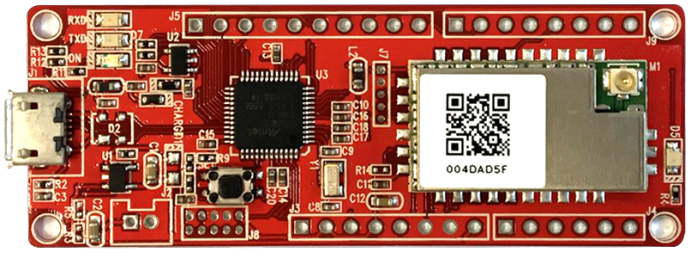

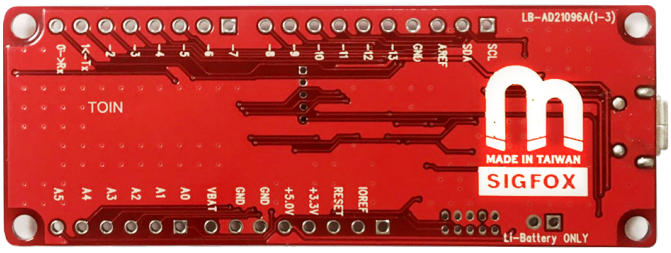

User Guide

MTDuino-SFM2CWW001

M0 and SigFox connectivity module

Mighty Net

sigfox

Index

Important Notice:
And reserves the right to alter the hardware, software, and/or specifications detailed here at any time without notice.

1. General Description

The MTDuino-SigFox is powered by Atmel's SAMD21 MCU, featuring a 32-bit ARM Cortex® M0 core. With the addition of the M0 board, the Arduino family becomes larger with a new member providing increased performance.

It is based on the Microchip SAMD21 and a UPLYNX-M-RCZx SigFox module.

2. Technical Specifications

Microcontroller	
Board Power Supply (USB/VIN)	ATSAMD21G18, ARM Cortex-M0+, 48pins LQFP
Supported Batteries(*)	5V
Circuit Operating Voltage	Li-polymer battery
Digital I/O Pins	3.3V
PWM Output	20
Analog Input Pins	12
Analog Output Pins	6 (ADC 8/10/12 bit)
DC Current per I/O Pin	1 (DAC 10 bit)
Flash Memory	7 mA
SRAM	256 KB
Clock Speed	32 KB
Antenna power	32.768 kHz (RTC), 48 MHz
Carrier frequency	0.3dB @ 868M, 1.3 dB @ 915M
Working region	868 MHz, 915MHz
Lenght	World Wide(WW)
Width	67 mm
	25 mm

Power

The MTDuino-SigFox can be powered via the micro USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from Lithium-battery. The MTDuino-SigFox will automatically detect which power sources are available and choose which one to use according to the following priority:

- External power: Li-polymer battery
- Target USB

The MTDuino-SigFox is a Constant-Voltage (CV) and Constant-Current (CC) type charging IC for linear charging of single-cell Li-ion batteries and Li-polymer batteries.

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Input and Output

Each of the 14 digital i/o pins on the MTDuino-SigFox can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 3.3 volts. 7mA as maximum DC current for I/O pins and an internal pull-up resistor (disconnected by default) of 20-60 kOhms. In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data using the ATSAMD21G18 hardware serial capability. Note that on the M0, the SerialUSB class refers to USB (CDC) communication; for serial on pins 0 and 1, use the Serial5 class.

- TWI: SDA and SCL. Support TWI communication using the Wire library.

- PWM: Pins 2 to 13 Provide 8-bit PWM output with the analogWrite() function. The resolution of the PWM can be changed with the analogWriteResolution() function. Note1 The pins 4 and 10 can not be used simultaneously as PWM. Note2 The pins 5 and 12 can not be used simultaneously as PWM.

- Analog Inputs: A0-A5. The M0 has 6 analog inputs, labeled A0 through A5. Pins A0-A5 appear in the same locations as on the Uno; Each analog input provides 12 bits of resolution (i.e. 4096 different values). By default the analog inputs measure from ground to 3.3 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function.

- DAC: pin A0 provides true analog outputs with 10-bits resolution (1023 levels) with the analogWrite() function. This pin can be used to create an audio output using the Audio library.

- Reset: Bring this line LOW to reset the microcontroller. This is typically used to add a reset button when shields are used that block the one already present on the board.

Communication

The MTDuino-SigFox has a number of facilities for communicating with a computer, with another Arduino or other microcontrollers, and with different devices like phones, tablets, cameras and so on. The SAMD21 provides one hardware UART and three hardware USARTs for 3.3V serial communication. The Arduino software includes a serial monitor allowing simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the ATSAMD21G18chip and USB connection to the computer (but not for serial communication on pins 0 and 1). The Native USB port is connected to the SAMD21. It allows for serial (CDC) communication over USB. This provides a serial connection to the Serial Monitor or other applications on your computer. The SAMD21 also supports TWI and SPI communication. The Arduino software includes a Wire library to simplify use of the TWI bus. For SPI communication, you can use the SPI library.on the board.

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Programming

The MTDuino-SigFox can be programmed with the Arduino software. Uploading sketches to the SAMD21 is different from how it works with the AVR microcontrollers found in other Arduino boards: the flash memory needs to be erased before being re-programmed. Upload operation is managed by a dedicated ROM area on the SAMD21. USB port: To use this port, select "Arduino M0 (Native USB Port)" as your board in the Arduino IDE. The Native USB port is connected directly to the SAMD21. Connect the M0 Native USB port (the one closest to the reset button) to your computer.

Antenna

Manufacturer: Molex

Part Number: 105262-0002

Description: Antennas ISM 868/915 MHz ANTENNA 150MM

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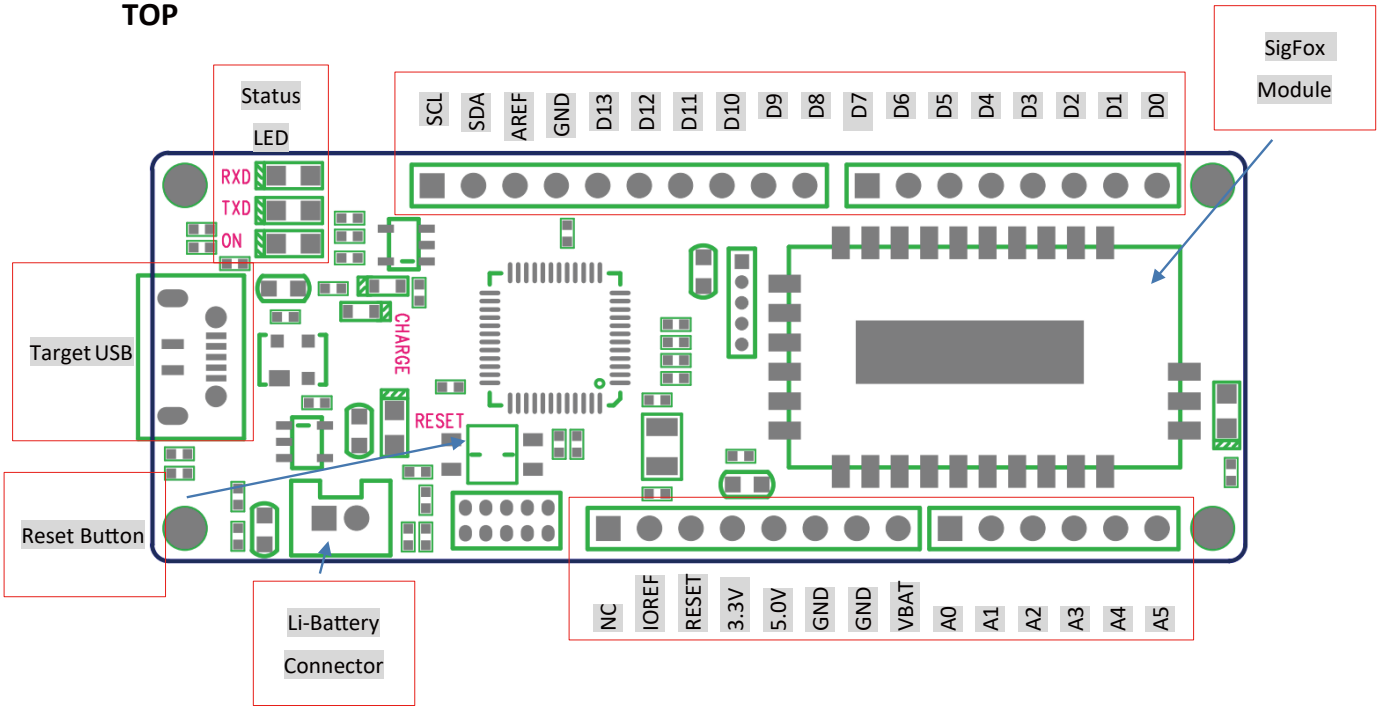
TOP



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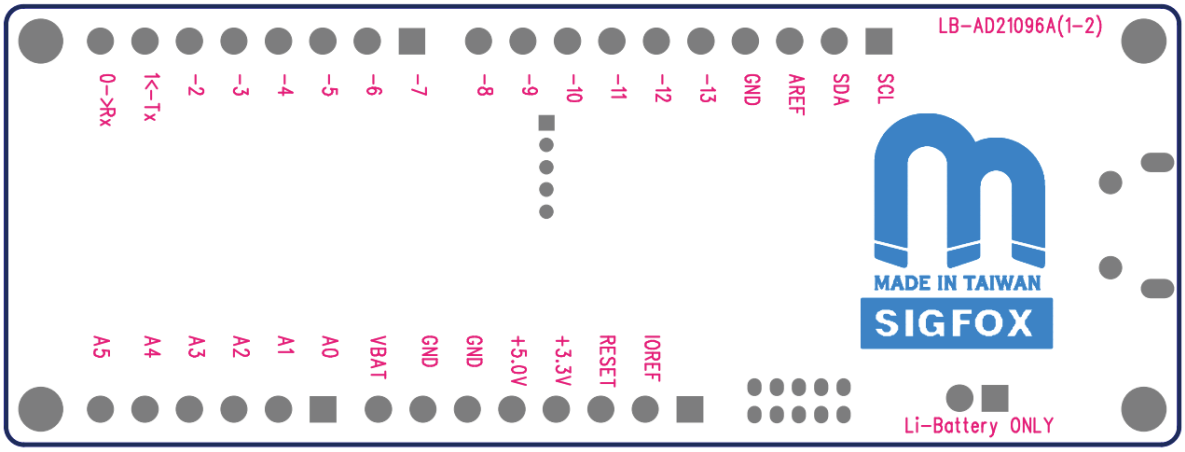

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Pin Assignment

Pin number	ZERO Board pin	PIN	Label/Name	Comments (* is for default peripheral in use)
	Digital Low			
0	0 -> RX	PA11		EIC/EXTINT[11] ADC/AIN[19] PTC/X[3] *SERCOM0/PAD[3]
1	1 <- TX	PA10		EIC/EXTINT[10] ADC/AIN[18] PTC/X[2] *SERCOM0/PAD[2]
2	2	PA14		EIC/EXTINT[14] SERCOM2/PAD[2]
3	~3	PA09		EIC/EXTINT[9] ADC/AIN[17] PTC/X[1] SERCOM0/PAD[1]
4	~4	PA08		EIC/NMI ADC/AIN[16] PTC/X[0] SERCOM0/PAD[0]
5	~5	PA15		EIC/EXTINT[15] SERCOM2/PAD[3]
6	~6	PA20		EIC/EXTINT[4] PTC/X[8] SERCOM5/PAD[2]
7	7	PA21		EIC/EXTINT[5] PTC/X[9] SERCOM5/PAD[3]
	Digital High			
8	~8	PA06		EIC/EXTINT[6] ADC/AIN[6] AC/AIN[2] PTC/Y[4] SERCOM0/PAD[2]
9	~9	PA07		EIC/EXTINT[7] ADC/AIN[7] AC/AIN[3] PTC/Y[5] SERCOM0/PAD[3]
10	~10	PA18		EIC/EXTINT[2] PTC/X[6] +SERCOM1/PAD[2]
11	~11	PA16		EIC/EXTINT[0] PTC/X[4] +SERCOM1/PAD[0]
12	~12	PA19		EIC/EXTINT[3] PTC/X[7] +SERCOM1/PAD[3]
13	~13	PA17	LED	EIC/EXTINT[1] PTC/X[5] +SERCOM1/PAD[1]
	Analog Connector			
14	A0	PA02	A0	EIC/EXTINT[2] *ADC/AIN[0] DAC/VOUT PTC/Y[0]
15	A1	PB08	A1	EIC/EXTINT[8] *ADC/AIN[2] PTC/Y[14] SERCOM4/PAD[0]
16	A2	PB09	A2	EIC/EXTINT[9] *ADC/AIN[3] PTC/Y[15] SERCOM4/PAD[1]
17	A3	PA04	A3	EIC/EXTINT[4] *ADC/AIN[4] AC/AIN[0] PTC/Y[2] SERCOM0/PAD[0]
18	A4	PA05	A4	EIC/EXTINT[5] *ADC/AIN[5] AC/AIN[1] PTC/Y[5] SERCOM0/PAD[1]
19	A5	PB02	A5	EIC/EXTINT[2] *ADC/AIN[10] PTC/Y[8] SERCOM5/PAD[0]
	Wire			
20	SDA	PA22	SDA	EIC/EXTINT[6] PTC/X[10] *SERCOM3/PAD[0]
21	SCL	PA23	SCL	EIC/EXTINT[7] PTC/X[11] *SERCOM3/PAD[1]

Reference

. https://store.arduino.cc/usa/arduino-m0

. http://www.mouser.tw/ProductDetail/Molex/105262-0002/?qs=IQwVXVmkiFIBK%2fDeZK%252bySg

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3. Hardware Introduction

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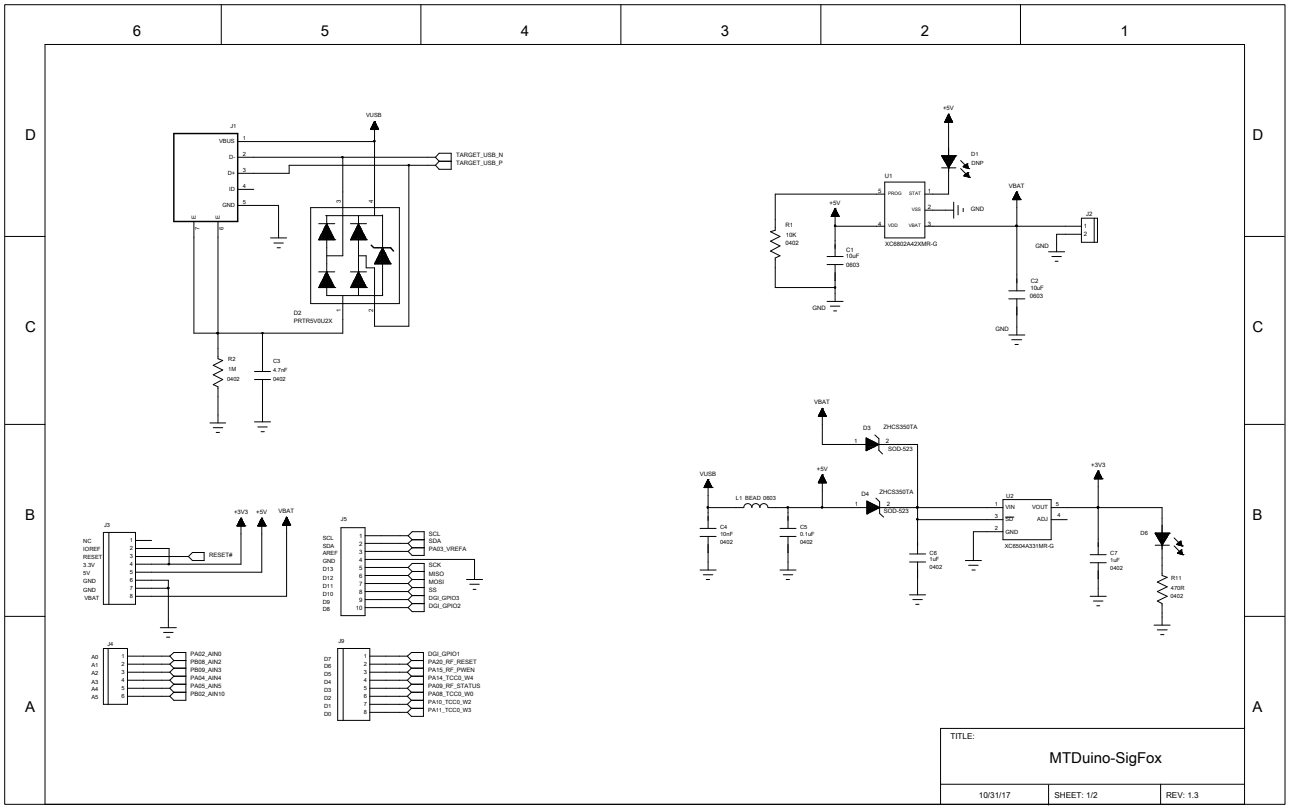

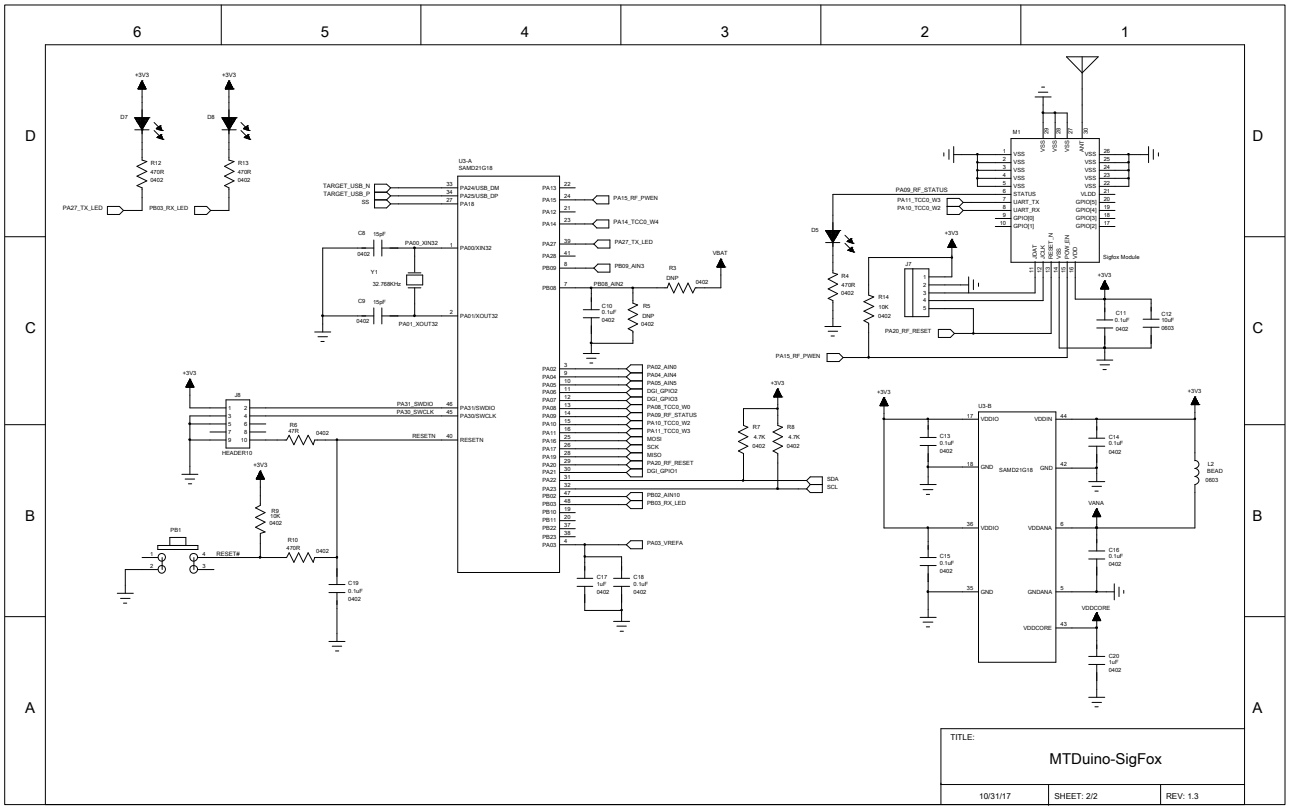

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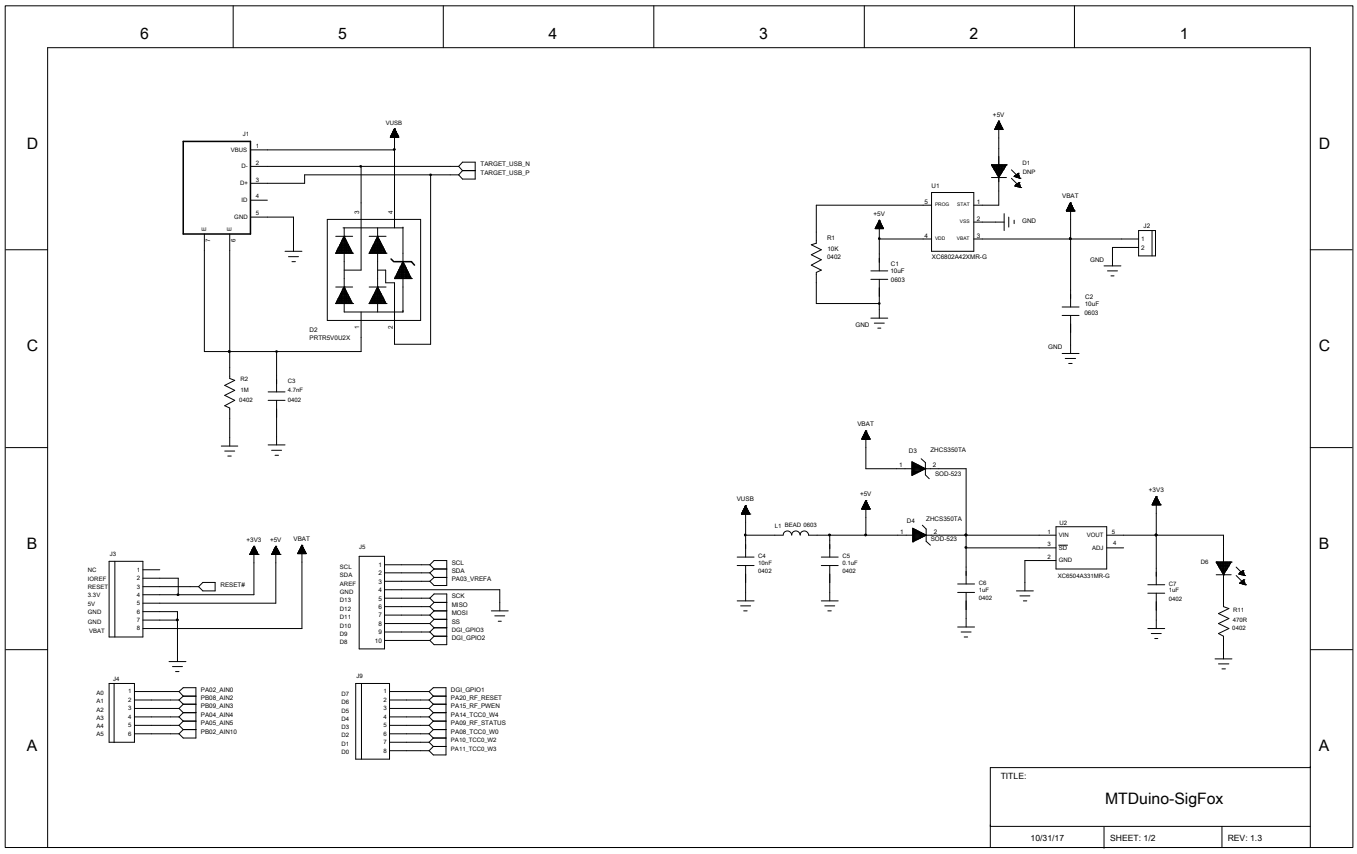

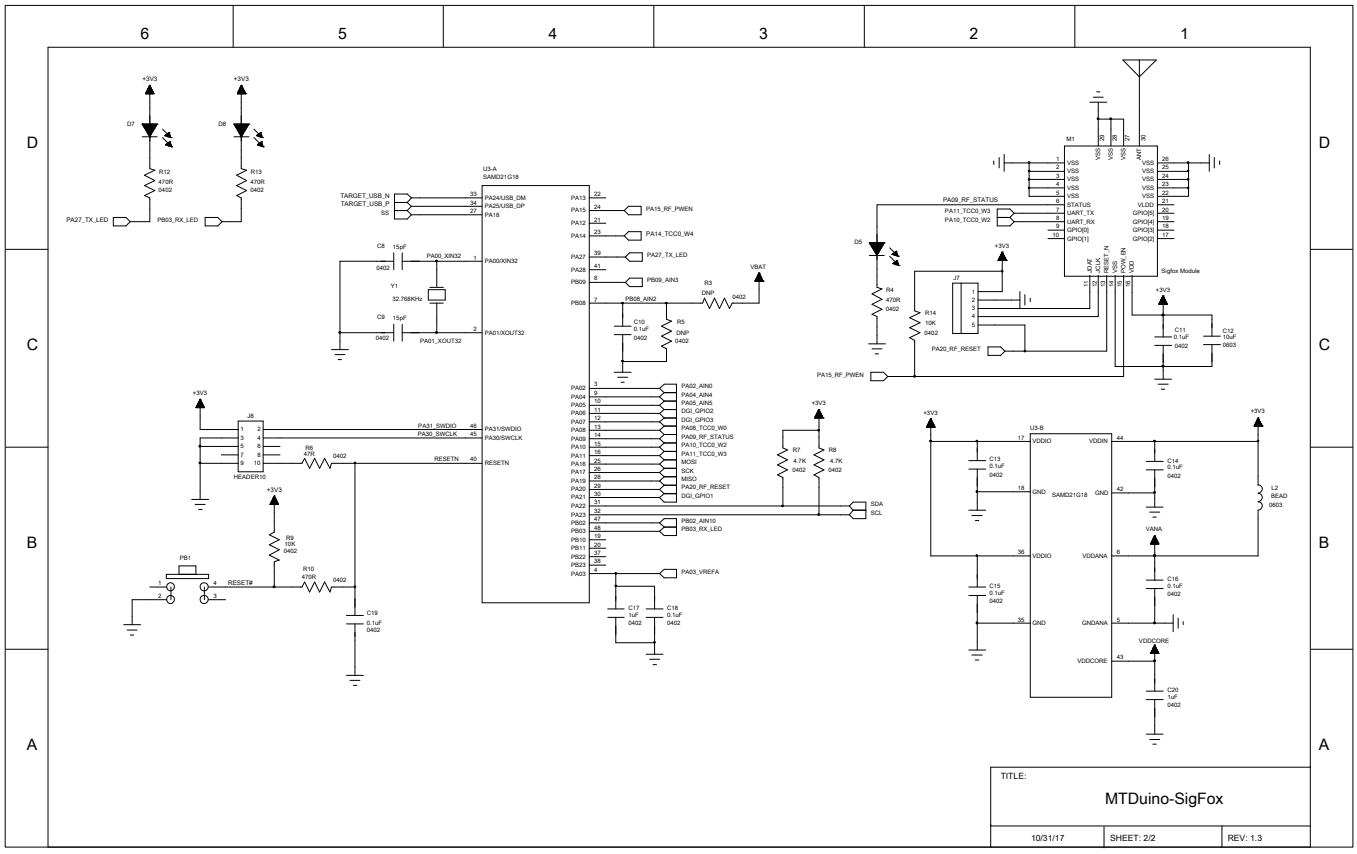

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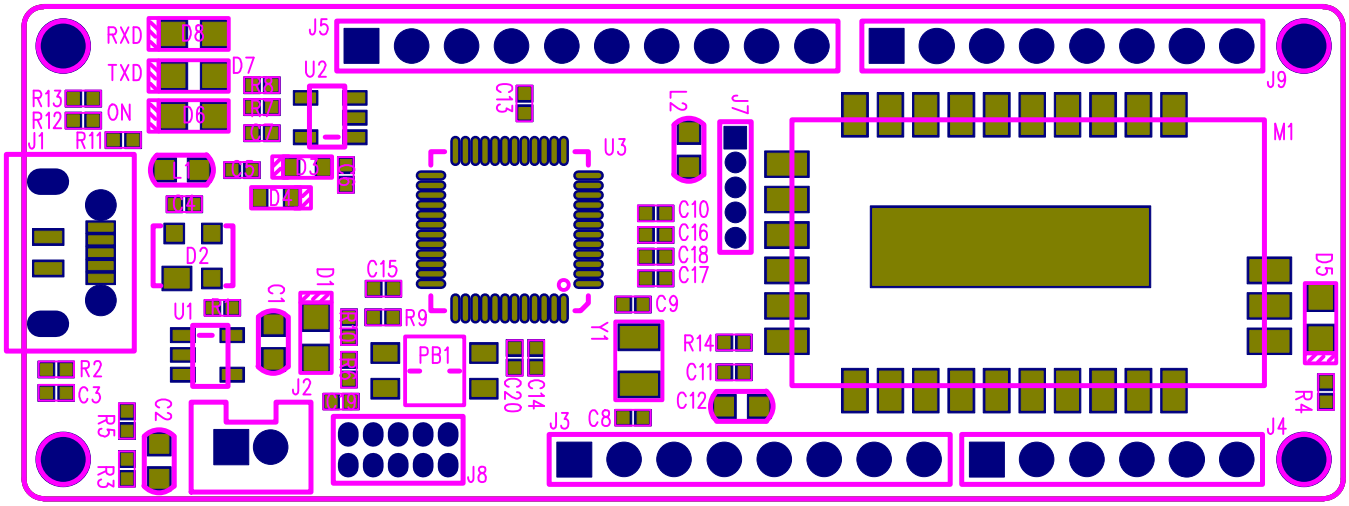

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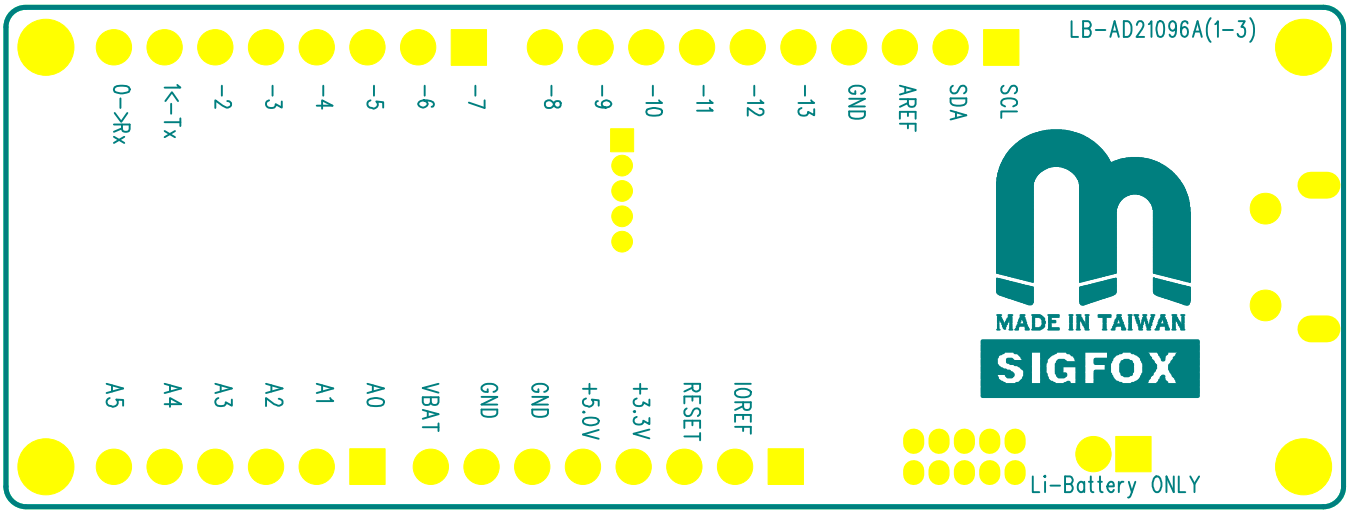

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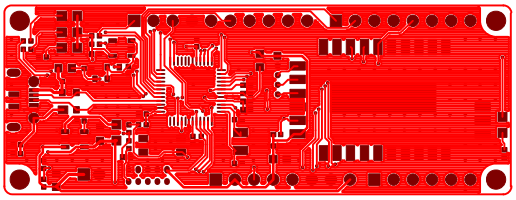

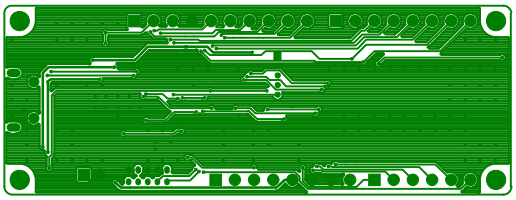

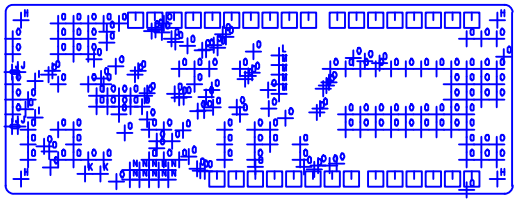

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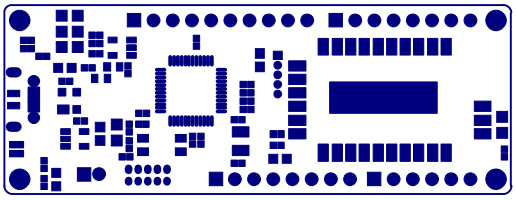
0.9398	32	H	YES	??x
2.54	4	I	YES	+/-0.0
0.7	2	J	YES	+/-0.0
0.5 x 1.3	2	K	YES	+/-0.0
0.8128	2	L	YES	+/-0.0
0.6	1	M	YES	+/-0.0
0.55	4	N	YES	+/-0.0
0.5	10	O	YES	+/-0.0
0.2032	179		YES	+/-0.0



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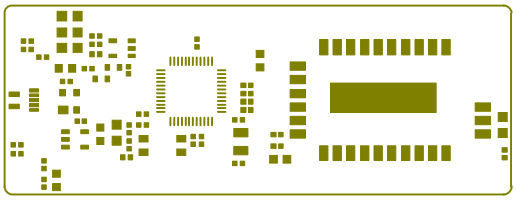
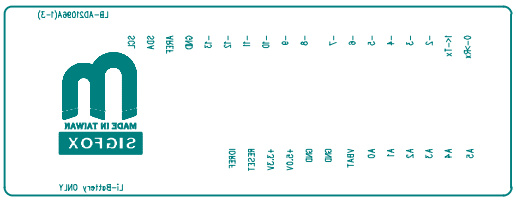
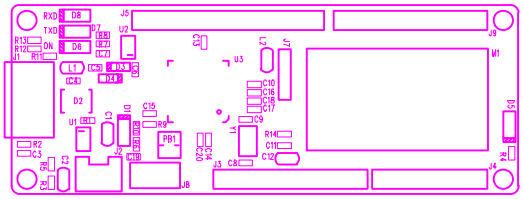
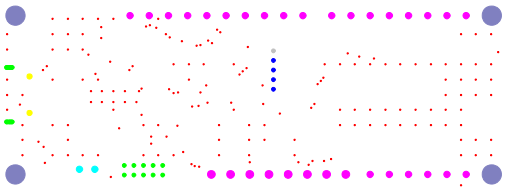
d. Gerber









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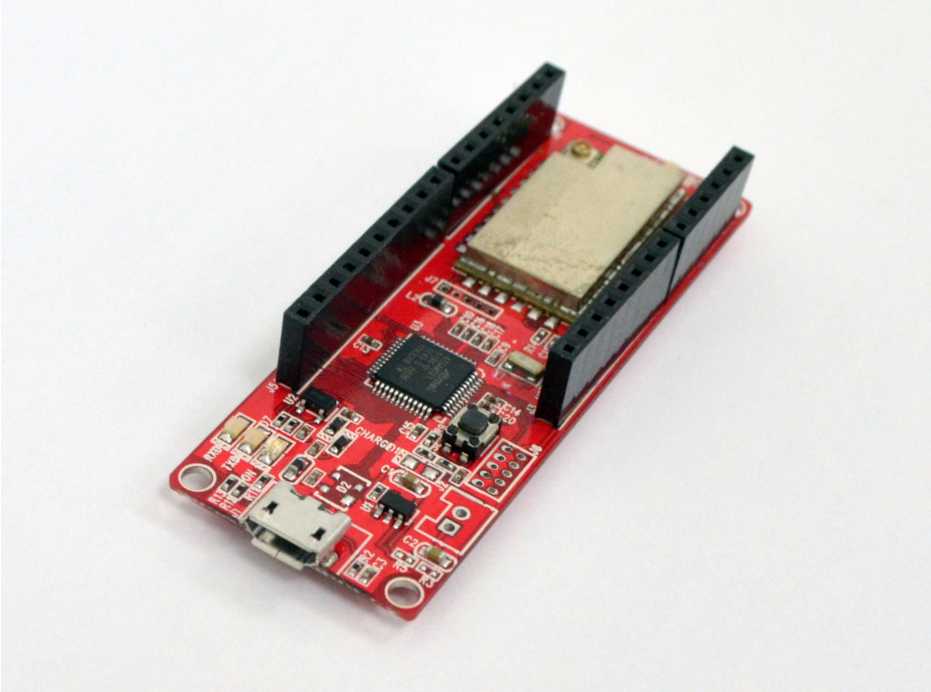
4. Introduction



4.1 Overview

The MTDuino is an easy to use powerful single board.The MTDuino is open-source, which means hardware is reasonably priced and development software is free.

This guide is for students who are confronting the MTDuino for the first time.

The Arduino project was started in Italy to develop low cost hardware for interaction design. An overview is on the Wikipedia entry for Arduino. The Arduino home page is

http://www.arduino.cc/

4.2 What You Need

1. MTDuino board
2. Micro USB cable
3. Host PC running the Arduino development environment. For Windows, Mac and Linux

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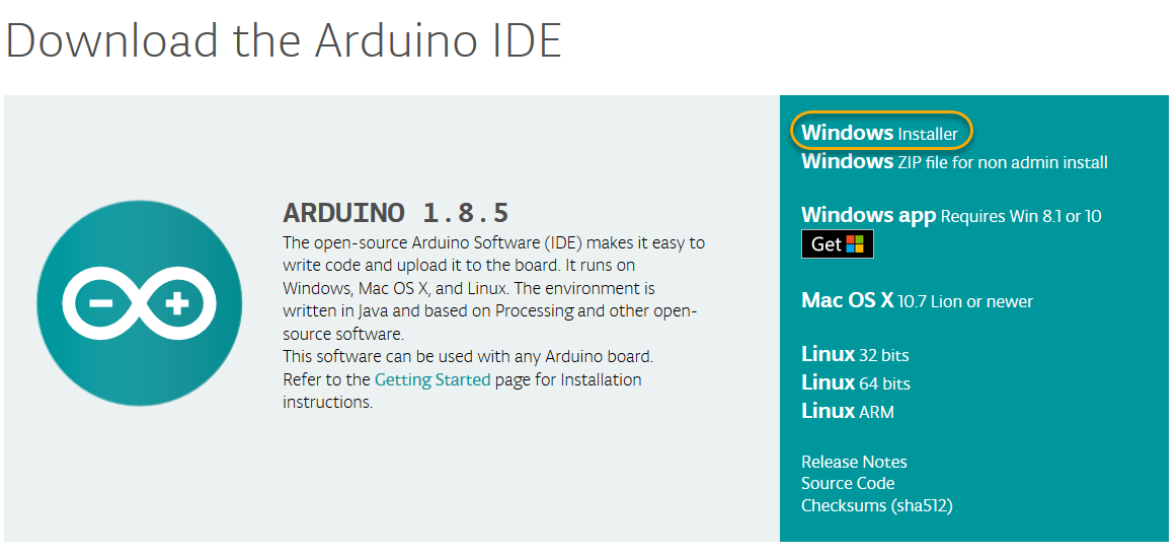
4.3 Installing Arduino IDE

Getting started of the Arduino web site, http://arduino.cc/en/Guide/HomePage

4.3.1 Download the Arduino Software (IDE)

Get the latest version from the download page. You can choose between the Installer (.exe) and the Zip packages. We suggest you use the first one that installs directly everything you need to use the Arduino Software (IDE), including the drivers. With the Zip package you need to install the drivers manually.



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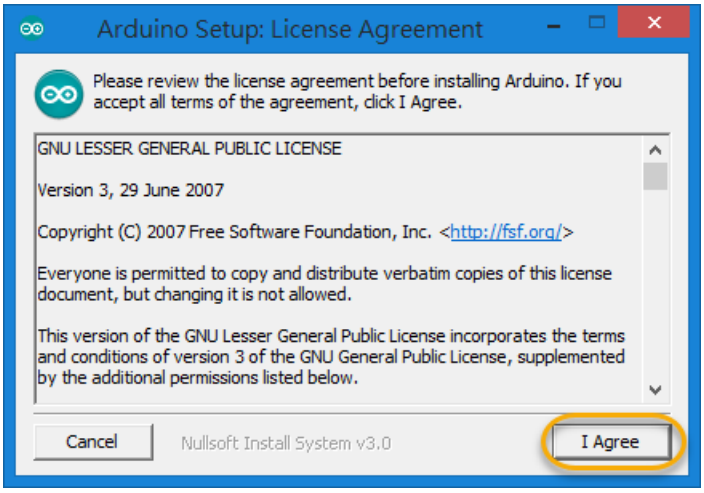
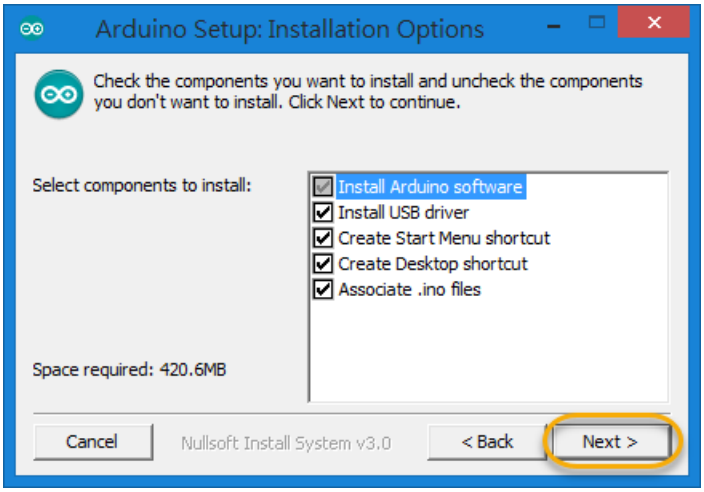
4.3.2 Install Arduino IDE

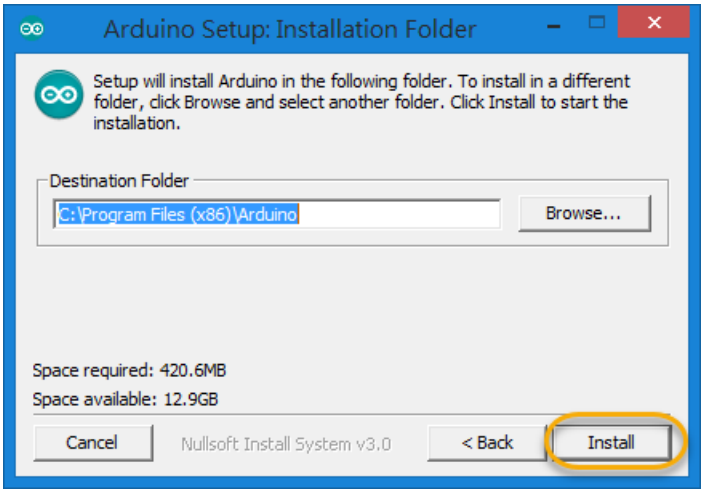
Step.1 Double click ".exe" and Click "I Agree"



Step.2 Click "Next



Step.3 Click "Install"



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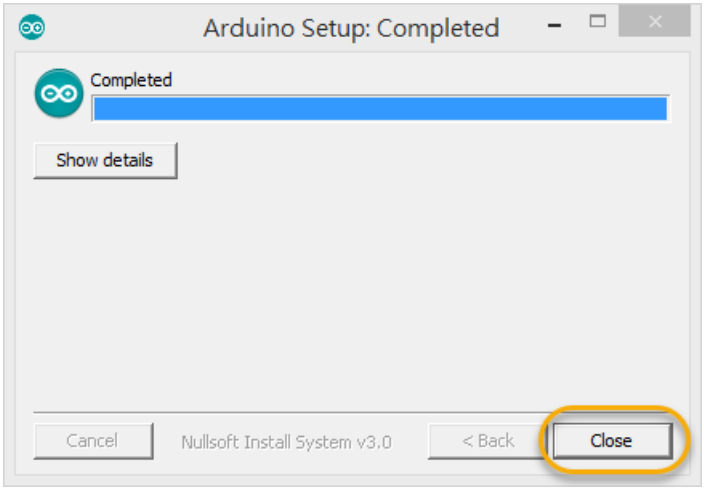
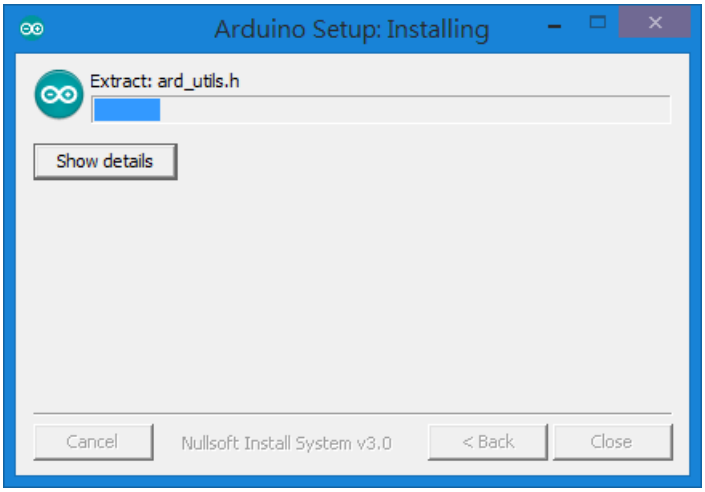
Wait for completed



Step.4 Completed and click "Close"



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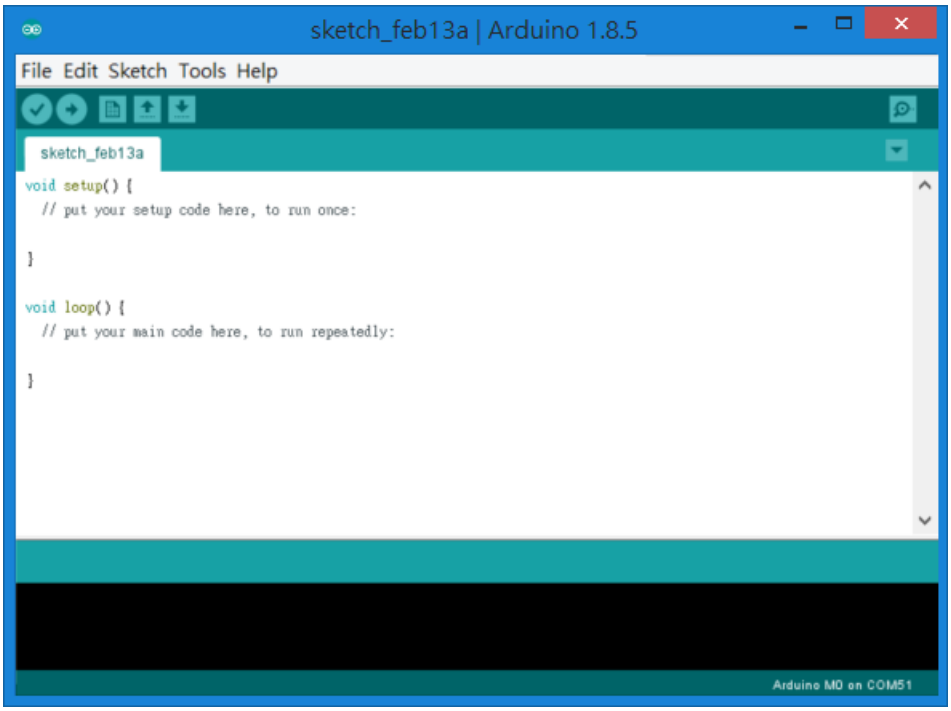
4.3.3 Install Arduino M0+ driver

Step.1 Double click "Arduino IDE" icon



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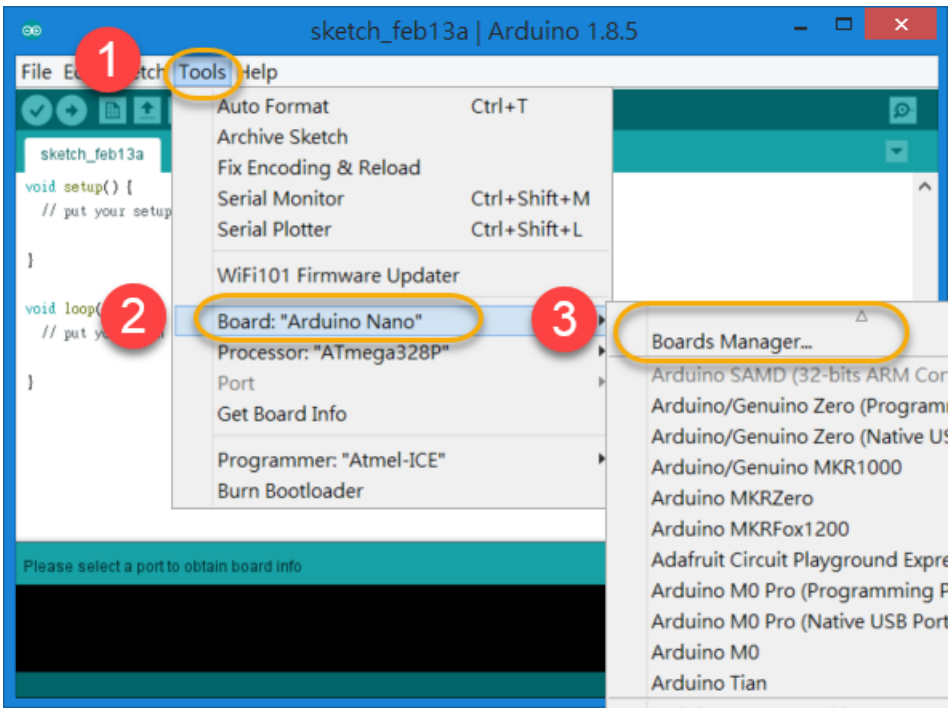
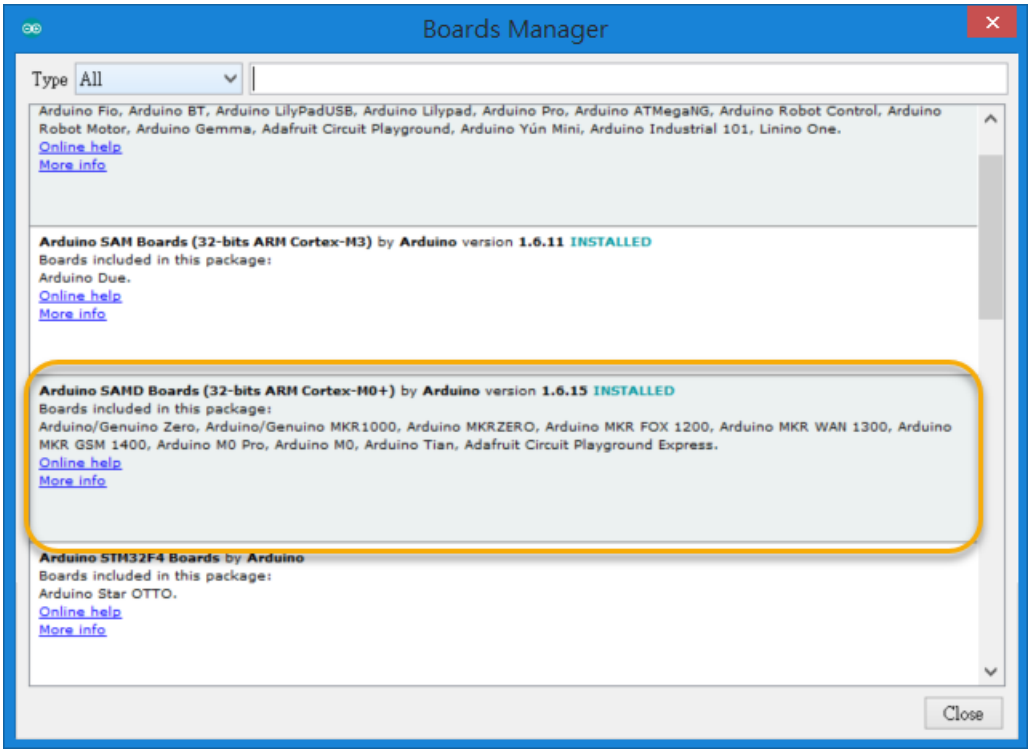
Step.2 Select Tools→Board: "xxxxxxxx" → Boards Manager



Step.3 Please install "Arduino SAMD Board (32bits ARM Cortex-M0+)"



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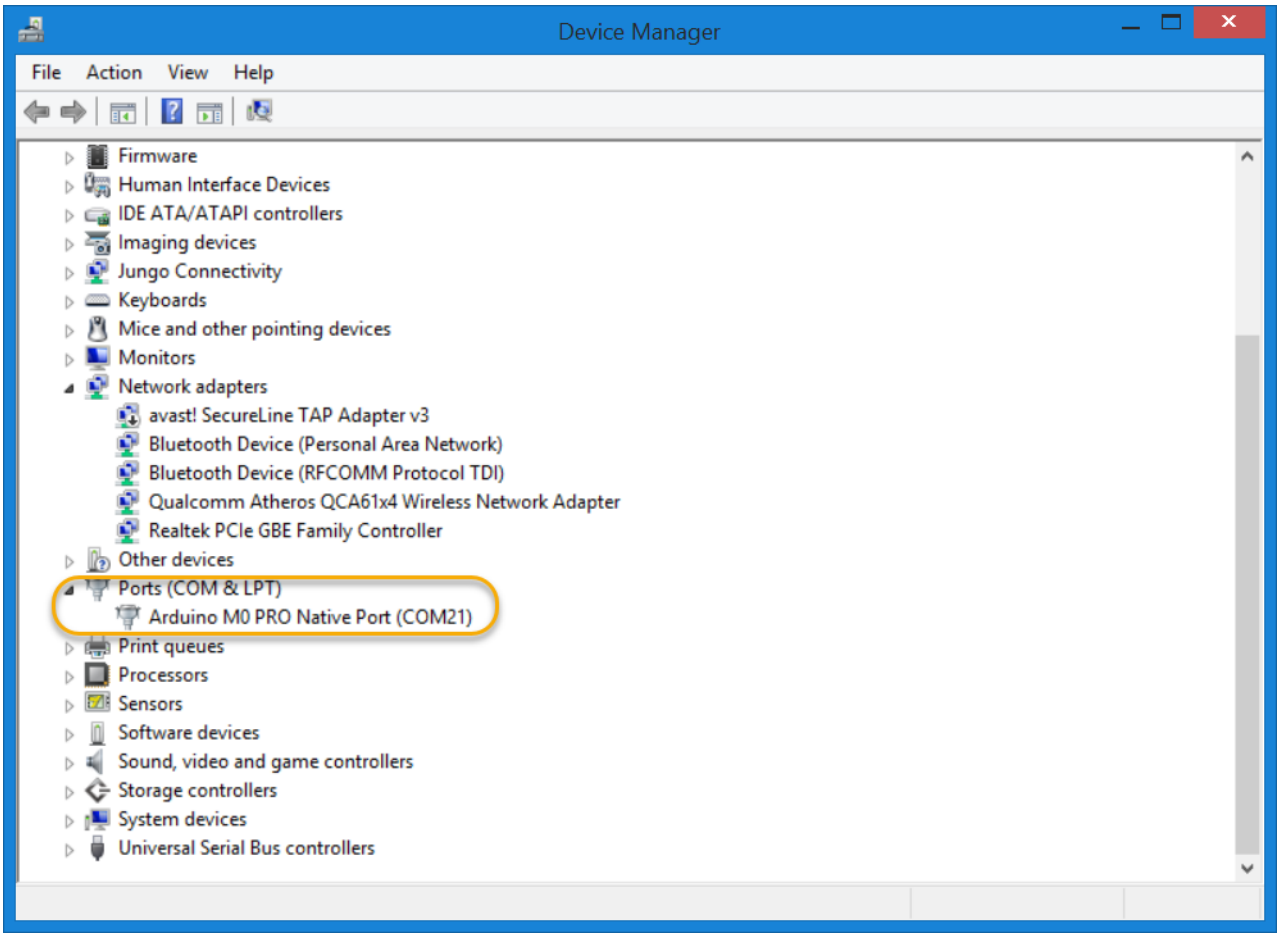
4.3.4 Check Hardware

Step.1 Plug in MTDuino device.

Step.2 Open Device management and confirm ComPort

If correct, it will show as figure.



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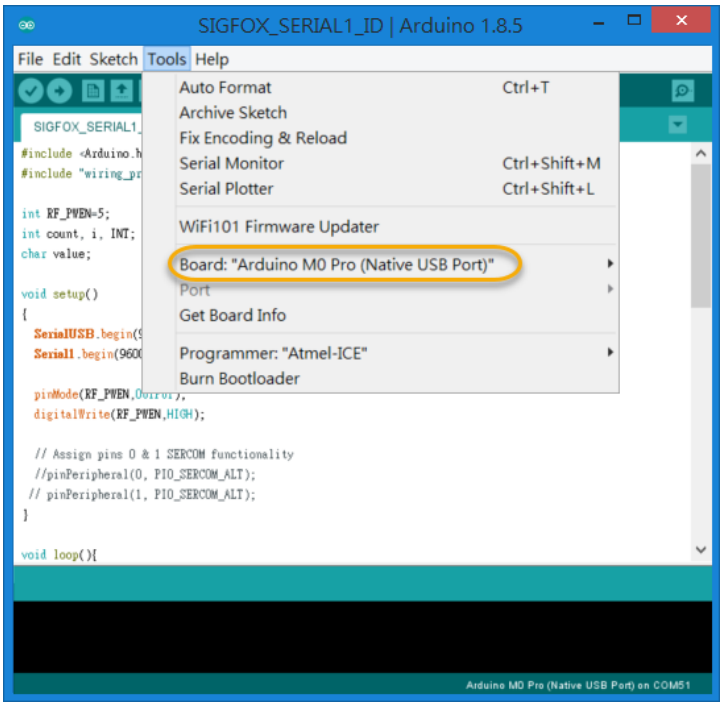
4.3.5 Upload sketch

Step.1 Open Sample code "SIGFOX_Terminal_SendAT.ino"

Step.2 Select Board: "Arduino M0 Pro(Native USB Port)



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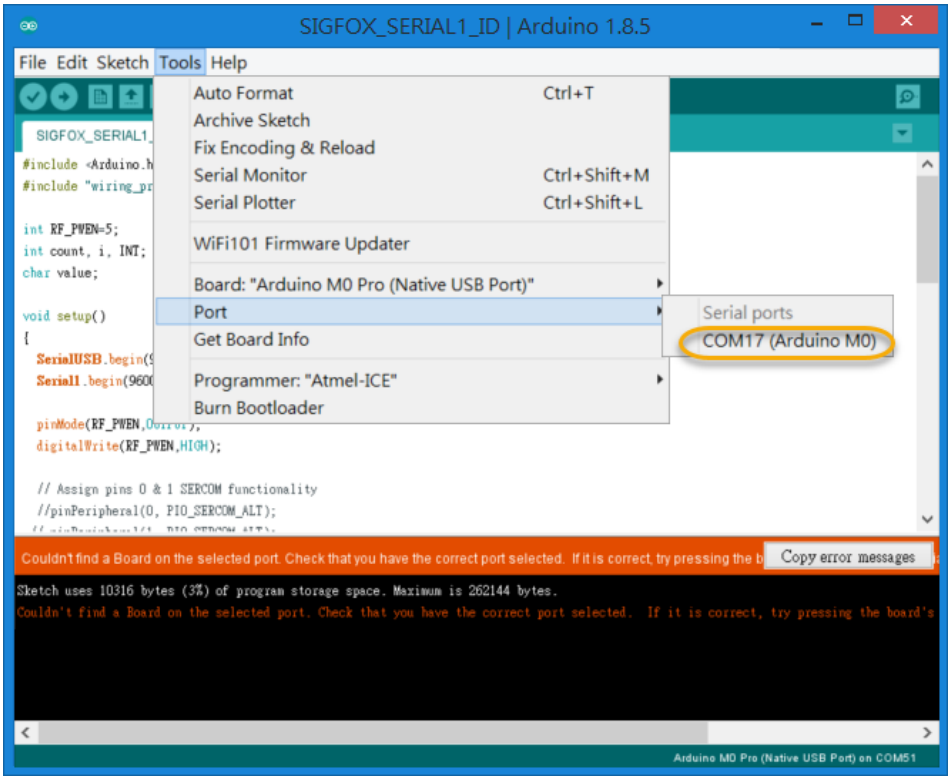
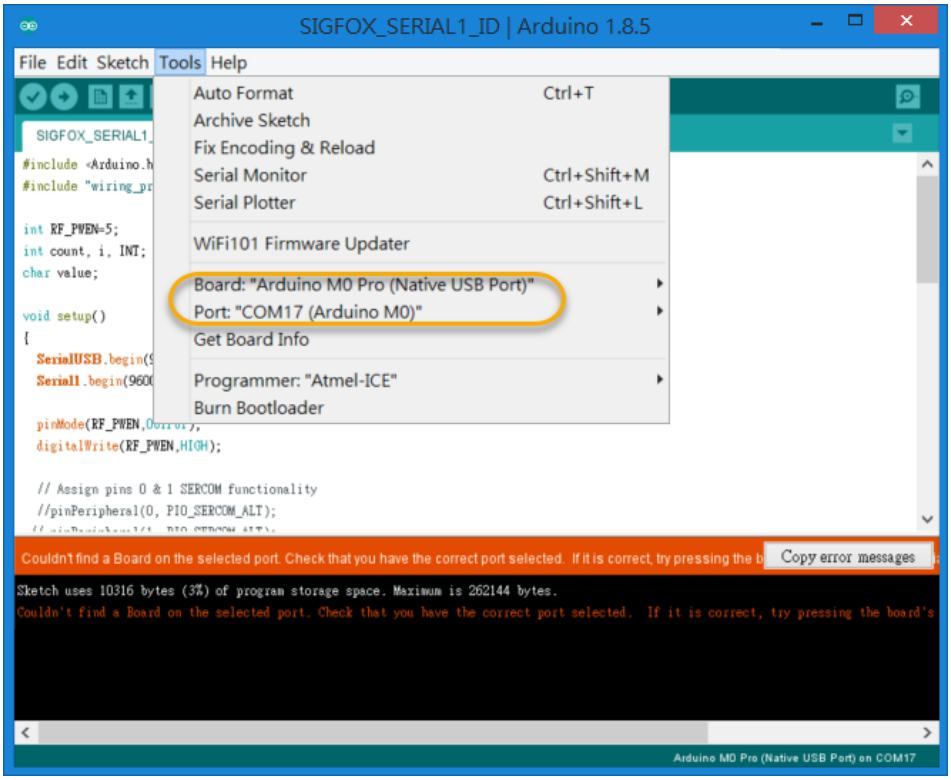
Step.3 Select Port





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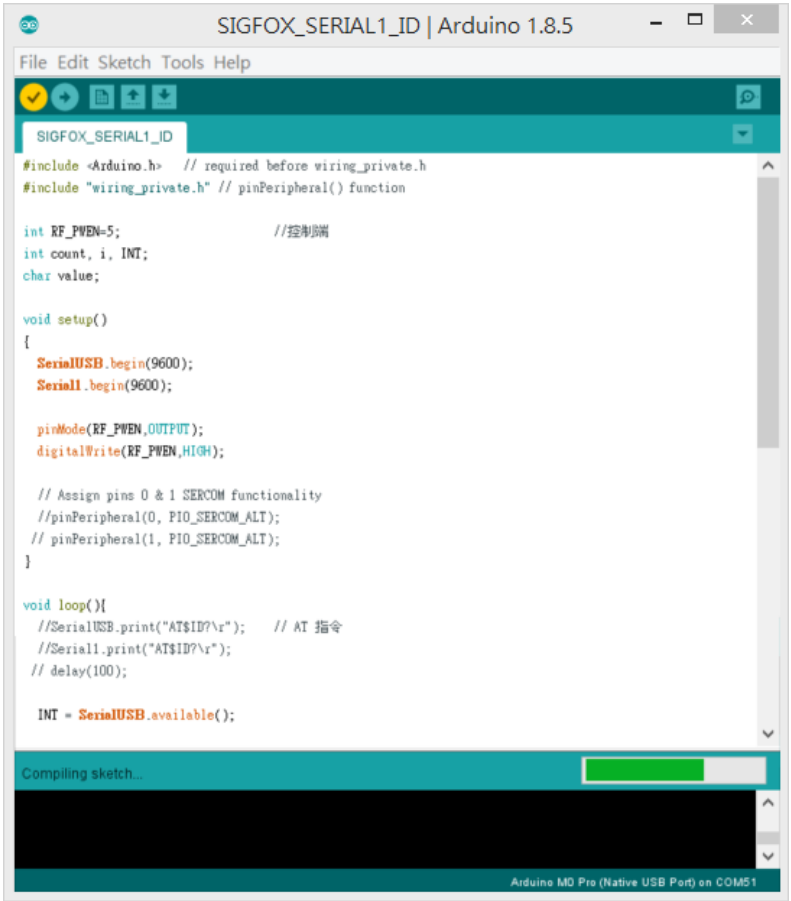
Step.4 Click "Verify"



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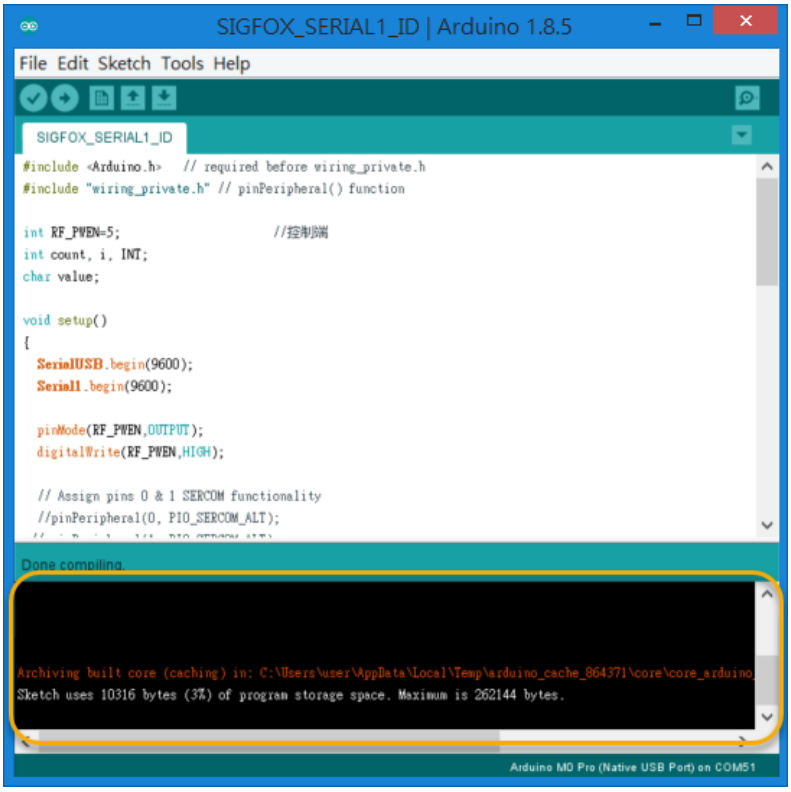

Step.5 Click "Upload"

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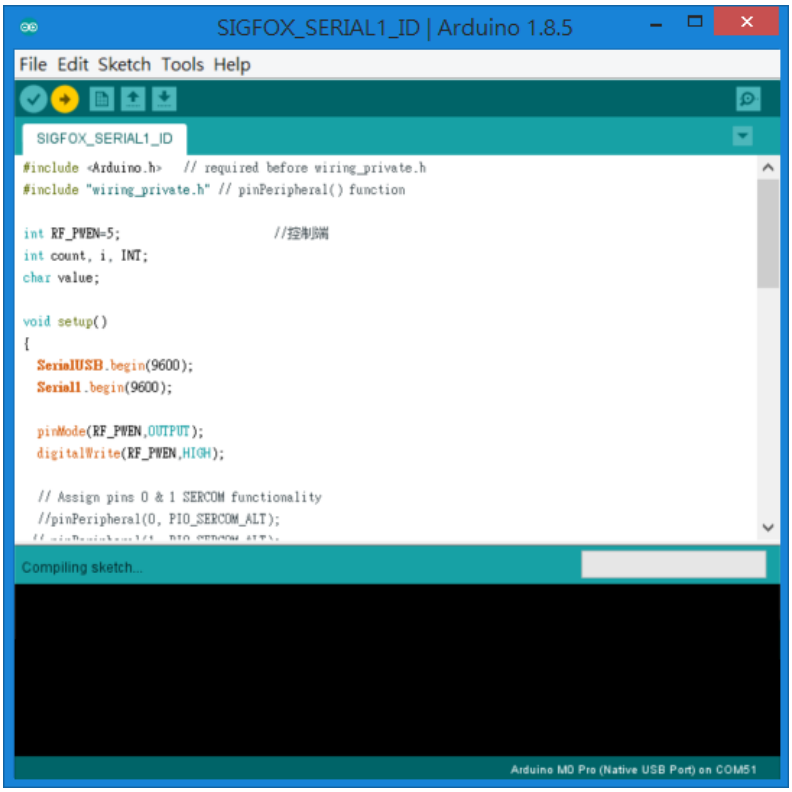

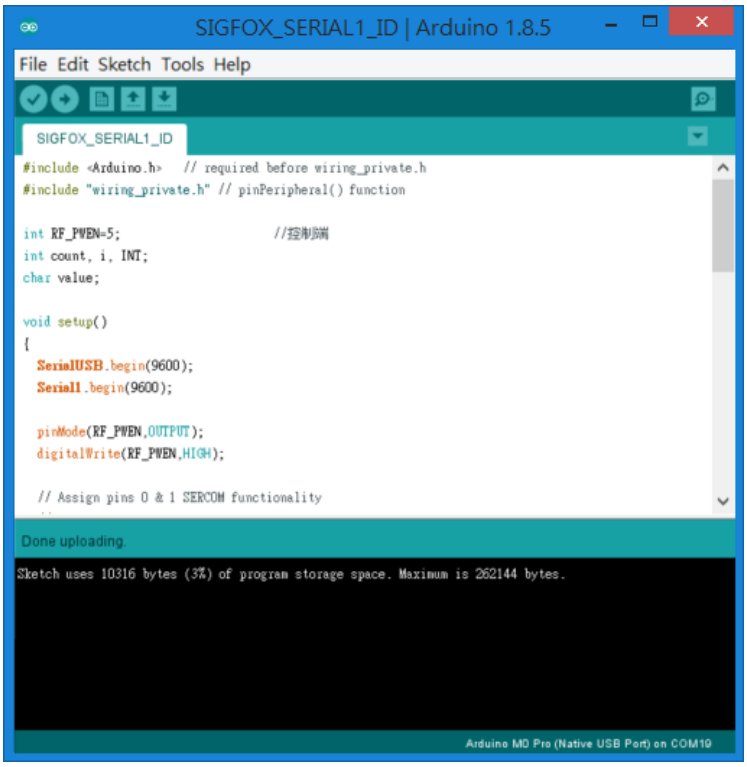

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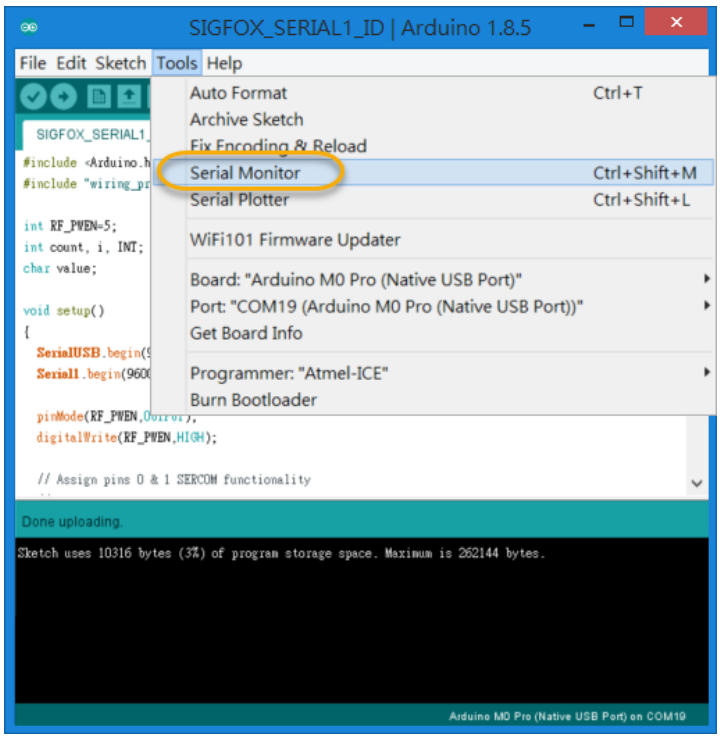
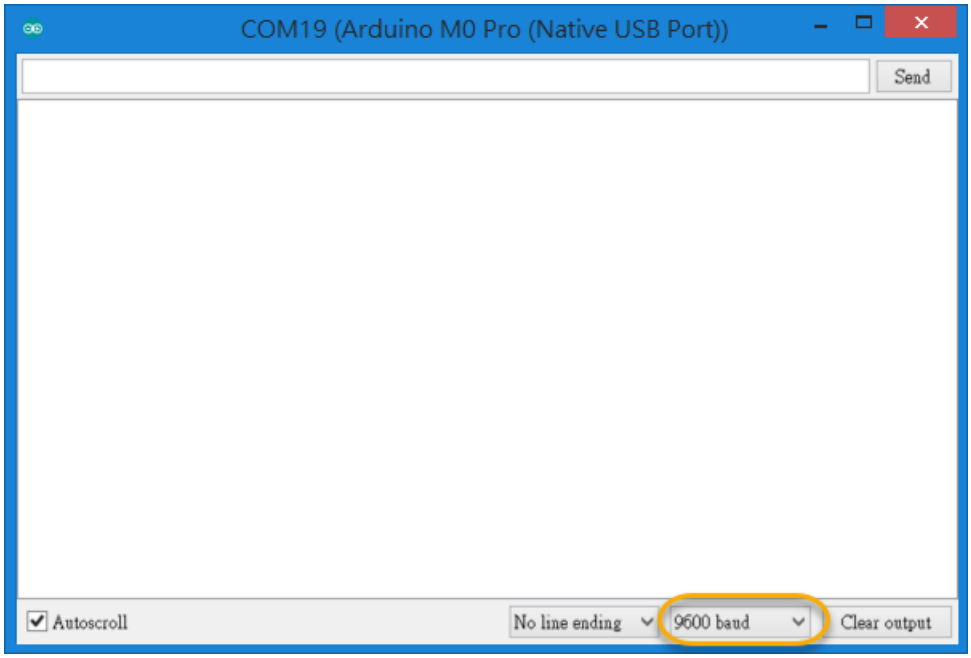
4.3.6 Confirm Upload

Step.1 Open Tools→Serial Monitor



Step.2 Select UART Baudrate →9600bps



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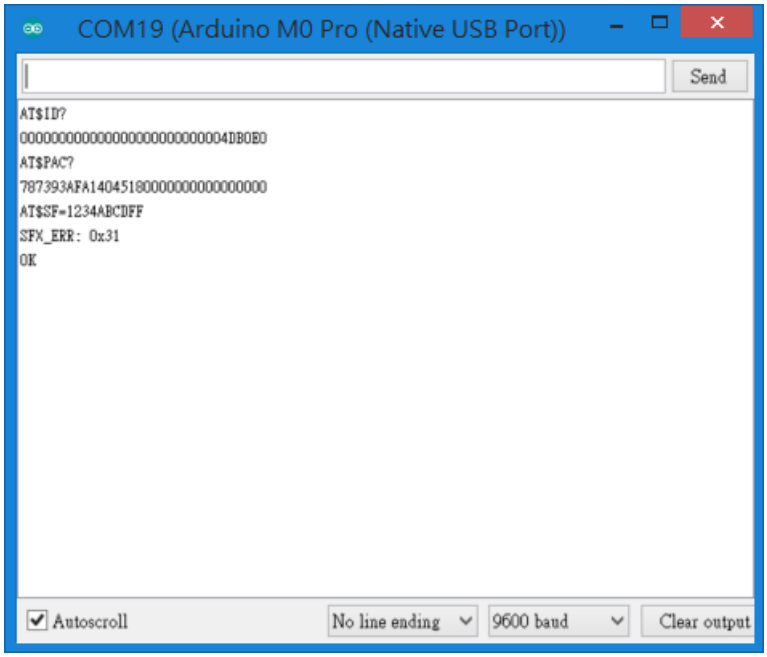
Step.3 Send Command

Command	Description	Value
AT$ID?	Get device ID	return ID
AT$PAC?	Get device PAC	return PAC
AT$SF=frame	Send payload data, 1 to 12 bytes	Frame: data bytes (0,1,2,3...C,D,E,F) to be sent, 12 byte maximum

Example:

ID: 4DB0E0

PAC: 787393AFA1404518



If success, you can see the message.

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4.4 Sigfox Backend - Active

When you first time to use Sigfox device, you need to active

Step.1 Open website

https://backend.sigfox.com/activate/

Step.2 Click "M2COMM"

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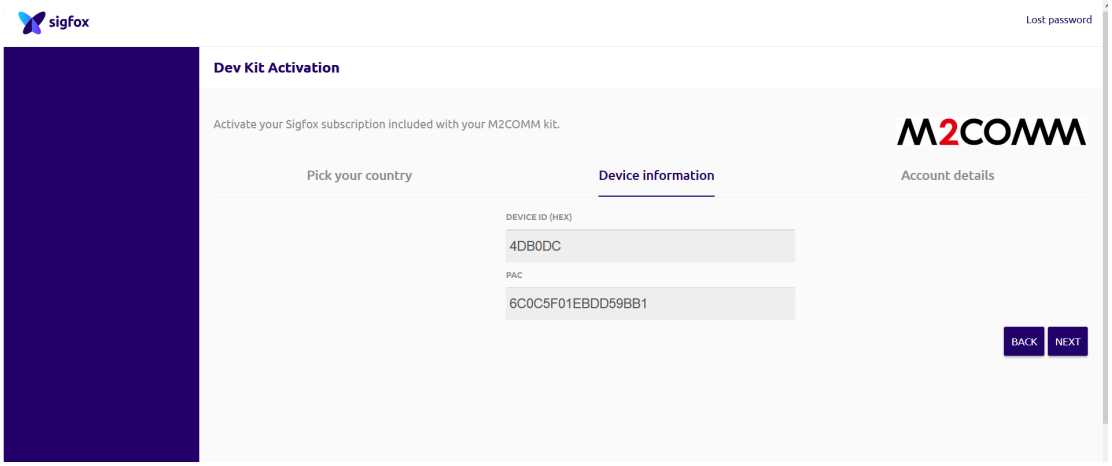
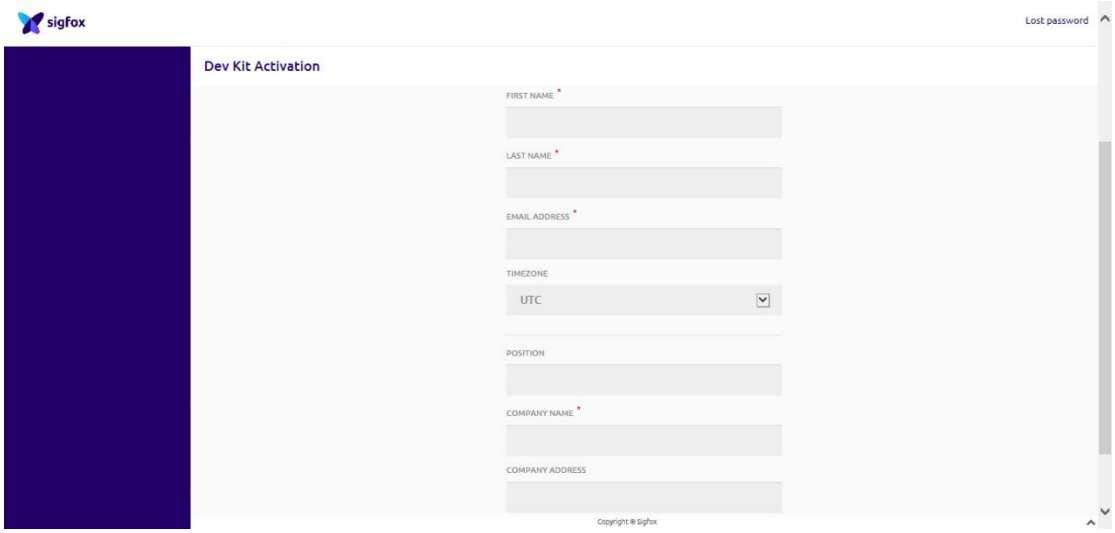
Step.3 Click "Singapore UnaBiz"

Step.4 Enter ID and PAC information



Step.5 Enter personal information



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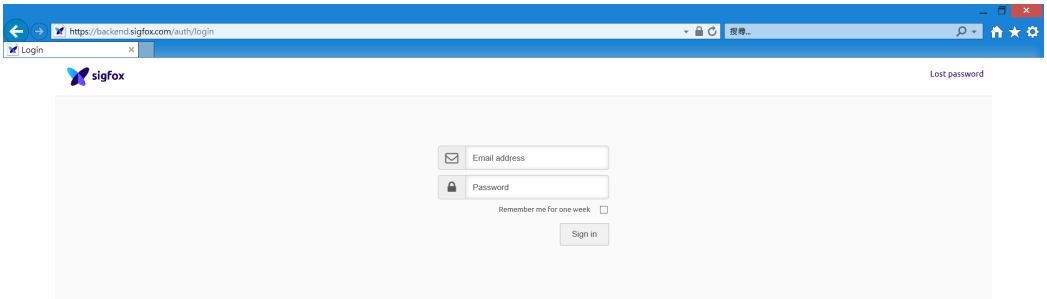
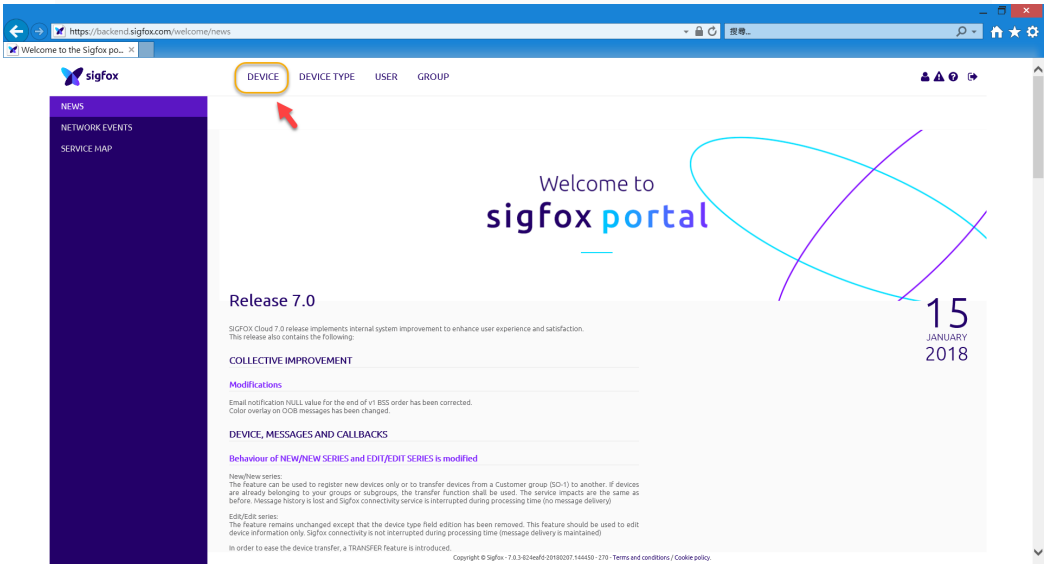
4.5 Sigfox Backend – Data Receive

Step.1 Open website, then enter "E-mail" and "Password"

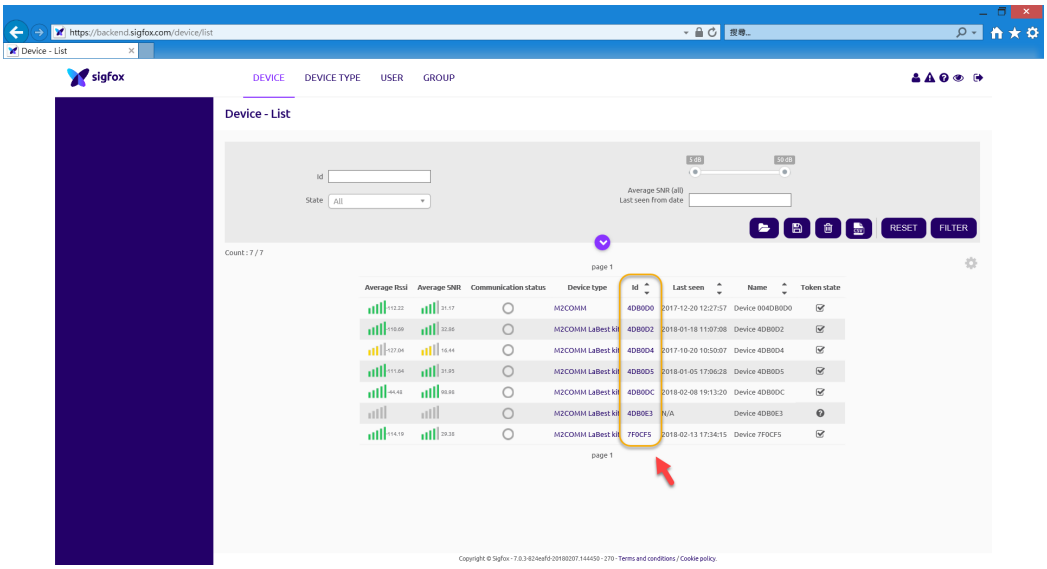
https://backend.sigfox.com



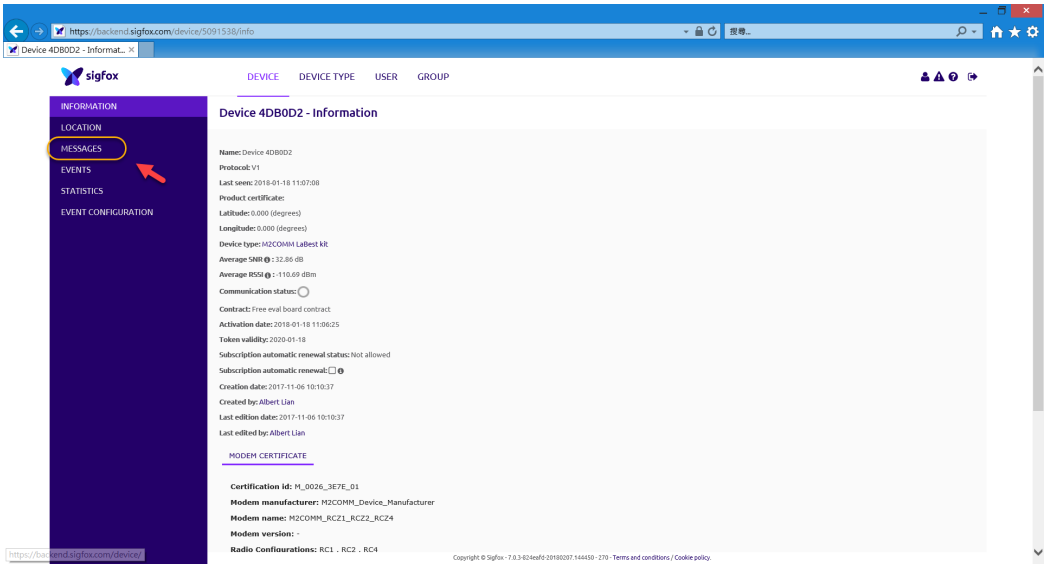
Step.2 Click "Device"



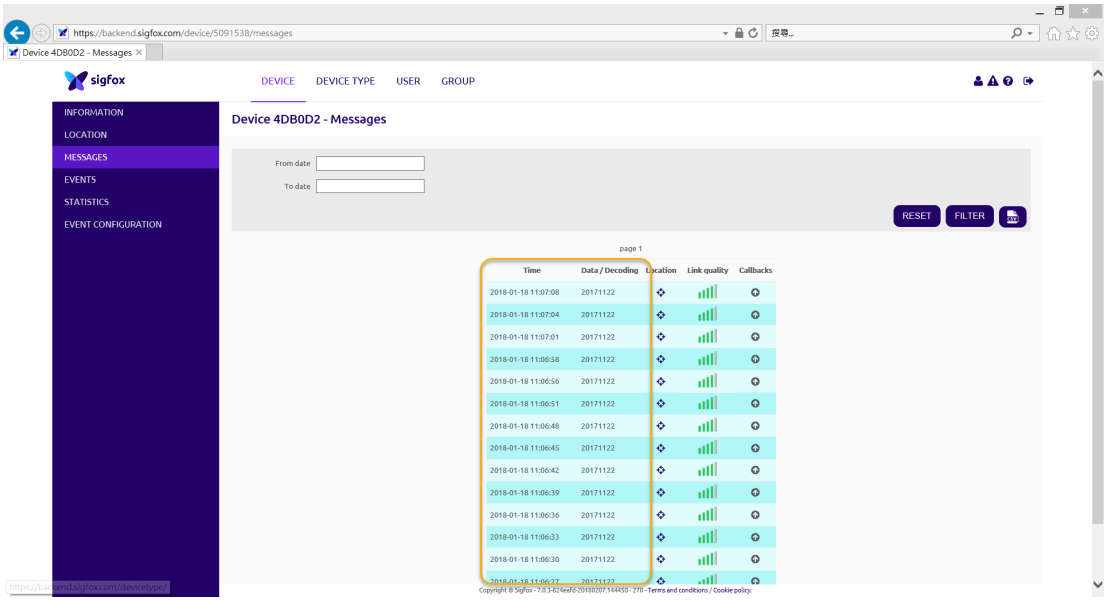
Step.3 Select ID and Click



Step.4 Click "Message"



Step.5 Check Data



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5. Example Code

5.1 Sigfox Terminal Send AT

Filename: SIGFOX_Terminal_SendAT.ino

This code is designed to send data to Sigfox backend by AT command via Terminal. Using command "AT$SF" to make sure device is ready to connect Sigfox backend. It also can used AT command to get Sigfox registered information ID and PAC from Terminal, show on screen.

Code

```
#include <Arduino.h>                                    // required before wiring_private.h
#include "wiring_private.h"                             // pinPeripheral() function
int LED_POW=3;                                          // sigfox status LED pin D3
int RF_PWEN=5;                                          // sigfox power control pin D5
int count, i, INT;
char value;

void setup()
{
        SerialUSB.begin(9600);                          // Set Terminal Baudrate: 9600bps
        Serial1.begin(9600);                            // Set sigfox Baudrate:9600bps
        pinMode(LED_POW,OUTPUT);                        // Set LED_POW pin as output
        pinMode(RF_PWEN,OUTPUT);                        // Set RF_PWEN pin as output
        digitalWrite(LED_POW,HIGH);                     // Set LED_POW to High
        digitalWrite(RF_PWEN,HIGH);                     // Set RF_PWEN to High, and Sigfox module power ON
}

void loop()
{
        INT = SerialUSB.available();                    // check Serial port

                                                        // check Serial port
        if(INT>1)
        {
                for(int i = 0; i < INT; i ++)
                {
                        value = SerialUSB.read();       // Receive Serial port data
                        Serial1.print(value);
                }
                Serial1.print("\r");
        }
        delay(100);
        count=Serial1.available();
        if(count>1)
        {
                for(int i = 0; i < count; i ++)
                {
                        value = Serial1.read();
                        SerialUSB.print(value);
                }
        }
        delay(100);
}
```


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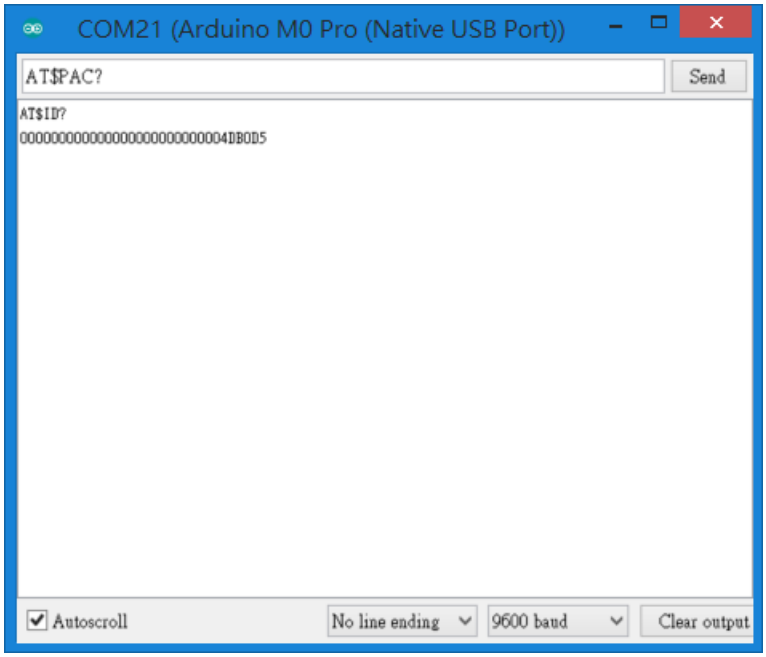
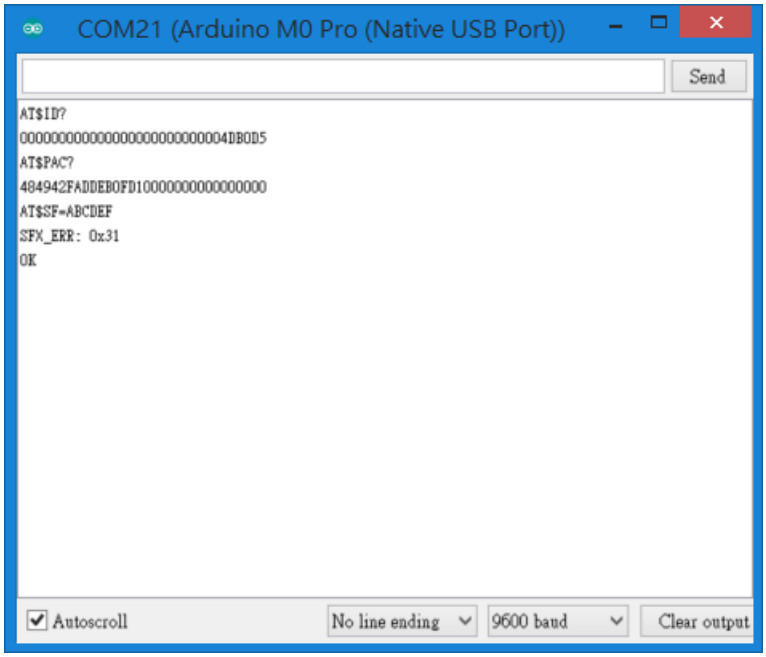
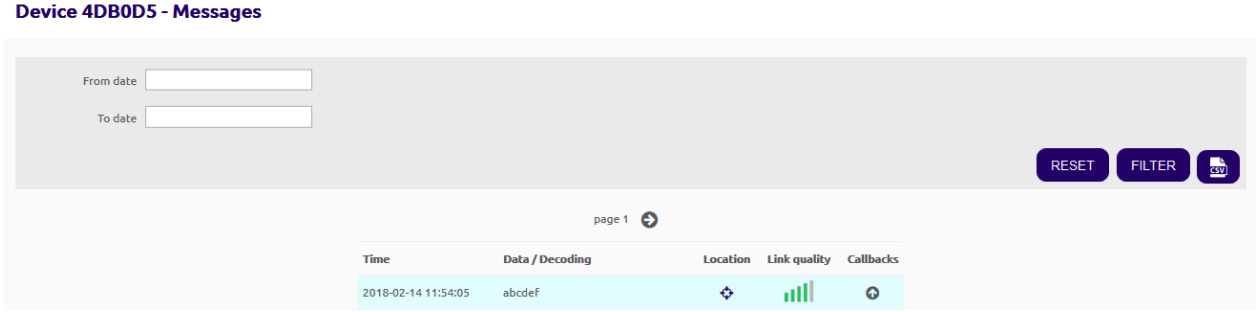
Result







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5.2 Sigfox Send

Filename: SIGFOX_Send_AT.ino

This code is designed to send data to Sigfox backend. It also can used AT command to get Sigfox registered information ID and PAC from Terminal, show on screen.

Code

```
#include <Arduino.h>                                    // required before wiring_private.h
#include "wiring_private.h"                             // pinPeripheral() function
int LED_POW=3;                                          // sigfox status LED pin D3
int RF_PWEN=5;                                          // sigfox power control pin D5

unsigned long previousMillis = 0;                       // Time Counter
const long interval = 10000;                            // Unit: ms

void setup() {
        SerialUSB.begin(9600);                          // Set Terminal Baudrate: 9600bps
        Serial1.begin(9600);                            // Set sigfox Baudrate:9600bps
        pinMode(LED_POW,OUTPUT);                        // Set LED_POW pin as output
        pinMode(RF_PWEN,OUTPUT);                        // Set RF_PWEN pin as output
        digitalWrite(LED_POW,HIGH);                     // Set LED_POW to High
        digitalWrite(RF_PWEN,HIGH);                     // Set RF_PWEN to High, and Sigfox module power ON

}
void loop()
{
        unsigned long currentMillis = millis();
                                                        //sigfox AT Command
        if (currentMillis - previousMillis >= interval)
        {
                sigfox_atcommand_tx("AT$RCZ?\r");       //sigfox AT Command: get RCZ
                sigfox_atcommand_tx("AT$ID?\r");        //sigfox AT Command: Get ID
                sigfox_atcommand_tx("AT$PAC?\r");       //sigfox AT Command: Get PAC
                delay(100);

                previousMillis = currentMillis;
                sigfox_atcommand_tx("AT$SF=1234567890AB\r");    // Send Data to backend function
        }
}

void sigfox_atcommand_tx(char *wBuffer)
{
        Serial1.print(wBuffer);                         // Send Data to backend
        sigfox_atcommand_rx();                          // Get feedback and show on Terminal function
}

void sigfox_atcommand_rx()
{
        char temp;
        while(Serial1.available() <= 0);
        while(Serial1.available() > 0)
        {
                temp = Serial1.read();
                SerialUSB.print(temp);
                delay(10);
        }
}
```


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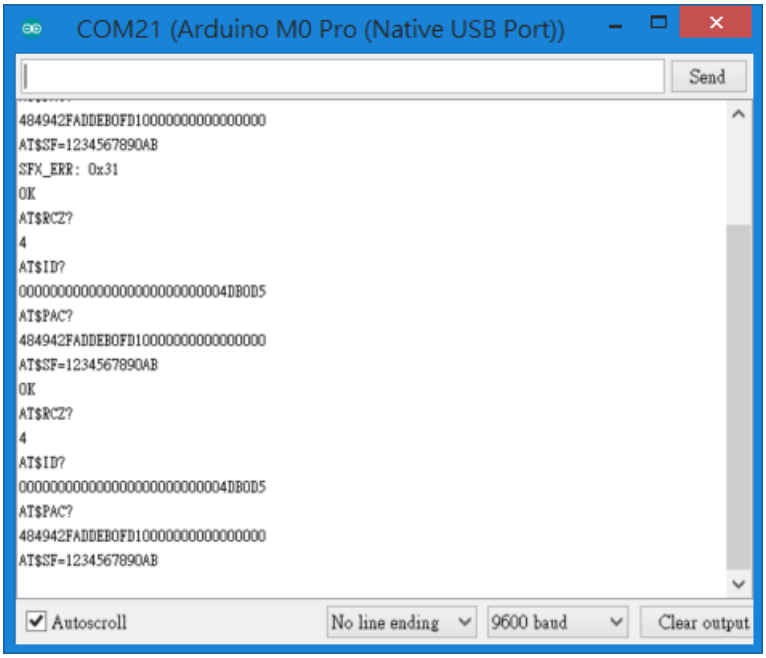
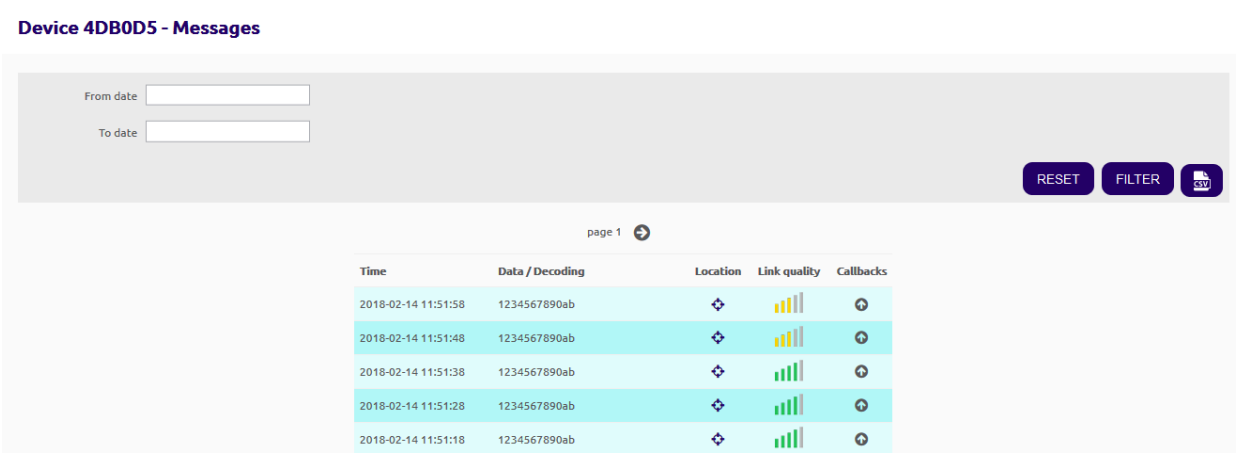
Result





NOTE

Command	Description	Value
AT$SF=frame	AT$SF=frameSend payload data, 1 to 12 bytes	Frame: data bytes (0,1,2,3...C,D,E,F) to be sent, 12 byte maximum

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