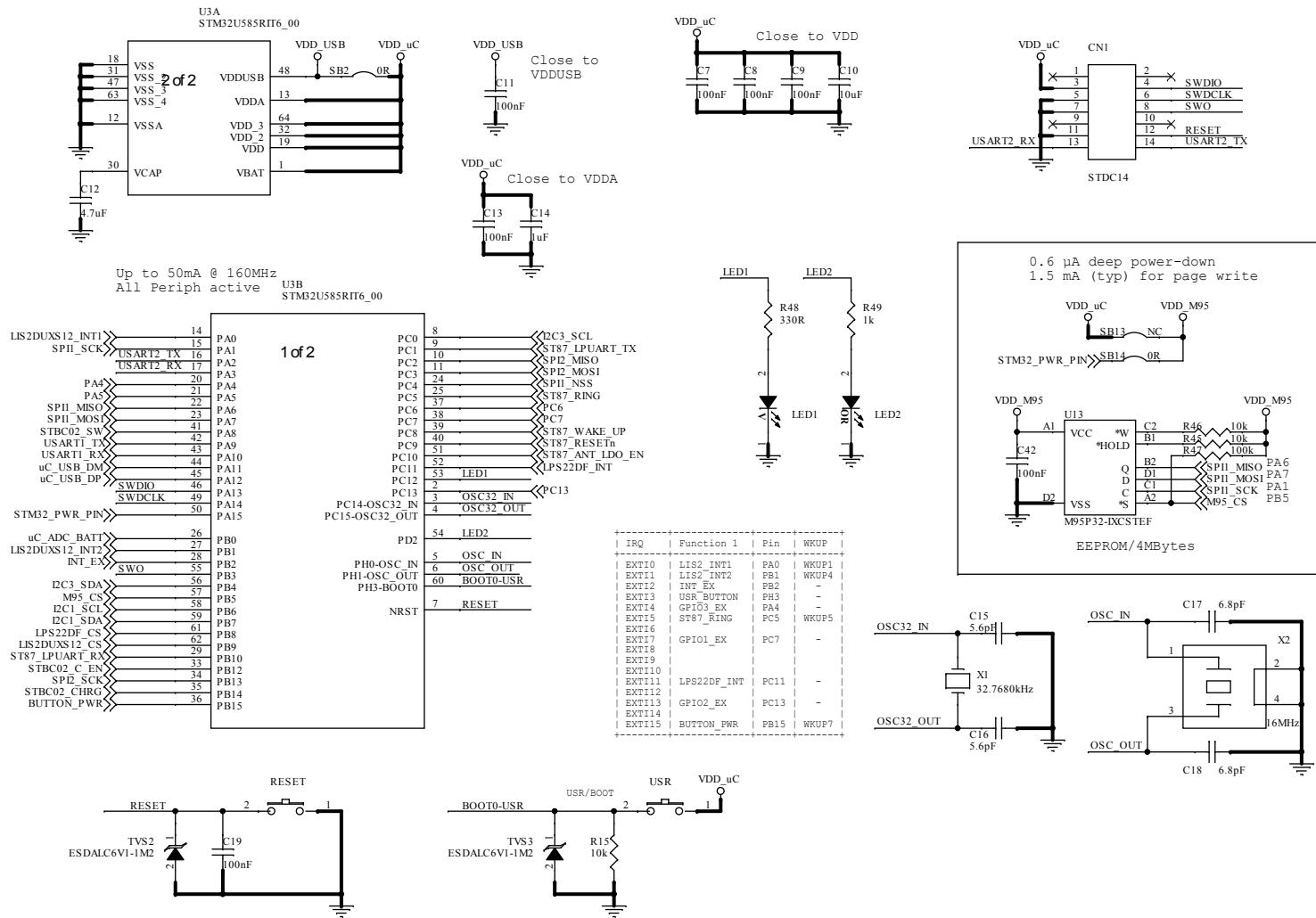


Figure 15. STEVAL-NBIOTV1 circuit schematic (3 of 5)

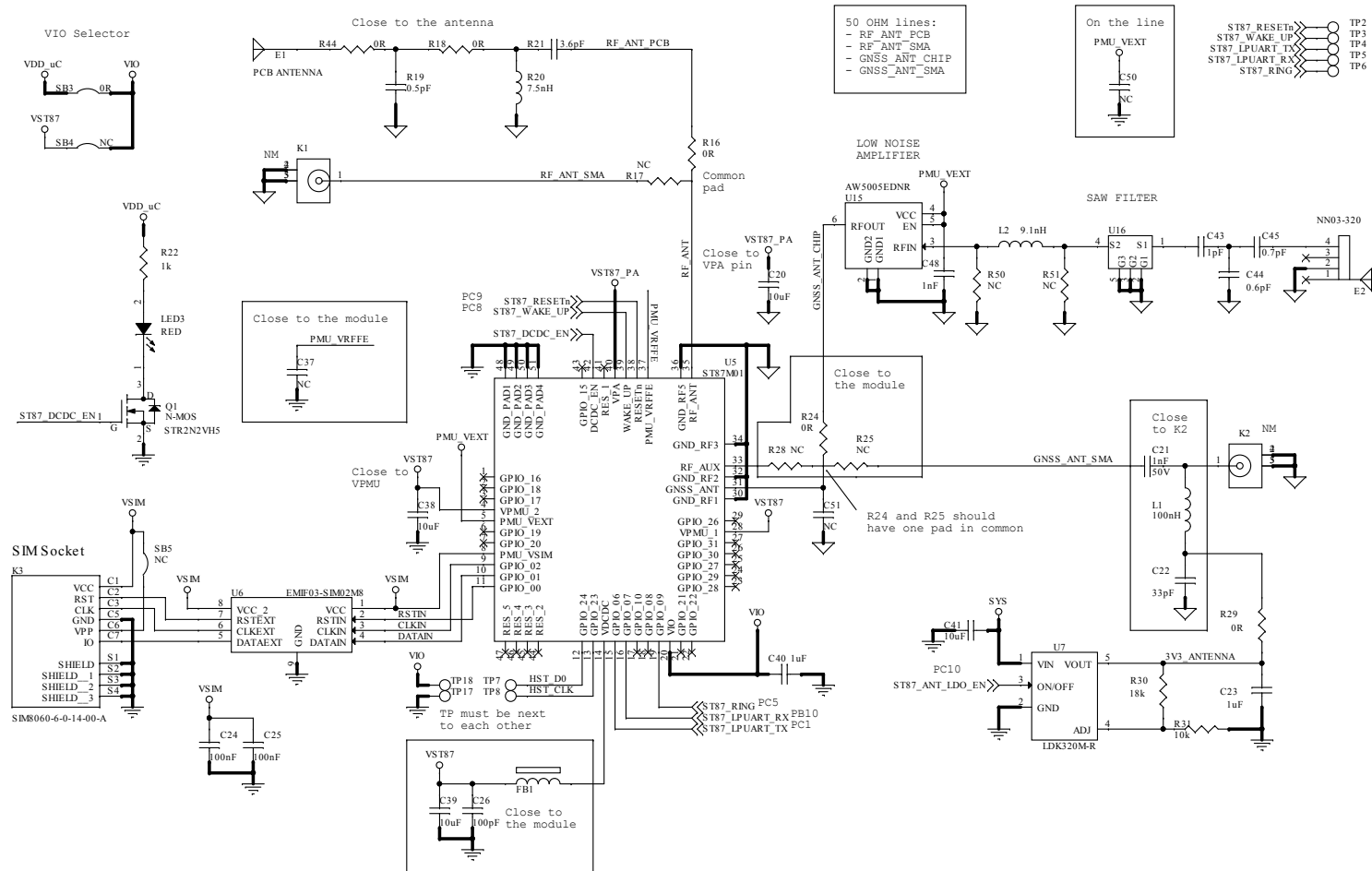
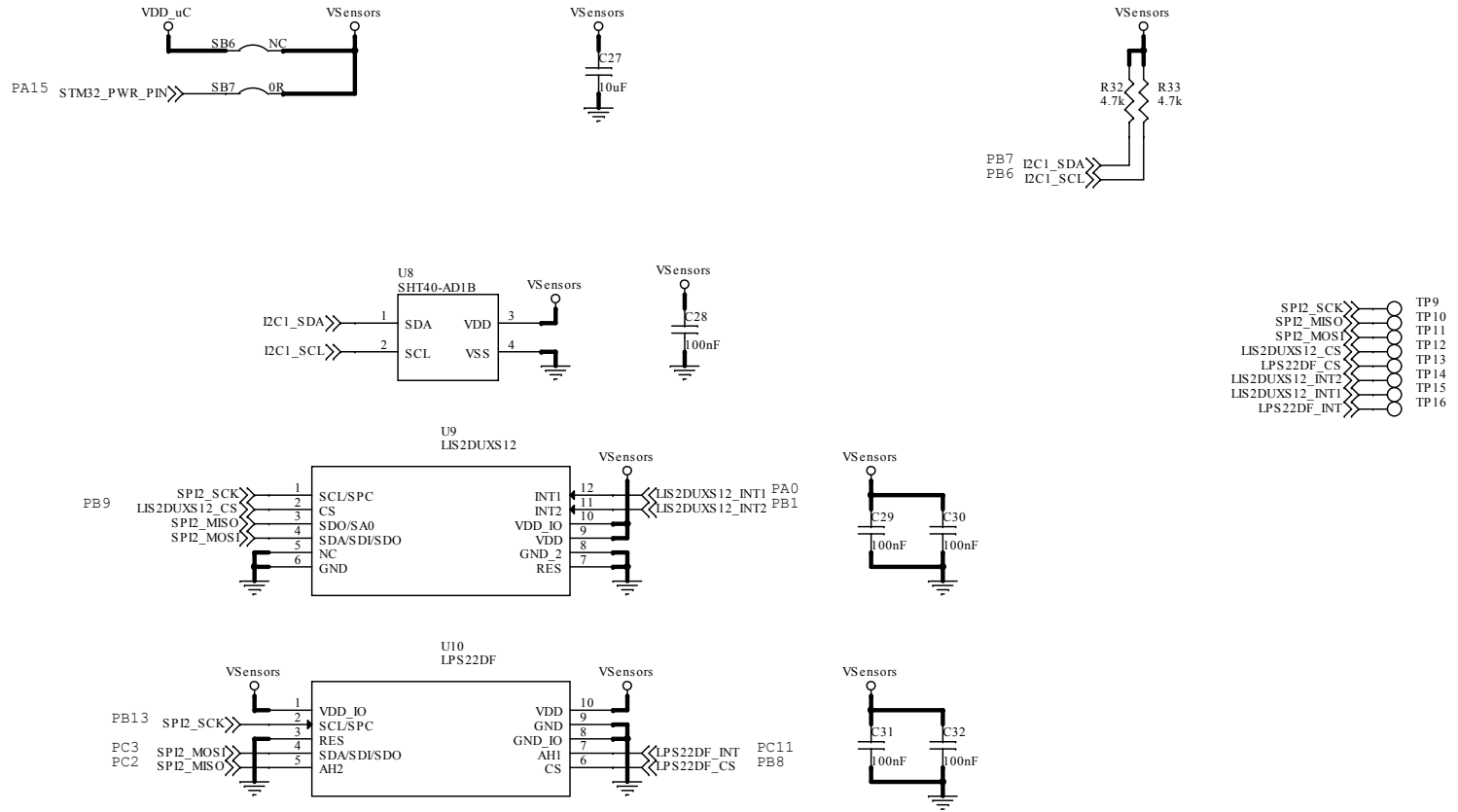


Figure 16. STEVAL-NBIOTV1 circuit schematic (4 of 5)



- SPI2\_SCK >> TP9
- SPI2\_MISO >> TP10
- SPI2\_MOSI >> TP11
- LIS2DUXS12\_CS >> TP12
- LPS22DF\_CS >> TP13
- LIS2DUXS12\_INT2 >> TP14
- LIS2DUXS12\_INT1 >> TP15
- LPS22DF\_INT >> TP16





## 10 Bill of materials

**Table 4. STEVAL-NBIOTV1 bill of materials**

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
1	1	BATT1	Battery Connector	Battery Connector Amass	Molex	78171-0003
2	1	CN1	STDC14	STDC14 - ARM MIPI10 compatible	Samtec	FTSH-107-01-L-DV-K-P
3	1	CN2	CON34-Socket	CONN SOCKET 34POS SMD GOLD	Panasonic Electric Works	AXF5G3412A
4	12	C1,C3,C4,C5,C10,C20,C27,C38,C39,C41,C46,C47	10uF	CAP CER 10UF 10V X5R 0402	Samsung Electro-Mechanics America, Inc.	CL05A106MP8N UB8
					WURTH ELEKTRONIK	885012105022
5	4	C2,C14,C23,C40	1uF	CAP CER 1UF 10V X5R 0201	Murata	GRM033R61A10 5ME44D
					WURTH ELEKTRONIK <sup>(1)</sup>	885012104007
6	2	C6,C12	4.7uF	CAP CER 4.7UF 10V X5R 0402	Murata	GRM155R61A47 5MEAAD
7	16	C7,C8,C9,C11,C13,C19,C24,C25,C28,C29,C30,C31,C32,C34,C36,C42	100nF	CAP CER 0.1UF 16V X5R 0201	Taiyo Yuden	EMK063BJ104K P-F
					WURTH ELEKTRONIK <sup>(1)</sup>	885012104001
8	2	C15,C16	5.6pF	CAP CER 5.6PF 10V C0G/NP0 0201	Murata	GJM0335C1E5R 6BB01D
					WURTH ELEKTRONIK <sup>(1)</sup>	885392004009
9	2	C17,C18	6.8pF	CAP CER 6.8PF 10V C0G/NP0 0201	Murata	GJM0335C1E6R 8BB01D
10	2	C21,C48	1nF	CAPACITOR SMD 0402 1nF 50V COG 5%	Murata	GRM1555C1H10 2JA01D
					WURTH ELEKTRONIK <sup>(1)</sup>	885012005067
11	1	C22	33pF	CAPACITOR SMD 0402 33pF 50V COG 5%	Taiyo Yuden	UMK105CG330J VHF
					WURTH ELEKTRONIK <sup>(1)</sup>	885012005058
12	1	C26	100pF	CAP CER 100PF 50V C0G/NP0 0402	WURTH ELEKTRONIK	WE 885012005013
13	1	C33	10n/1kV	CHIP CAP.CER. 10nF 1000V 10% X7R 1206	WURTH ELEKTRONIK	WE 885342208021
14	1	C35	NC	CAP CER 330pF (not mounted)	Any	Any

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
15	1	C37	NC	CAP CER 0402 18pF COG (not mounted)	Murata	GRM1555C2A18 0GA01D
16	1	C43	1pF	CAPACITOR SMD 0402 1pF 50V COG 5%	Murata	GJM1555C1H1R 0WB01
					WURTH ELEKTRONIK <sup>(1)</sup>	885392005005
17	1	C44	0.6pF	CAPACITOR SMD 0402 0.6pF 50V COG 5%	Murata	GJM1555C1HR6 0WB01
18	1	C45	0.7pF	CAPACITOR SMD 0402 0.7pF 50V COG 5%	Murata	GJM1555C1HR7 0WB01
					WURTH ELEKTRONIK <sup>(1)</sup>	885392005019
19	1	C49	NC	CAPACITOR SMD 0402 27pF COG (not mounted)	WURTH ELEKTRONIK	WE-8853920051 16
20	2	C50,C51	NC	CAP CER 0402 (not mounted)	Any	Any
21	1	D2	STPS120M, Stmite	Power Schottky rectifier (1A)	ST	STPS120M
22	1	D3	ESDA25P35-1U1 M, QFN-2L	High power transient voltage suppressor	ST	ESDA25P35-1U1 M
23	1	D4	BAT30KFILM, SOD523	DIODO SCHOTTKY 0.3A 30V BAT30KFILM SOD523	ST	BAT30KFILM
24	1	E1	PCB ANTENNA	(not mounted)		
25	1	E2	NN03-320	Ignion Chip Antenna	Ignion	NN03-320
26	1	FB1	FERRITE	Ferrite WE-CBF 0603 550MHz 140Ohm 550mA	WURTH ELEKTRONIK	WE 742792621
27	3	J1,J2,J6	CON3	2.54 TH Jumper	Samtec	TSW-103-07-G-S
					WURTH ELEKTRONIK <sup>(1)</sup>	61300311121
28	1	J3	NC	Battery SMD PAD (not mounted)		
29	1	J4	12401598E4#2A	CONN. USB 3.0 F/90°	Amphenol ICC	12401598E4#2A
30	1	J5	CON2	2.54 TH Jumper	Samtec	TSW-102-07-G-S
					WURTH ELEKTRONIK <sup>(1)</sup>	61300211121
31	2	K1,K2	WE 60312202114514	SMA JACK PCB EDGE 1,6mm (not mounted)	WURTH ELEKTRONIK	WE 60312202114514
32	1	K3	SIM8060-6-0-14- 00-A	Nano SIM Card Connector	GCT	SIM8060-6-0-14- 00-A

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
33	1	LED1	KPHHS-1005MG CK	GREEN LED	Kingbright	KPHHS-1005MG CK
					WURTH ELEKTRONIK <sup>(1)</sup>	150040VS73240
34	1	LED2	SML- P12DTT86R	ORANGE LED	Rohm Semiconductor	SML- P12DTT86R
35	1	LED3	RED	RED LED	Vishay Semiconductor Opto Division	VLMS1500- GS08
					WURTH ELEKTRONIK <sup>(1)</sup>	150040SS73240
36	1	L1	100nH	INDUCTOR 100nH	Murata	LQW18ANR10J0 0
					WURTH ELEKTRONIK <sup>(1)</sup>	744917210
37	1	L2	9.1nH	INDUCTOR 9.1NH 540MA 0.14OHM	Murata	LQW15AN9N1G 00D
38	3	USR,RESET,PWR	PUSHBUTTON	TACTILE SWITCH, SIDE ACTUATED, SMD	Omron Electronics	B3U-3000P-B
39	1	Q1	STR2N2VH5, SOT-23	Enhancement Mode Field Effect	ST	<a href="#">STR2N2VH5</a>
40	1	Q2	STL6N3LLH6, PowerFLAT 2x2	MOSFET N-CH 30V PWRFLT2X2	ST	<a href="#">STL6N3LLH6</a>
41	1	R2	NC	RES SMD 24.3k OHM 0402	Yageo	RT0402FRE0724 K3L
42	3	R3,R5,R47	100k	RES SMD 100K OHM 0201	Yageo	RC0201FR-7D10 0KL
43	1	R4	NC	RES SMD 11.5k OHM 0402	Yageo	RT0402FRE0711 K5L
44	1	R6	NC	RES SMD 10K OHM 1% 1/16W 0402	Yageo	RC0402FR-0710 KL
					WURTH ELEKTRONIK <sup>(1)</sup>	560112110020
45	9	R7,R12,R16,R18,R24 ,R29,R38,R40,R44	0R	RES SMD 0 OHM 0402	Vishay Dale	CRCW04020000 Z0ED
					WURTH ELEKTRONIK <sup>(1)</sup>	560112110001
46	2	R8,R9	4.02k	RES SMD 4.02k OHM 0201	Yageo	RC0201FR-074K 02L
47	2	R10,R11	40.2k	RES SMD 40.2K OHM 0201	Yageo	RC0201FR-0740 K2L
48	1	R13	27.4k	RES SMD 27.4k OHM 0402	Yageo	RT0402FRE0727 K4L
49	1	R14	100k	RES SMD 100k OHM 0402	Yageo	AT0402FRE0710 0KL
					WURTH ELEKTRONIK <sup>(1)</sup>	560112110019

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
50	2	R15,R37	10k	RES SMD 10K OHM 1% 1/20W 0201	Yageo	RT0201FRE0710 KL
51	5	R17,R25,R28,R50,R51	NC	RES SMD 0 OHM 0402	Vishay Dale	CRCW04020000 Z0ED
					WURTH ELEKTRONIK <sup>(1)</sup>	560112110001
52	1	R19	0.5pF	Ceramic Capacitor 0.5pF	Murata	GJM1555C1HR5 0BB01D
					WURTH ELEKTRONIK <sup>(1)</sup>	885392005004
53	1	R20	7.5nH	Inductor 7.5nH 1.7A	Murata	LQW15AN7N5G 8ZD
54	1	R21	3.6pF	Ceramic Capacitor 3.6pF	Murata	GJM1555C1H3R 6BB01D
					WURTH ELEKTRONIK <sup>(1)</sup>	885392005044
55	2	R22,R49	1k	RES SMD 1K OHM 1% 1/16W 0402	Yageo	RC0402FR-071K L
					WURTH ELEKTRONIK <sup>(1)</sup>	560112110012
56	1	R30	18k	RES SMD 18k OHM 0402	Vishay Dale	CRCW040218K0 FKEDC
57	1	R31	10k	RES SMD 10K OHM 1% 1/16W 0402	Yageo	RC0402FR-0710 KL
					WURTH ELEKTRONIK <sup>(1)</sup>	560112110020
58	4	R32,R33,R35,R36	4.7k	RES SMD 4.7K OHM 1% 1/16W 0201	Yageo	RC0201FR-074K 7L
59	1	R34	1M	CHIP RES. 1M 0603 1/16W 1%	TE Connectivity Passive Product	CRGCQ0603J1 M0
					WURTH ELEKTRONIK <sup>(1)</sup>	560112116074
60	1	R39	2.7k	RES SMD 2.7K OHM 1% 1/16W 0201	Yageo	RC0201FR-072K 7L
61	2	R45,R46	10k	RES SMD 10K OHM 1% 1/20W 0201	Yageo	RC0201FR-7D10 KL
62	1	R48	330R	RES SMD 330 OHM 1% 1/16W 0402	Yageo	RC0402FR-0733 ORL
					WURTH ELEKTRONIK <sup>(1)</sup>	560112110231
63	11	SB1,SB2,SB3,SB7,SB8,SB9,SB10,SB11,SB14,SB15,SB18	0R	RES SMD 0 OHM 0402	Vishay Dale	CRCW04020000 Z0ED
64	6	SB4,SB5,SB6,SB13,SB16,SB17	NC	RES SMD 0 OHM 0402	Vishay Dale	CRCW04020000 Z0ED

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
65	18	TP1,TP2,TP3,TP4,TP5,TP6,TP7,TP8,TP9,TP10,TP11,TP12,TP13,TP14,TP15,TP16,TP17,TP18	TP	TEST POINT 1MM SMD PADSTASCK	Any	Any
66	3	TVS1,TVS2,TVS3	ESDALC6V1-1M2, SOD882	DIODO TVS TRANSIL UNIDIIR	ST	ESDALC6V1-1M2
67	1	U1	STBC02AJR, Chip Scale Package	Li-Ion Battery Charger	ST	STBC02AJR
68	1	U2	LD39100PU25R Y, DFN6	2.5V 1A low Iq and low noise LDO	ST	LD39100PU25R Y
69	1	U3	STM32U585RIT6 , LQFP64	Ultra-low-power with FPU Arm Cortex-M33 MCU	ST	STM32U585RIT6
70	1	U5	ST87M01-1301, SMD MODULE	Ultra-compact, low-power NB- IoT and GNSS Module	ST	ST87M01-1301
71	1	U6	EMIF03- SIM02M8, QFN-8L	3-line EMI filter and ESD protection for SIM card	ST	EMIF03- SIM02M8
72	1	U7	LDK320M-R, SOT23-5L	ADJUSTABLE_L DO	ST	LDK320M-R
73	1	U8	SHT40-AD1B	Humidity, Temperature	Sensirion	SHT40-AD1B
74	1	U9	LIS2DUXS12TR, LGA12L	Ultralow-power 3-axis smart accelerometer	ST	LIS2DUXS12TR
75	1	U10	LPS22DFTR, HLGA-10L	260-1260 hPa absolute digital output barometer	ST	LPS22DFTR
76	1	U11	USBLC6-2P6, SOT666	USB Protection	ST	USBLC6-2P6
77	1	U12	TCPP01-M12, QFN12	USB type-C port protection	ST	TCPP01-M12
78	1	U13	M95P32- IXCSTEF,WLCS P8	Ultra low-power 32 Mbit Page EEPROM	ST	M95P32- IXCST/EF
79	1	U14	STLQ020J25R, Flip-Chip4	200 mA ultra-low quiescent current LDO	ST	STLQ020J25R
80	1	U15	AW5005EDNR	Ultra-Low Noise Amplifier for Global Navigation	AWINIC	AW5005EDNR
81	1	U16	SAW Filter	SAW Filter	Murata	SAFFB1G57KE0 FOA
82	1	X1	32.7680kHz	32.768KHz Crystal	NDK	NX2012SA 32.768KHz EXS00A- MU00527

Item	Q.ty	Ref.	Part / Value	Description	Manufacturer	Order code
82	1	X1	32.7680kHz	32.768KHz Crystal	WURTH ELEKTRONIK <sup>(1)</sup>	830106545501
83	1	X2	16MHz	16MHz Crystal	NDK	NX2016SA 16 MHz EXS00A- CS07826
					WURTH ELEKTRONIK <sup>(1)</sup>	830108178109
84	2	Jumpers for J1,J2	Jumper	2pin 2.54mm Open Top Jumper Socket	Harwin	M7582-46
85	1	Battery		LiPo-752535	Himax	LiPo-752535
86	1	Single-Coated Urethane Foam Tape		3M 4726	3M	3M 4726
87	1	Plastic Case: Base + Cover			Protolabs	
88	1	SIM Card		Sim card + Flyer	WirelessLogic	
89	3	Screws for plastic case		Vite per plastica a testa cilindrica (croce) - L:8mm	Screwtek	STP310250080S
90	2	Light Pipes		Light Pipes - 3 x 12.7 mm - UL94- V0	Bivar	PLP2-500

1. Alternative manufacturer.

## 11 Board versions

Table 5. STEVAL-NBIOTV1 versions

PCB version	Schematic diagrams	Bill of materials
STV\$NBIOTV1A <sup>(1)</sup>	STV\$NBIOTV1A schematic diagrams	STV\$NBIOTV1A bill of materials

1. This code identifies the STEVAL-NBIOTV1 evaluation board first version. It is printed on the board PCB.

## 12 Regulatory compliance information

### Notice for the European Union

The evaluation kit STEVAL-NBIOTV1 is in conformity with the essential requirements of the Directive 2014/53/EU (RED) and of the Directive 2011/65/EU (RoHS II), including subsequent revisions and additions, as well as amended by the Delegated Directive 2015/863/EU (RoHS III). Applied harmonized standards are listed in the EU Declaration of Conformity. Compliance to EMC standards in Class A (industrial intended use).

This evaluation board is delivered with a factory-default "Transparent Bridge" firmware configuration. In this specific state, the board's compliance with the essential requirements of Article 3.3 (d) and (e) of Directive 2014/53/EU is ensured through the inherited certification of the integrated ST87M01 radio module. Any modification, reprogramming, or replacement of the factory-default firmware by the user or third parties may alter the device's behavior, data handling, and security features. Consequently, such actions void the manufacturer's original cybersecurity compliance assessment. The user (customer) assumes full responsibility for ensuring that any custom application logic, modified firmware, or final system integration complies with the applicable essential requirements of the Radio Equipment Directive (RED) and any other relevant cybersecurity regulations. The manufacturer shall not be held liable for non-compliance or security vulnerabilities resulting from unauthorized firmware modifications.

### Notice for the United Kingdom

The evaluation kit STEVAL-NBIOTV1 is in compliance with the relevant provisions of the following EU legislation recognized by the United Kingdom:

- Radio Equipment Regulations 2017 (S.I. 2017/1206 and amendments) implementing Directive 2014/53/EU (RED)
- The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (RoHS) (S.I. 2012/3032) implementing Directive 2011/65/EU (RoHS II), including subsequent revisions and additions, as well as amended by the Delegated Directive 2015/863/EU (RoHS III).

Applied harmonized standards are listed in the UK Declaration of Conformity. Compliance to EMC standards in Class A (industrial intended use).

## Revision history

**Table 6. Document revision history**

Date	Revision	Changes
16-Mar-2026	1	Initial release.

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