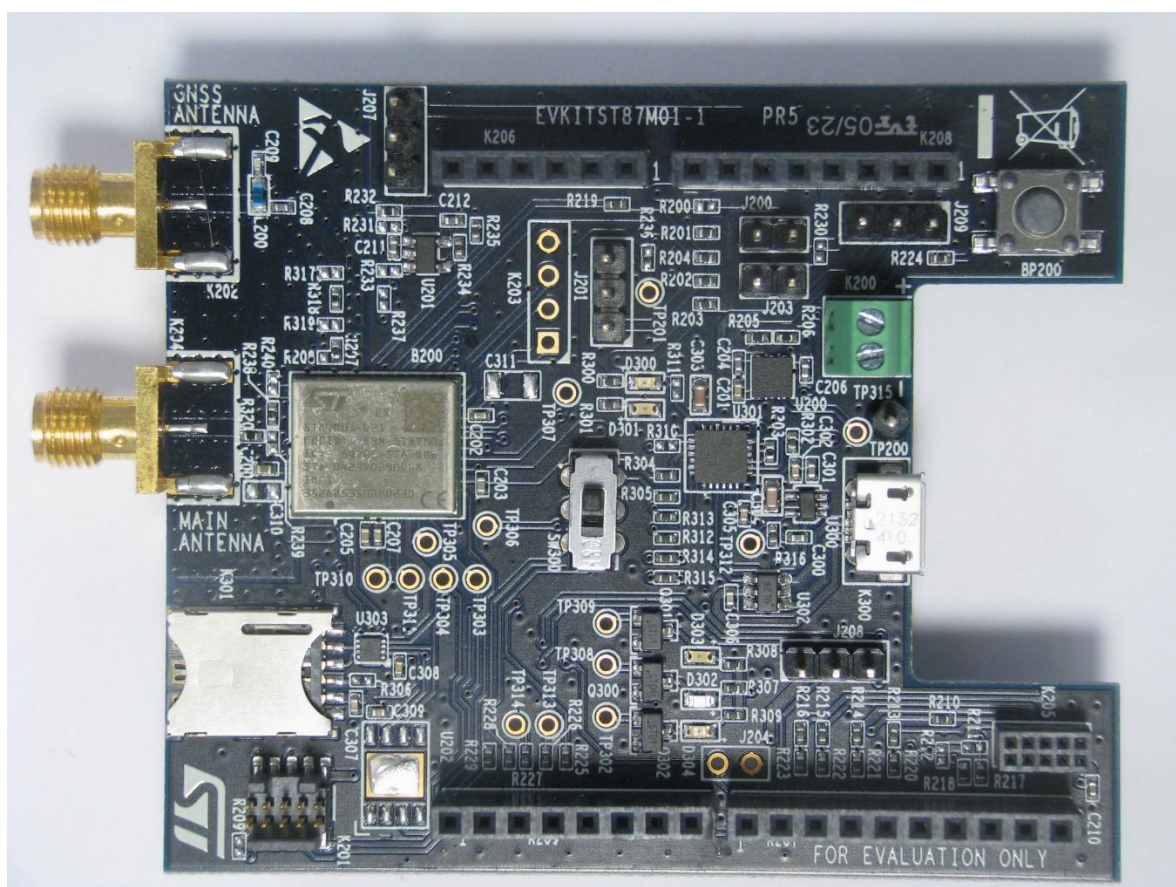## EVKITST87M01-1

Introduction

The EVKITST87M01-1 board is an evaluation board for the ST87M01 module based on the ST8700 system on chip (SoC).
The EVKITST87M01-1 board is designed as a X-Nucleo Shield form factor to be compatible with the Nucleo and Arduino environment. Besides, 2 HOST connections to ST8700 are possible : PC or associate board.

Figure 1. ST87M01 module on EVKITST87M01-1 board

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1 General information

1.1 Acronyms and terms

PA	Power Amplifier
SIM / eSIM	Subscriber Identity Module / embedded Subscriber Identity Module
LDO regulator	Low Dropout regulator
RF	Radio Frequence
SoC	System on a Chip
PC	Personal computer

1.2 Reference documents

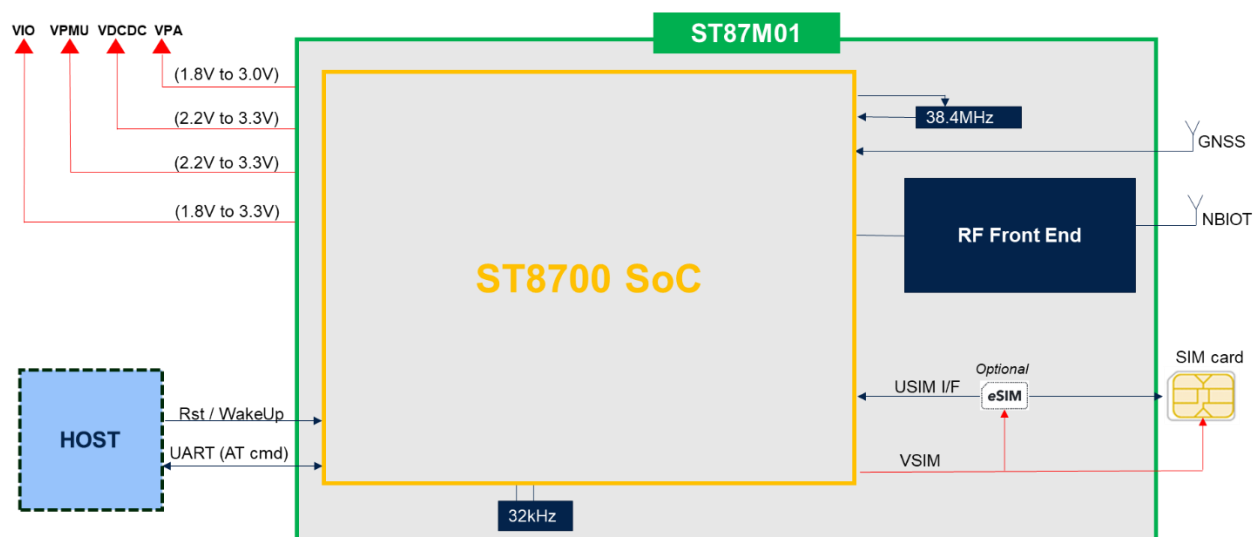| Reference	Document
[1]	Datasheet ST87M01
[2]	ST87MXX_UM_AT commands description
[3]	GUI User Manual

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2 ST87M01 product description

2.1 Module description

ST87M01 is the name of the module, that includes the following parts:
- ST8700 SoC
- RF Front End (RF-FE)
- Low speed oscillator
- High frequency oscillator
- eSIM GSMA (optional)

2.2 Module block diagram

.
Figure 2. ST87M01 Block diagram

2.3 Module features

See document [1] Reference documents to find the features of the ST87M01 module.

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3 EVKITST87M01-1 block diagram

Figure 3. EVKITST87M01-1 Block diagram
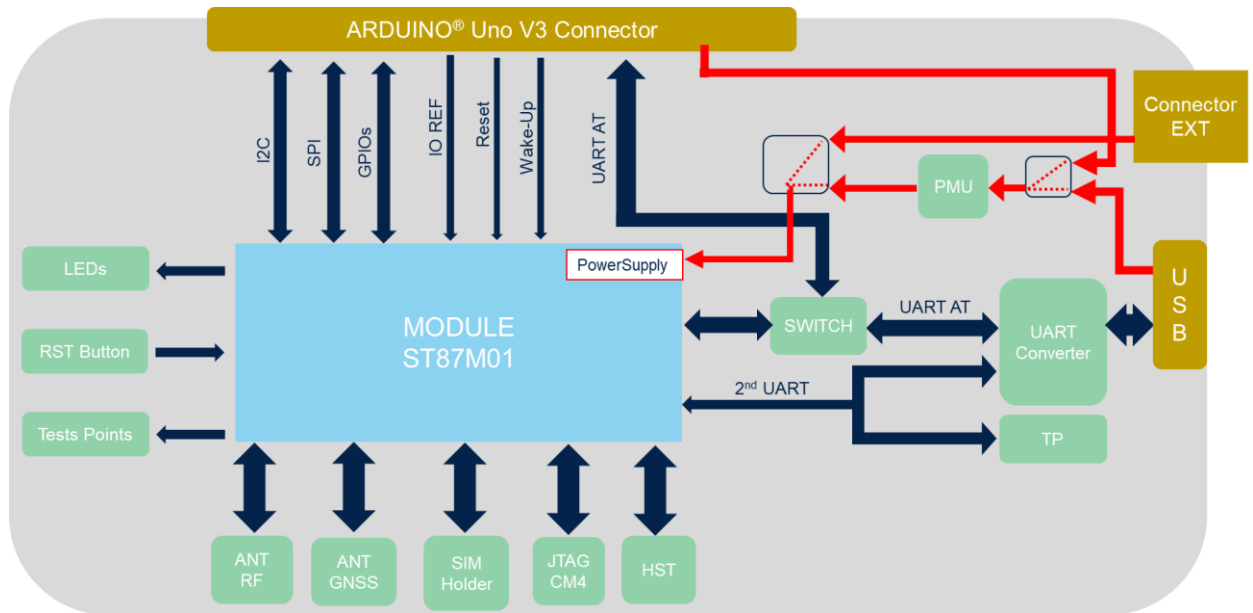
Figure 4: EVKITST87M01-1 board - Main functions position on board

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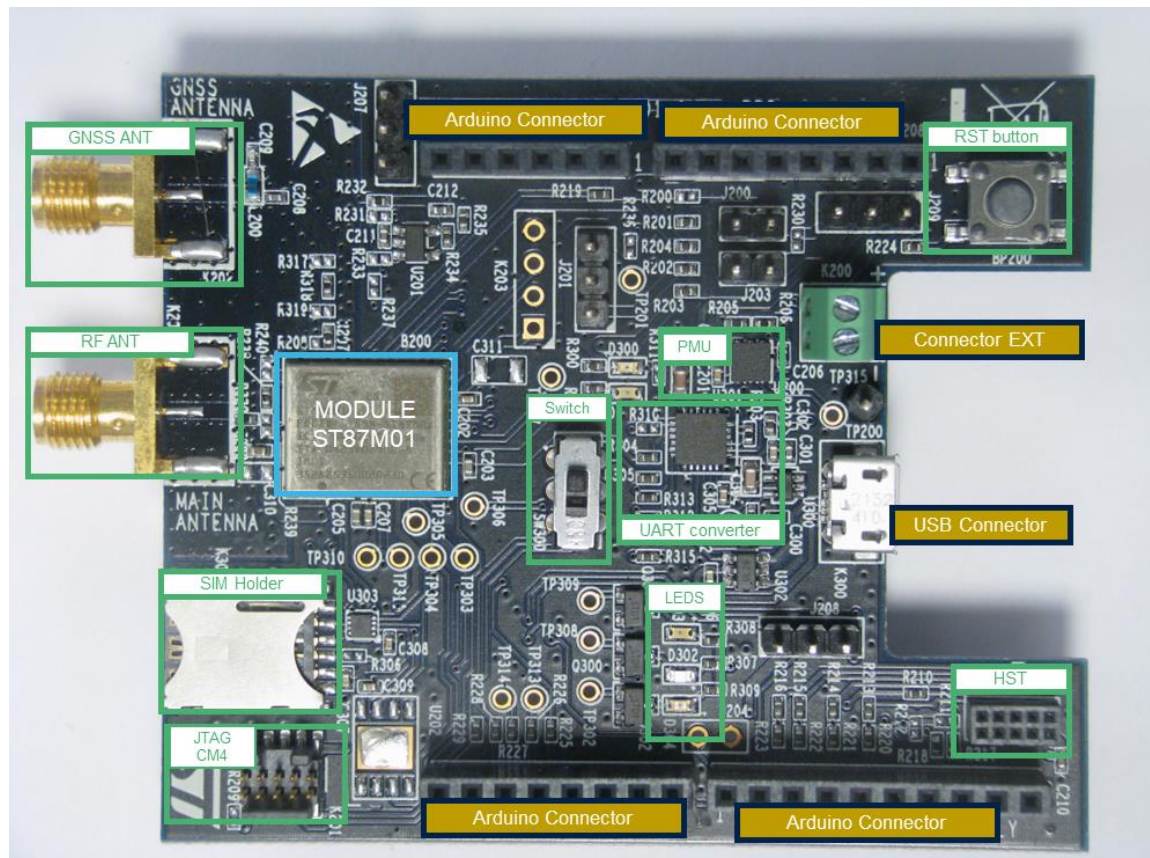
4 EVKITST87M01-1 platform

4.1 KIT Features

- EVKITST87M01-1 board
- RF Antenna
- Micro-B USB Cable

4.2 Configurations

As written before, the ST87M01 module on EVKITST87M01-1 board can have 2 host : PC or Associate board.
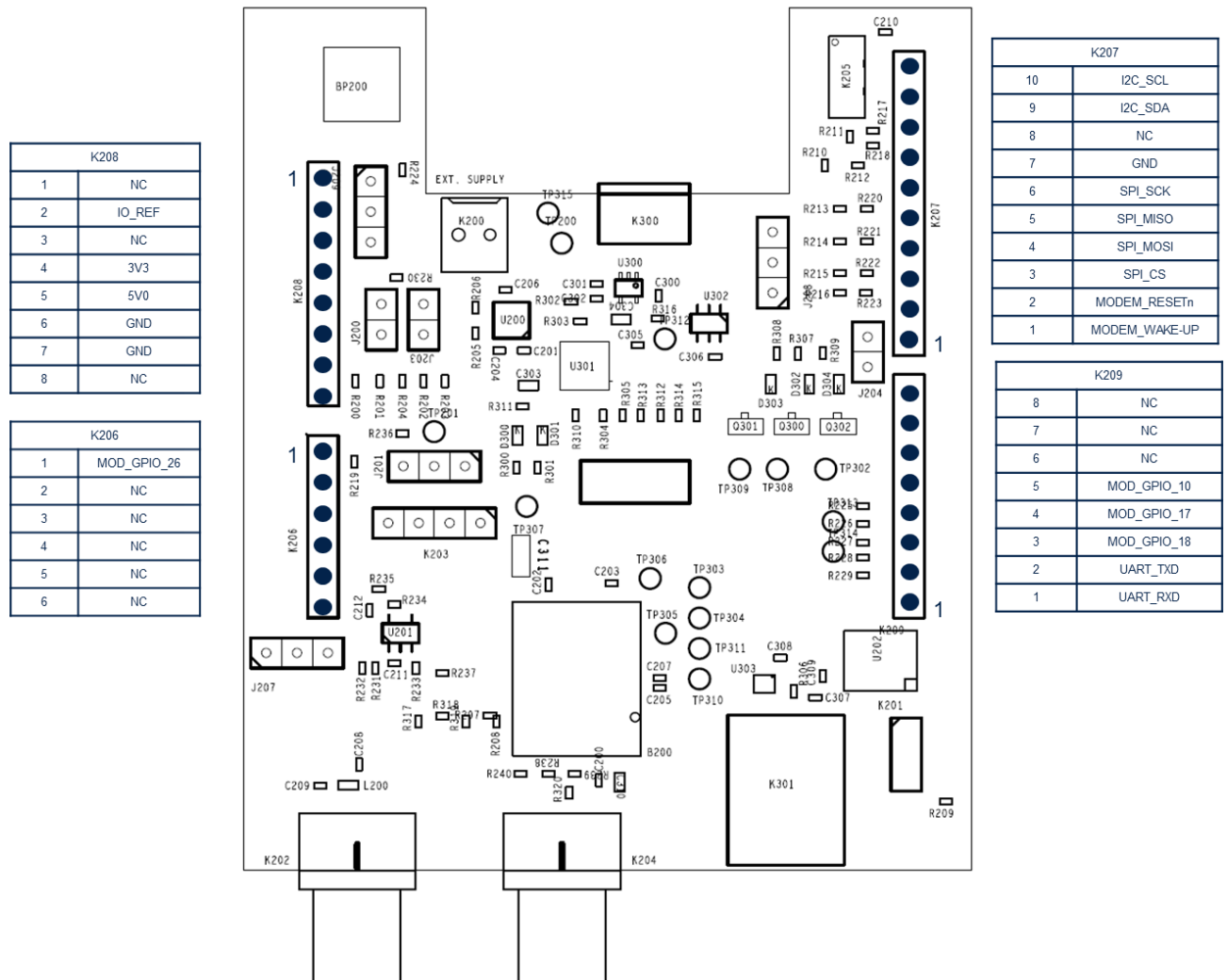
The Power supply source of EVKITST87M01-1 board can be :
- PC via USB connector
- External [2.2;3.0V] power supply via EXT connector
- Supply from associate board plugged on Arduino connector

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5 Arduino connectors

Figure 5. EVKITST87M01-1 Board - Arduino connectors

K208	
1	NC
2	IO_REF
3	NC
4	3V3
5	5V0
6	GND
7	GND
8	NC

K206	
1	MOD_GPIO_26
2	NC
3	NC
4	NC
5	NC
6	NC

K207	
10	I2C_SCL
9	I2C_SDA
8	NC
7	GND
6	SPI_SCK
5	SPI_MISO
4	SPI_MOSI
3	SPI_CS
2	MODEM_RESETn
1	MODEM_WAKE-UP

K209	
8	NC
7	NC
6	NC
5	MOD_GPIO_10
4	MOD_GPIO_17
3	MOD_GPIO_18
2	UART_TXD
1	UART_RXD

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6 Power supply

6.1 Architecture

Three power supply configurations are described in the next sections. These configurations can be achieved with the 0R resistors and jumpers on board.

6.2 Default power supply configuration

6.2.1 MicroUSB Power supply

In this configuration, a 5VDC power supply comes from the PC. All the power supplies of the ST87M01 are 2.5V, output of the linear voltage regulator *LD39050* on the board.
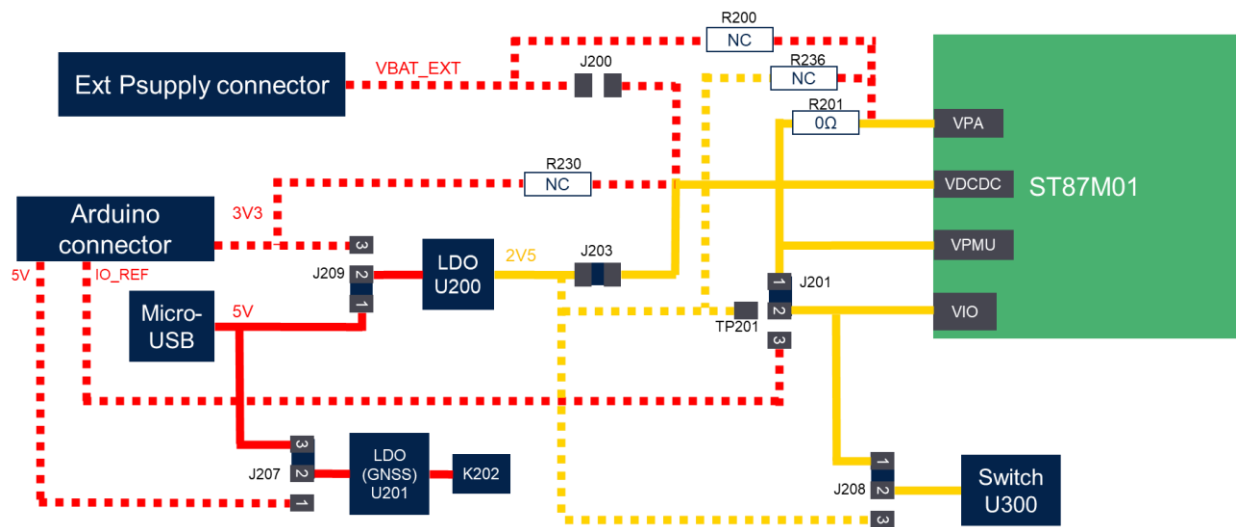
Figure 6. Micro-USB Power supply configuration

Table 1. Micro-USB power supply configuration - Jumpers and 0R resistors

Ref	Configuration	Picture
J200	OPEN	
J201	1-2 CLOSED	
J203	CLOSED	
J207	2-3 CLOSED	
J208	1-2 CLOSED	
J209	1-2 CLOSED	
R200	NC	
R201	Mounted	
R230	NC	
R236	NC	

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6.3 Other Power supply configurations

6.3.1 ArduinoConnector Power supply

In this configuration, an associate board, Arduino connector compatible, must be plugged under the EVKITST87M01-1 board. Besides, the associated board must output a 3.3VDC supply on the Arduino connector, EVKITST87M01-1 - K208 pin4 (See 5). The IO_REF pin is used in order to have the same IO voltage level.

Note : Compare to the default resistors configuration, some modification are needed, see below in Table 1Table 2

Figure 7. Arduino connector Power supply configuration
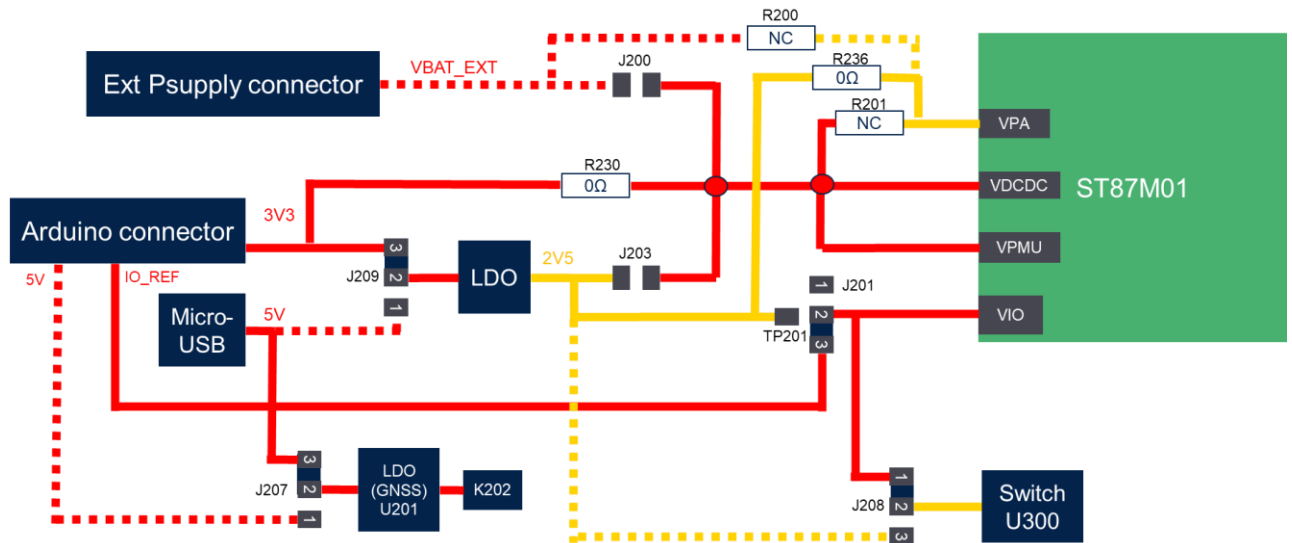
Table 2. Arduino connector power supply configuration - Jumpers and 0R resistors

Ref	Configuration	Picture
J200	OPEN	
J201	2-3 CLOSED	
J203	OPEN	
J207	2-3 CLOSED	
J208	1-2 CLOSED	
J209	2-3 CLOSED	
R200	NC	
R201	NC	
R230	Mounted	
R236	Mounted	

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6.3.2 External connector Power Supply

In this configuration, an external power supply with the range [2.2;3.0VDC] must be used.

Figure 8. External connector Power supply configuration
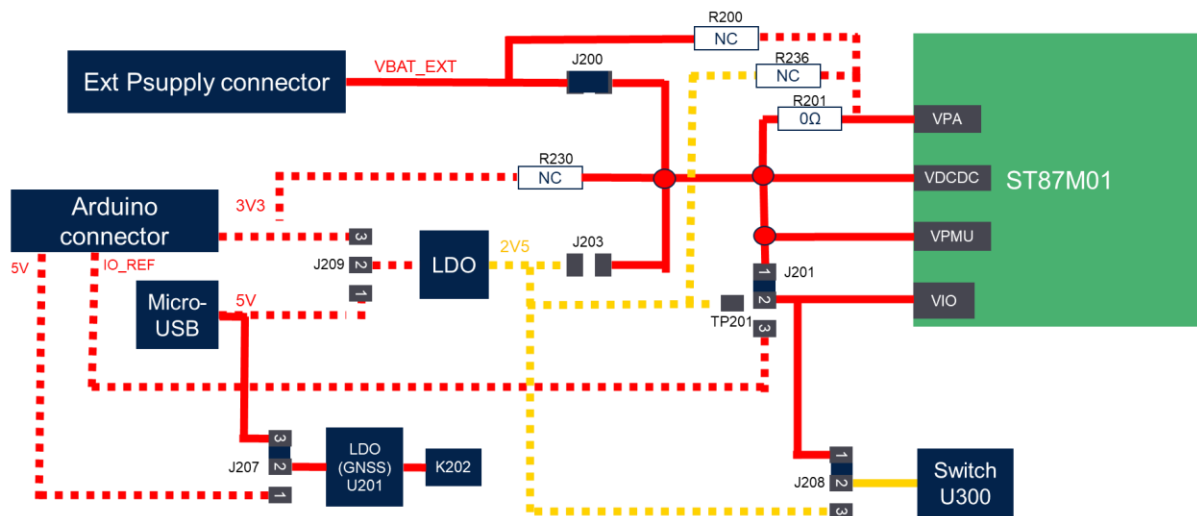
**Table 3. External connector power supply configuration - Jumpers and 0R resistors**

Ref	Configuration	Picture
J200	CLOSED	
J201	1-2 CLOSED	
J203	OPEN	
J207	2-3 OPEN	
J208	1-2 CLOSED	
J209	OPEN	
R200	NC	
R201	Mounted	
R230	NC	
R236	NC	

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7   HST Interface

Note : The SPI function of Arduino connector K207 and HST trace function can not be used at the same time.

Figure 9: SPI and HST functions connection to K205 and K207 connectors
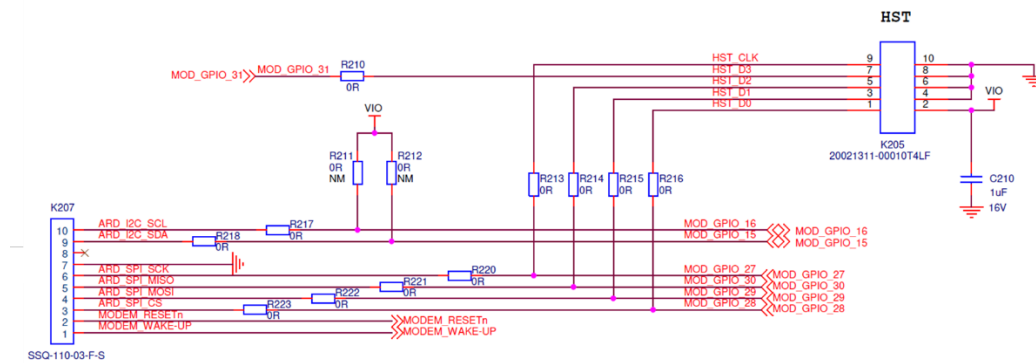
HST (High Speed Interface) is available to output firmware data log from application and modem.
This interface which supports high data rate (up to 25Mb/s) required an external hardware TPA device (named: Dongle HST Logger) to recover the data flow for ST analysis.

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8 UART

Figure 10. UART Switch diagram
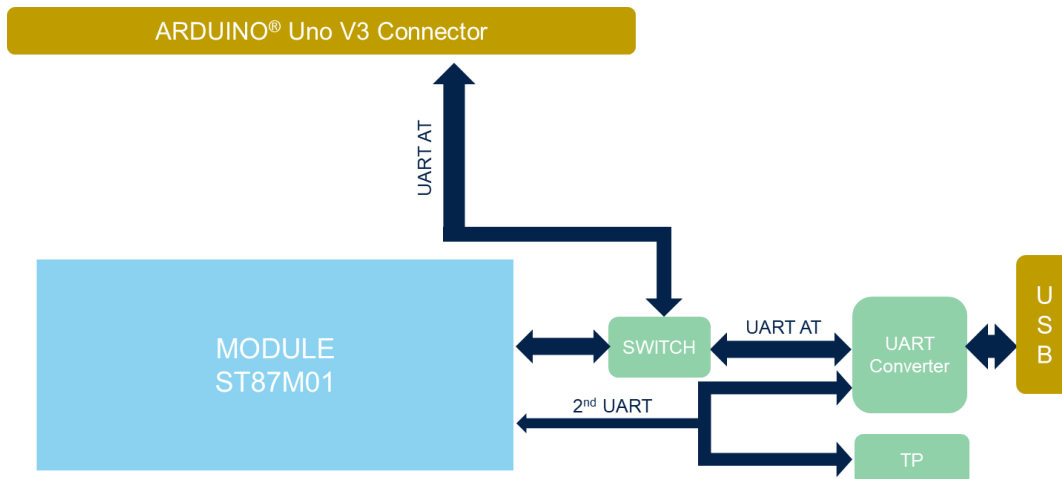
8.1 USB to UART converter

To convert USB to UART signals, the CP2105-F01-GM converter is used on EVKITST87M01-1 board. In order to supply its VIO pin, two options are offered to choose the voltage source thanks to jumper J208 :
- VIO
- VBAT_LDO (in case the user wants to measure VIO consumption of module only)

Note : It is mandatory to supply the VIO pin of U301 to communicate through the USB connector.

8.2 UART0 (AT)

To Switch the UART0 AT TX/RX path between ST87M01 and PC(USB connector) or associate board (Arduino connector) a mechanical switch is used.

Figure 11. UART Switch position for PC Host	Figure 12. UART Switch position for associate board Host
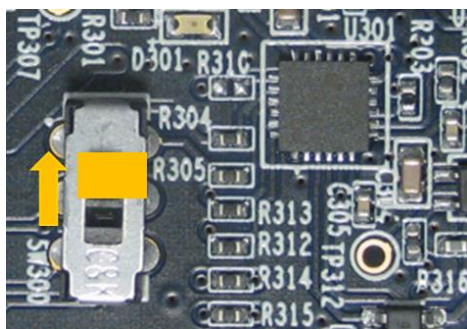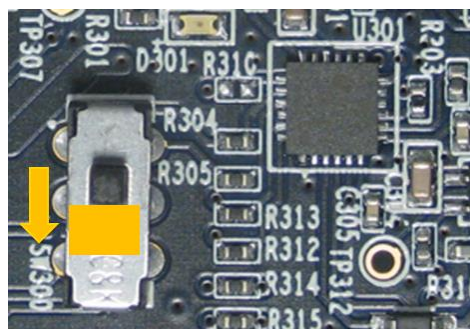
The COM Port settings for the UART0 AT communication are :

Baud rate	460800
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

The COM port that must be selected for UART0 AT communication is the Standard COM Port.

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Figure 13: UART0 (AT)COM Port selection
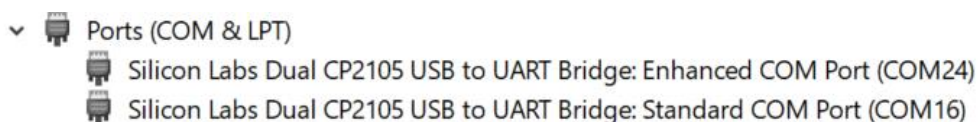
8.3 UART1 (CAP)

The COM Port settings for the UART1 CAP communication are :

Baud rate	Configurable
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

The COM port that must be selected for UART1 CAP communication is the Enhanced COM Port.

Figure 14: UART1 (CAP) COM Port selection
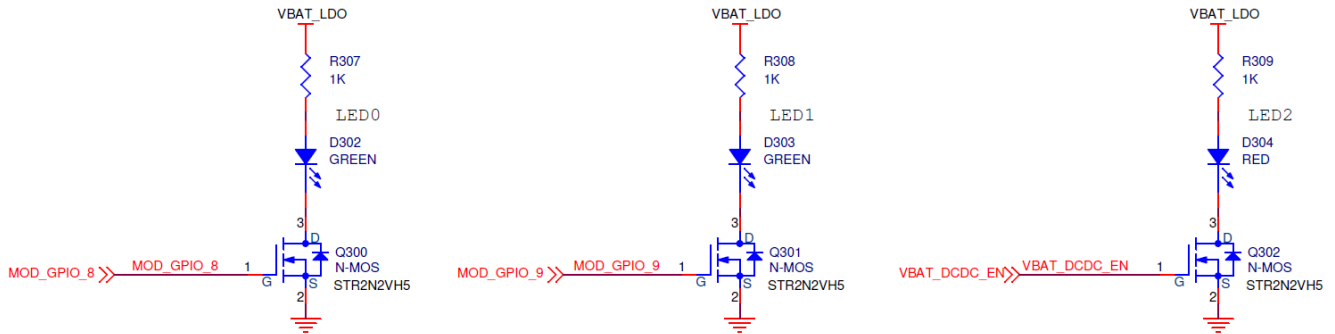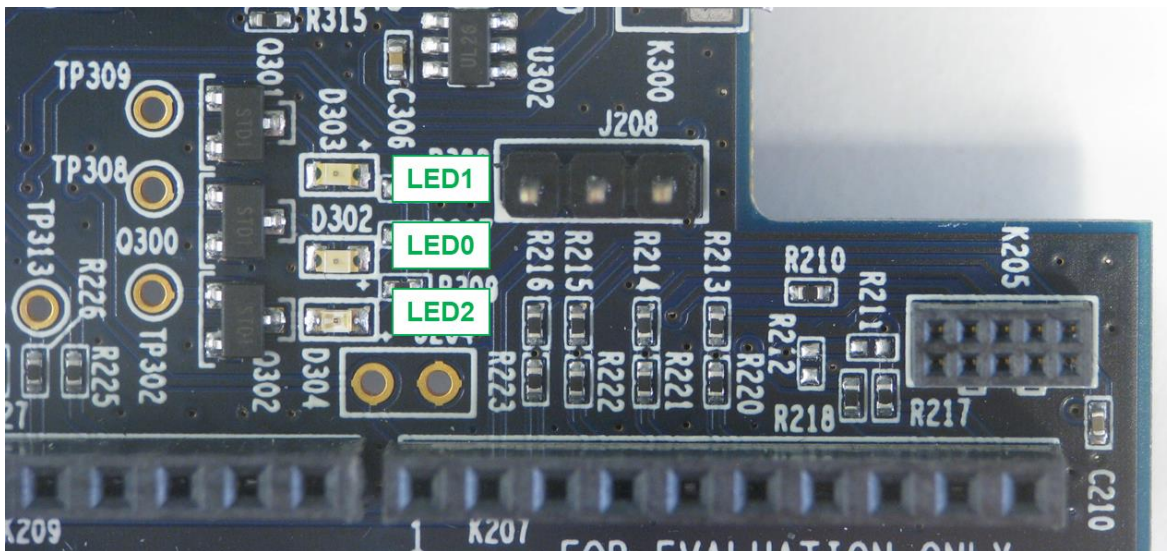

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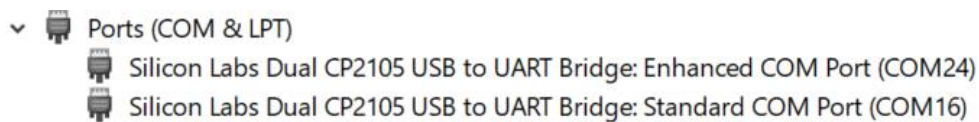
9 LEDs

Figure 15. LEDs schematic

Table 4. LEDs behaviour description

LED number	Signal control	Color	Status
LED0	MOD_GPIO8	GREEN	BLINK = S87M01 is running normally
LED1	MOD_GPIO9	GREEN	BLINK = S87M01 is running normally[1]
LED2	VBAT_DCDC_EN	RED	ON = Active mode OFF = Sleep or Low-Power mode

1. See datasheet dcoument [1] in Reference documents for blinking behaviours

Figure 16. LEDs identification on EVKITST87M01-1 board

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10 Wake-up and reset

10.1 Wake-up

The wake-up function of the module can be activate through two options :

- UART : See ST87MXX_UM_AT commands description (Reference documents)

- WAKE-UP Pin : From the arduino connector , with signal on pin 1 of K207
  See ST87MXX_UM_AT commands description (Reference documents)

10.2 Reset

The reset function of the module of the module is an active low input, two options are available to activate it:

- A press-button

Figure 17. Reset press-button position on EVKITST87M01-1 board
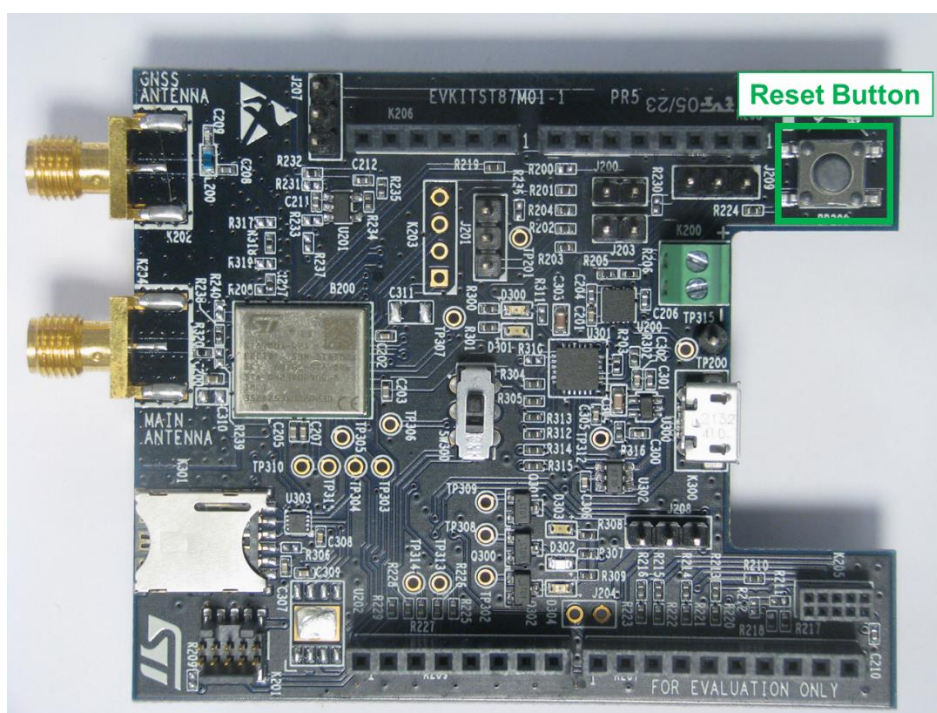
- From the arduino connector, the board plugged on Arduino connector can activate the reset with signal on pin 2 of K207

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11   GNSS

ST87M01 module has a GNSS receiver that allows to support multiple satellite constellations to address high accuracy localization applications. An antenna can be connected on the EVKITST87M01-1 to the GNSS receiver through K202 connector.

The EVKITST87M01-1 board offers the possibility to use an active antenna by mounting the L200 inductor.
Then, the power supply source can be chosen depending on 0R resistor mounted :
-    5V_LDO
-    VANT_LDO
-    VRFFE
-    VEXT

For the default configuration, R232 is mounted. VANT_LDO , 3.3V power supply, being the power supply source.
Note : In case the EVKITST87M01-1 is used in Standalone configuration, the 5V input of the voltage regulator U201 can be the 5V_USB from USB connector.

A GNSS active antenna reference is given in paragraph 12.2.

Figure 18: GNSS Antenna schematic
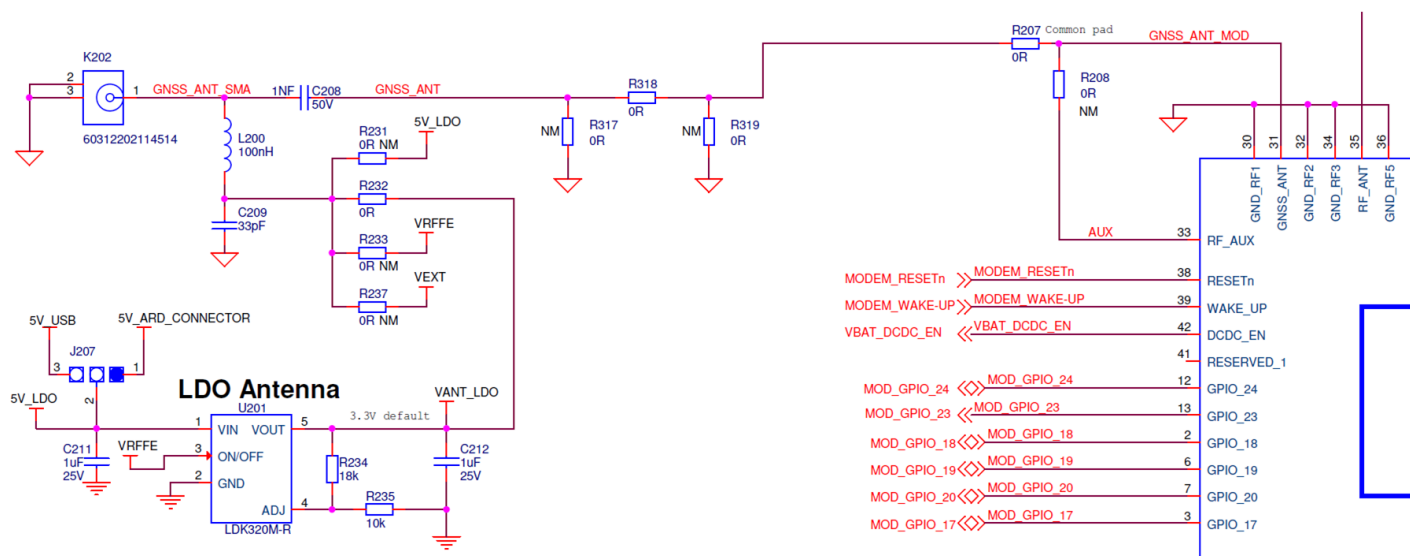
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12 Antennas

12.1 RF Antenna

The RF antenna that you can find in the EVKITST87M01-1 is :
Manufacturer : MOLEX
Series Number: 213523

12.2 GNSS Antenna

Possible active GNSS Antenna compatible with Figure 18: GNSS Antenna schematic configuration :
Manufacturer : ABRACON
Part number : APAMPG-117

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13 Using EVKITST87M01-1

13.1 Standalone configuration

In the standalone configuration, here is the list of hardware parts needed :
- EVKITST87M01-1 Board
- PC
- Micro-USB cable
- Antenna

Figure 19. EVKITST87M01-1 Board standalone configuration
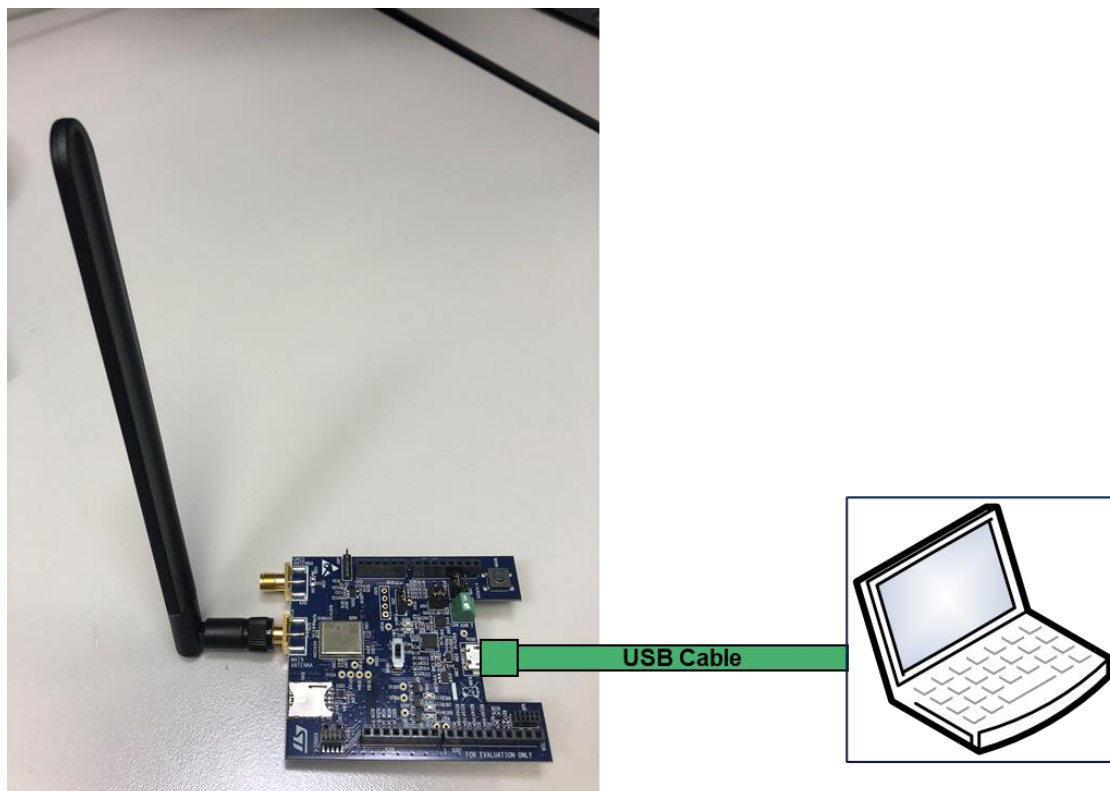
13.1.1 Power supply

The power supply configuration is MicroUSB Power supply described in 6.2.1.

13.1.2 UART Switch position

The UART switch must be in the position PC Host, see Figure 11.

13.1.3 SIM Card

A NBIOT SIM should be plugged in K301 connector to enable modem network connection

13.1.4 Antenna connection

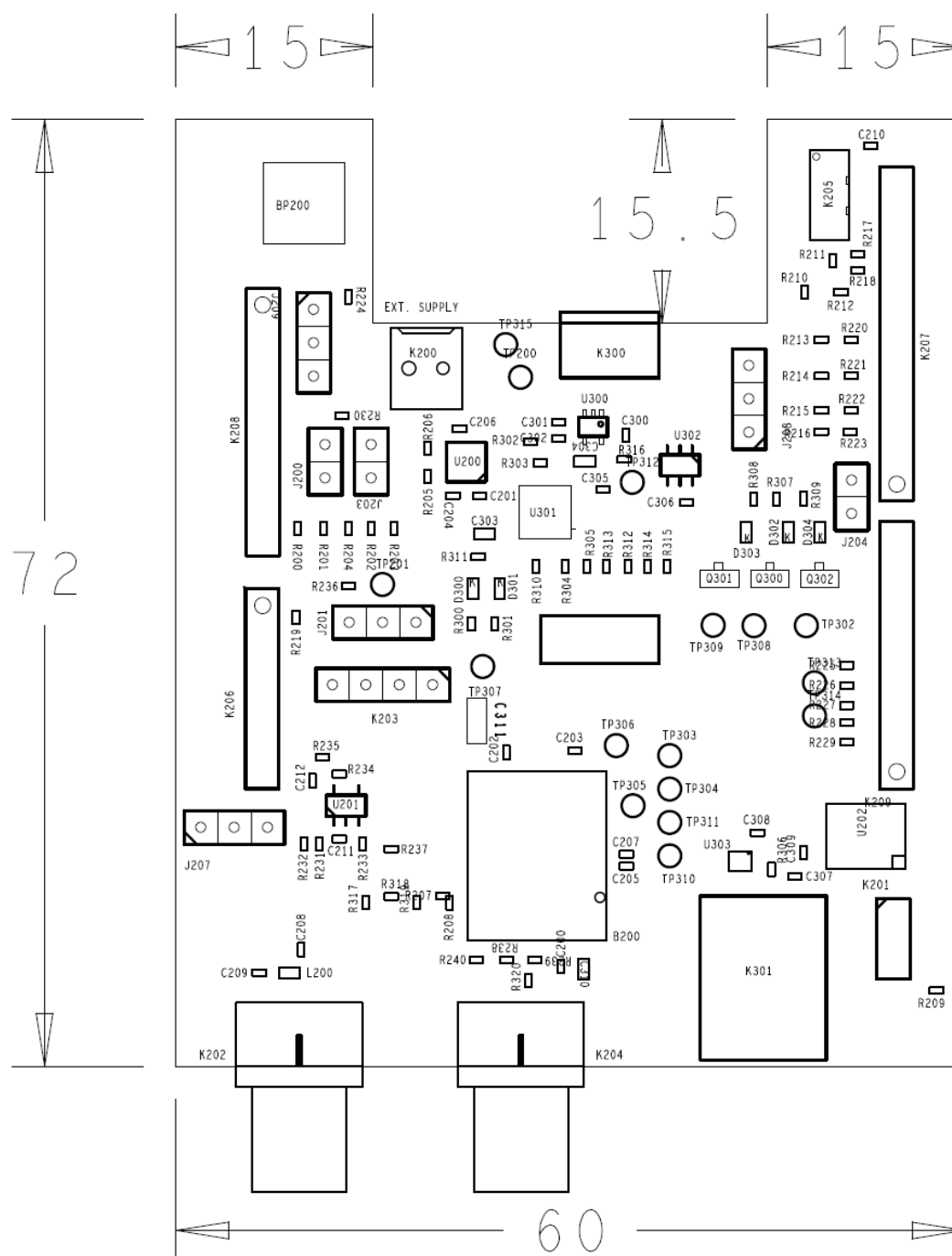Connect the antenna to K204 connector.

13.1.5 Drivers installation

In order to connect the EVKITST87M01-1 to the PC, install Virtual COM Port drivers for the SiLabs CP2105 device (which converts data between the PC USB port and ST87M01 UART0). The latest drivers are available at:
https://www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers

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The LEDs D300 and D301 show the UART TX and RX activity.
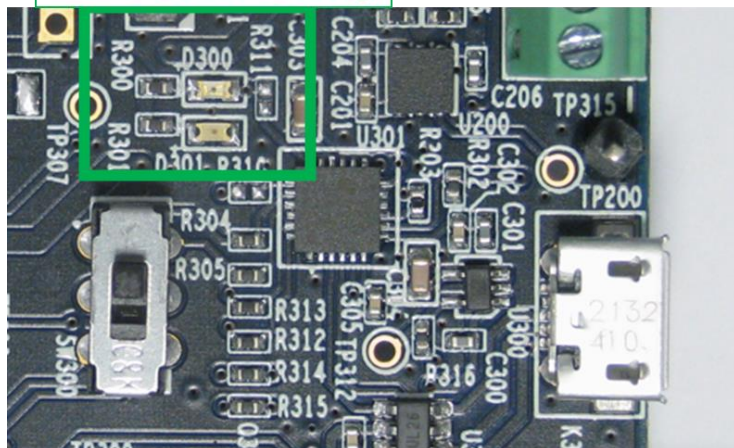
13.1.6 Verification procedure

1. Connect MicroUSB cable from PC to K300 (USB Connector) connector.
2. Verify that the Virtual COM ports have been installed.
3. Verify that the LED0 and LED1 are blinking green and LDE2 is red lighting red continously.

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13.2 Associated board configuration

In the associate board configuration, here is the list of hardware parts needed :

- EVKITST87M01-1 Board
- Associate board – Arduino connector compatible board with 3.3V power supply.
- PC
- Antenna

13.2.1 Power supply

The power supply configuration is ArduinoConnector Power supply described in 6.3.1.

13.2.2 UART Switch position

The UART switch must be in the position PC Host, see Figure 12

13.2.3 SIM Card

A NBIOT SIM should be plugged in K301 connector to enable modem network connection

13.2.4 Antenna connection

Connect the antenna to K204 connector.

13.2.5 EVKITST87M01-1 connection

Plug-in the EVKITST87M01-1 board on associate board connectors.

13.2.6 Verification procedure

1. Connect the power-supply to the associate board.
2. Verify that the LED0 and LED1 are blinking green and LDE2 is red lighting red continously.

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14 Mechanical dimensions

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Revision history

25/03/2022	Rev 0.1	Preliminary version
15/03/2023	Rev 0.2	Power supply update : Jumper J202, J205 deleted and J209 added Arduino connectors Update Mechanical dimensions Update UART Update GNSS Creation GNSS Antenna creation Figures board update USB to UART converter HST Interface creation SIM Card creation Wake-up update

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