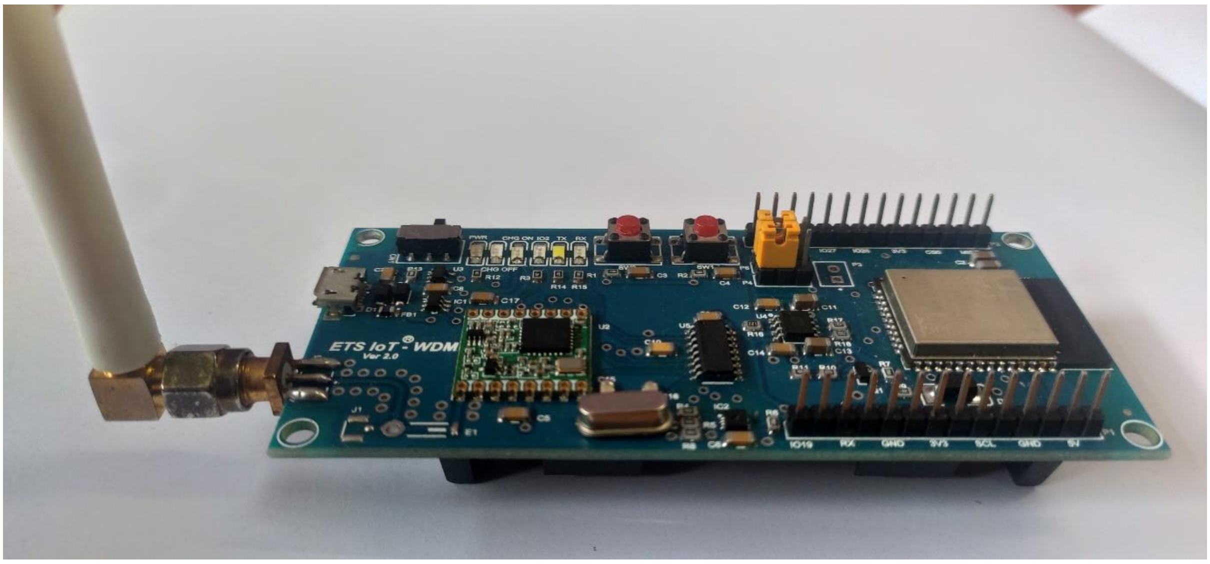
ETS IoT® - WDM Ver 2.0

Document Ver 1.0



What is WDM?

WDM is the Wireless Development Module suitable to comple your Proof of Concept in faster way. It supports Multiple Wireless Communication Protocol as follows

- Bluetooth Classic
- Bluetooth Low Energy (BLE ver 4.2)
- Wi-fi
- LoRa
- LoRaWAN

Features:

- LoRaWAN 1.0.3 Class A
- LoRaWAN Activation Method Support: ABP & OTAA
- Low power consumption
- Suitable to Interface Different Sensors
- Onboard SHT31 – Temperature and Humidity Sensor
- Bands: IN865
- Arduino Programmable
- LMIC Library Compatible
- Option for Battery Powered Device (3.7V - 18650 rechargeable lithium Polymer battery) – Not Included in the Pack
- Onboard Battery Recharge option

Specification:

MCU Specifications:

- CPU: Xtensa dual-core 32-bit LX6 microprocessor, up to 240MHz
- ROM: 448KB for booting and core functions
- SRAM: 520KB for booting and instructions
- SRAM: 16 KB in RTC
- SPI Flash: 4MB
- Ultra-Low Power (ULP) Co-processor
- Crystal oscillator: 40 MHz
- 8x Hybrid Digital IO with Special Functions
- Special Functions: 1x I2C, 1x SPI, 1x UART
- 4x Hybrid Analog & Digital IO: 4 No's
- 2x Hybrid Analog & Digital IN: 2 No's
- Analog Resolution: 8,10,12-bit configurable
- Pulse Width Modulation (PWM)
- Onboard Temperature Sensing (typ., -40°C to 90°C with Accuracy □0.3 °C)
- Onboard Humidity Sensing (typ., 0%RH to 100%RH with Accuracy □ 2%RH)
- Onboard LED: 1xRED
- Baud rate configurable
- 802.11 b/g/n Wi-Fi
- Bluetooth Classic and Bluetooth Low Energy (BLE) in the 2.4GHz band
- General ISM < 1GHz LoRa™ Transceiver 868MHz Surface Mount
- Onboard Antenna for Wi-fi & Bluetooth
- Open source software

LoRa Specification:

- LoRa Chip: RF96
- Data Rate: 300kbps
- Power Output: 20dBm
- Sensitivity: -148dBm
- Current Transmitting: 120mA
- Operating Temperature: -20°C ~ 70°C
- RF Family/Standard: General ISM < 1GHz
- Protocol: LoRa™
- Modulation: FSK, GFSK, GMSK, MSK, OOK
- Frequency: 865-867 MHz
- Antenna Type - External Antenna via SMA / I-Pex connector
- Supply Voltage: 1.8V ~ 3.7V
- Receiving Current: 12.1mA
- Transmitting Current: 120mA
- Operating Temperature: -20°C ~ 70°C

Wi-Fi:

- 802.11b/g/n
- Bit rate: 802.11n up to 150 Mbps
- A-MPDU and A-MSDU aggregation
- 0.4 µs guard interval support
- Center frequency range of operating channel: 2412 ~ 2484 MHz

Bluetooth Specification:

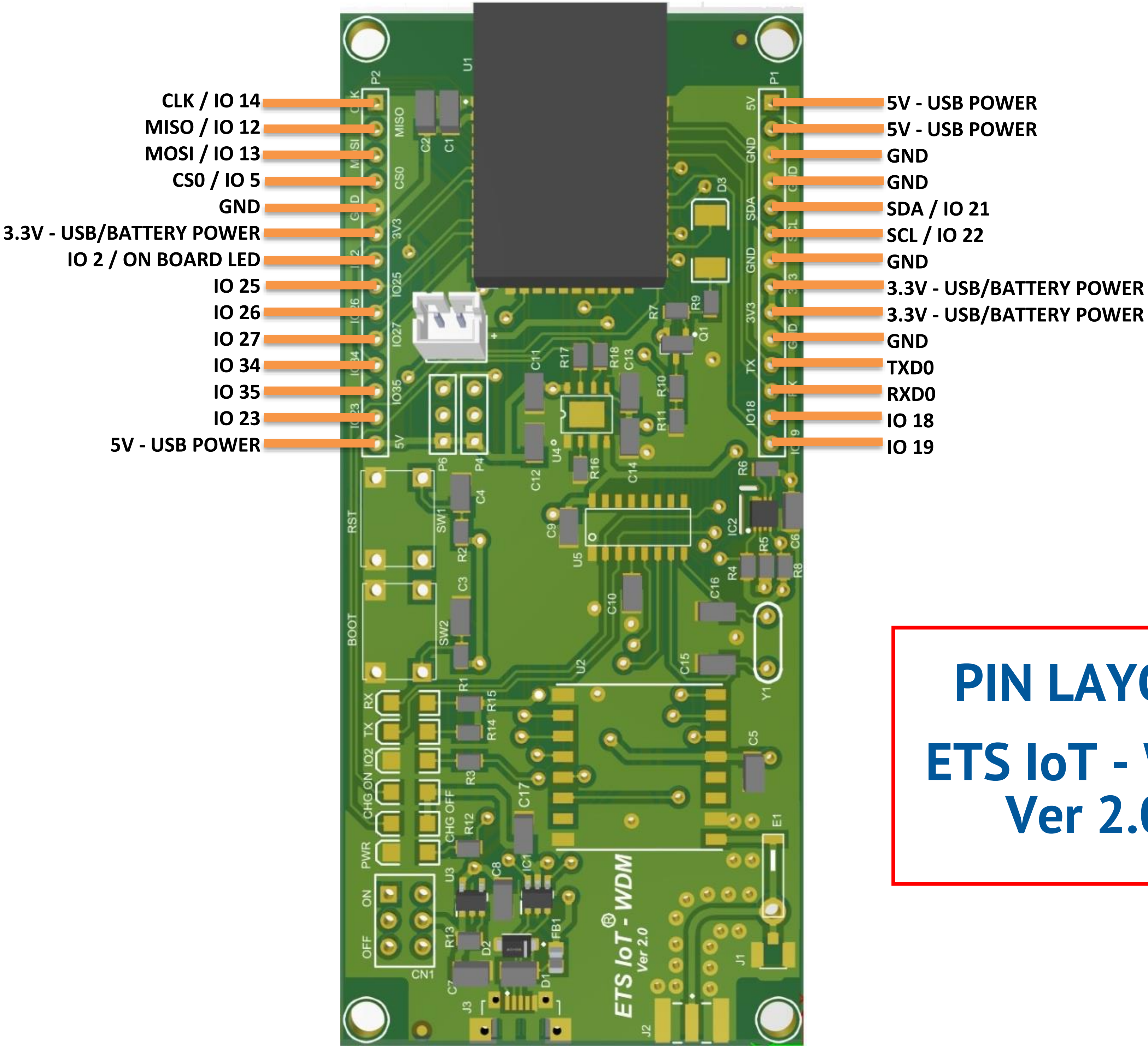
- Bluetooth v4.2 BR/EDR and BLE specification
- Class-1, class-2 and class-3 transmitter
- Adaptive Frequency Hopping (AFH)

Common DC Characteristics:

- Supply Voltage: 5 V
- Operating Voltage: 3.0 - 3.6 V
- Minimum current delivered by power supply: 500 mA
- Battery Voltage: 3.7 V Li-Poly
- operating temperature range: – 40 °C ~ 85 °C
- Wake up from GPIO interrupt, timer, ADC measurements

Applications:

- Home Automation
- Smart Building
- Industrial Automation
- Smart Agriculture



Infinite Innovations

PIN LAYOUT

ETS IoT - WDM Ver 2.0

ETS IoT® – WDM Ver2.0 Pin Description

Pin No.	Pin Name	IO No.	Type	Function
1	CLK	14	I/O	GPIO, ADC, RTC, SPI_CLK, LoRa_SPI_CLK
2	MISO	12	I/O	GPIO, ADC, RTC, SPI_MISO, LoRa_SPI_MISO
3	MOSI	13	I/O	GPIO, ADC, RTC, SPI_MOSI, LoRa_SPI_MOSI
4	CS0	5	I/O	GPIO, SPI_CS0
5	GND	--	GND	GROUND
6	3V3	--	PWR	3.3V Power Supply while connecting Battery (or) USB
7	IO2	2	I/O	GPIO, ADC, RTC, On Board LED
8	IO25	25	I/O	GPIO, ADC, RTC
9	IO26	26	I/O	GPIO, ADC, RTC
10	IO27	27	I/O	GPIO, ADC, RTC
11	IO34	34	I	Input_Pin, ADC, RTC
12	IO35	35	I	Input_Pin, ADC, RTC
13	IO23	23	I/O	GPIO
14	5V	--	PWR	5V Power Supply while connecting USB Only
15	IO19	19	I/O	GPIO
16	IO18	18	I/O	GPIO
17	RXD0	3	I/O	GPIO, U0RXD
18	TXD0	1	I/O	GPIO, U0TXD
19	GND	--	GND	GROUND
20	3V3	--	PWR	3.3V Power Supply while connecting Battery (or) USB
21	3V3	--	PWR	3.3V Power Supply while connecting Battery (or) USB
22	GND	--	GND	GROUND
23	SCL	22	I/O	GPIO, I2C_SCL, Also Configured for Onboard SHT31 SCL
24	SDA	21	I/O	GPIO, I2C_SDA, Also Configured for Onboard SHT31 SDA
25	GND	--	GND	GROUND
26	GND	--	GND	GROUND
27	5V	--	PWR	5V Power Supply while connecting USB Only
28	5V	--	PWR	5V Power Supply while connecting USB Only

Note:

- **I/O – Input/Output, I – Input, PWR – Power Supply, GND – Ground**
- **IO No. can be used for Programming the WDM**
- **IO15 is Internally Connected to LoRa_NSS**
- **IO17 is Internally Connected to LoRa_Reset**
- **IO4, IO33, IO32 is Internally Connected to LoRa DIO0, DIO1, DIO2 respectively**

Arduino Configuration for Getting Started with WDM

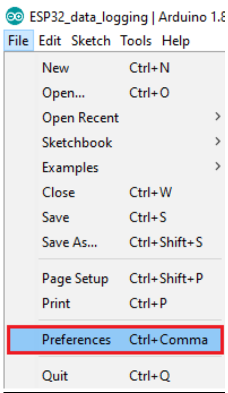
Prerequisite:

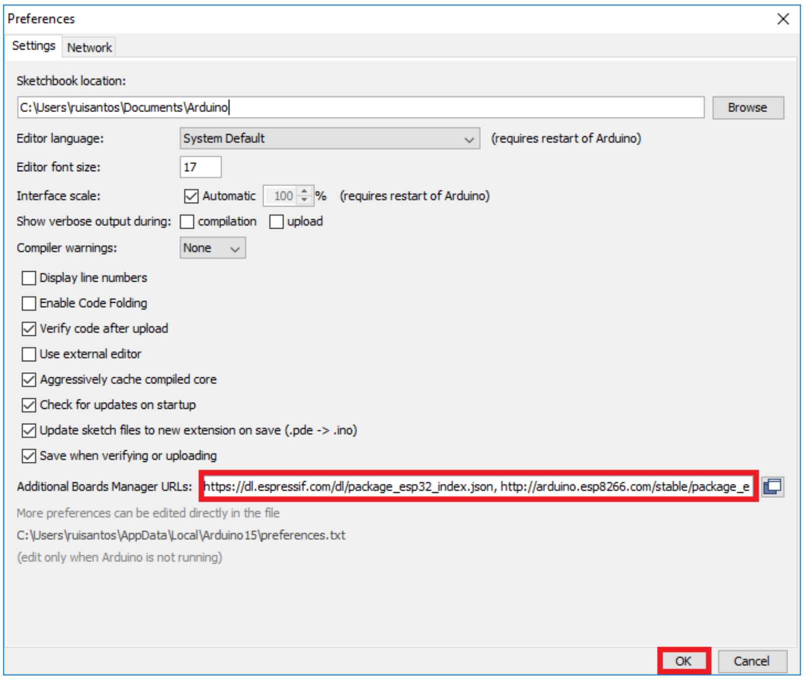
1. **ETS IoT® - WDM Ver 2.0**
   (Buy at: https://www.enthutech.in/shop/product/wdm-ets-iot-wdm-1591)
2. **PC / Laptop Installed with ArduinoIDE Ver 1.8.15**
   (Download at: https://www.arduino.cc/en/software)
3. **Driver for CH340G**
   (Download at: https://www.enthutech.in/shop/product/wdm-ets-iot-wdm-1591)
4. **LMIC Library Files & Sample Codes**
   (Download at: **https://www.arduinolibraries.info/libraries/mcci-lo-ra-wan-lmic-library**)

Procedure for installing and uploading the code in WDM module:

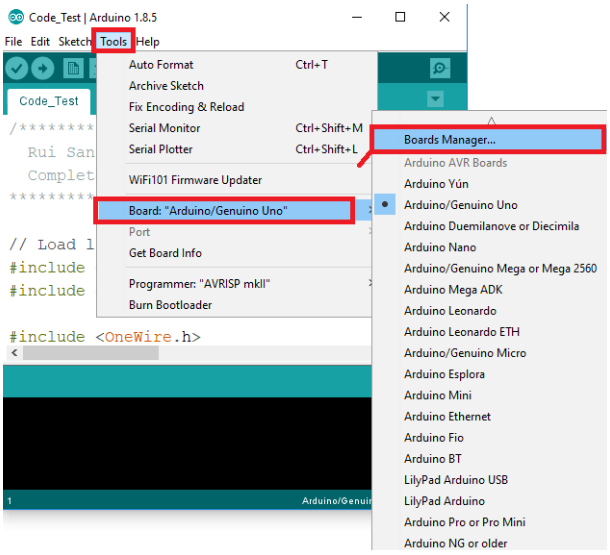
- Arduino IDE Version 1.8.15 is used to program the WDM module
- Use the following link to download the Arduino IDE Version 1.8.15
  https://downloads.arduino.cc/arduino-1.8.15-windows.exe

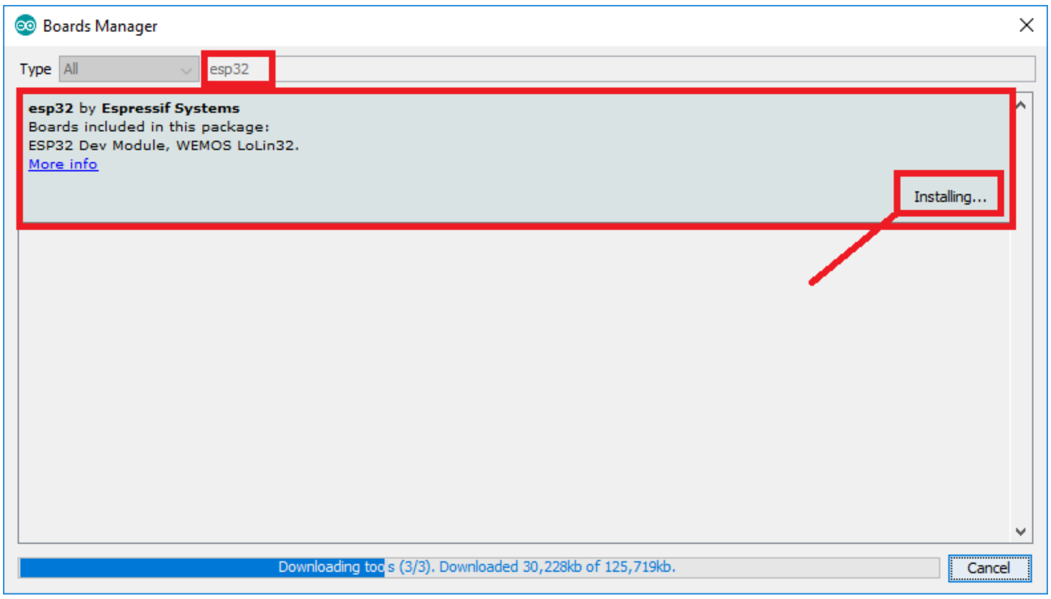
- After installing the ArduinoIDE we need to install the ESP32 board support package in the Arduino IDE software
- Open the Arduino IDE and go to **Files -> Preferences** and paste the below link **https://dl.espressif.com/dl/package_esp32_index.json** in Additional Board manager URL field



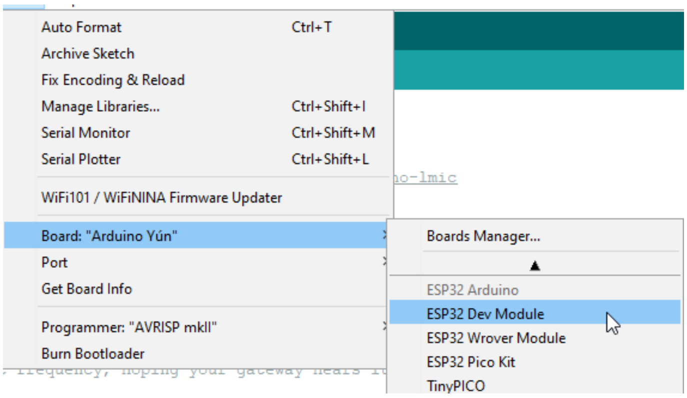


- ➢ After pasting the link and go to **Tools -> Boards ->Board Manager**

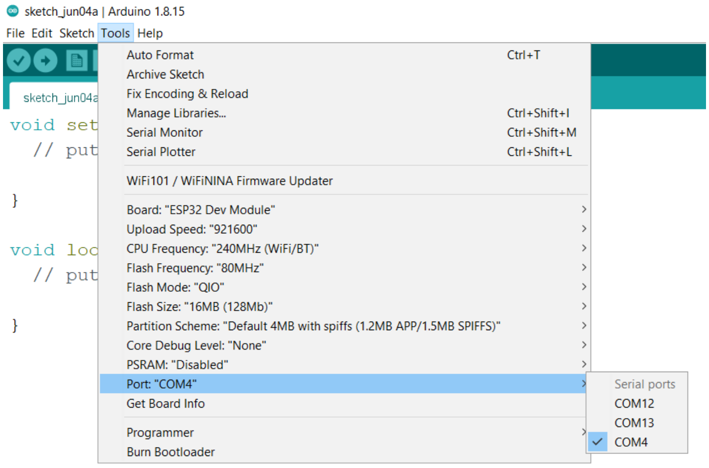




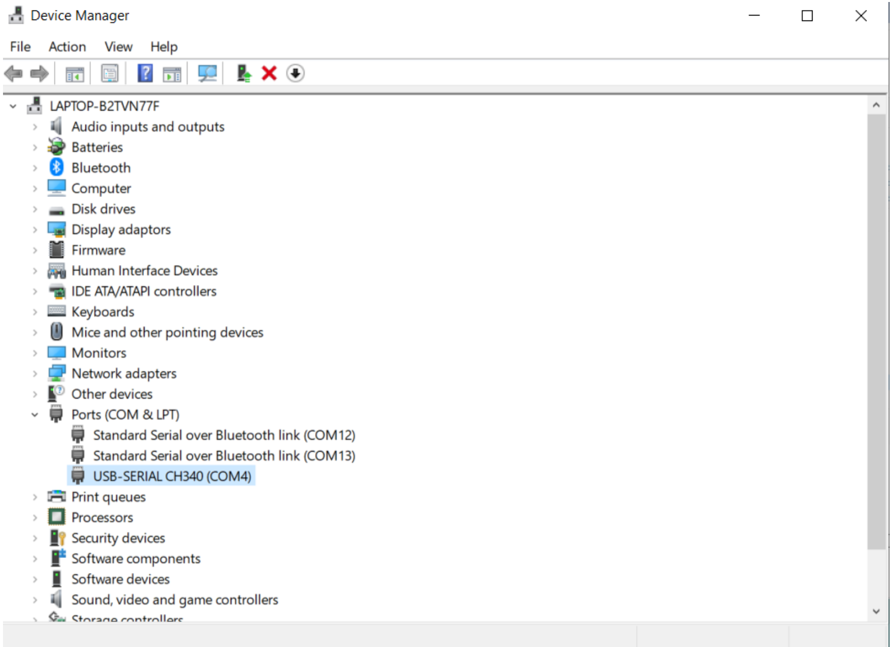
- After installing the ESP32, Go to **Tools** >> **Board** >> **ESP32 Dev Module**



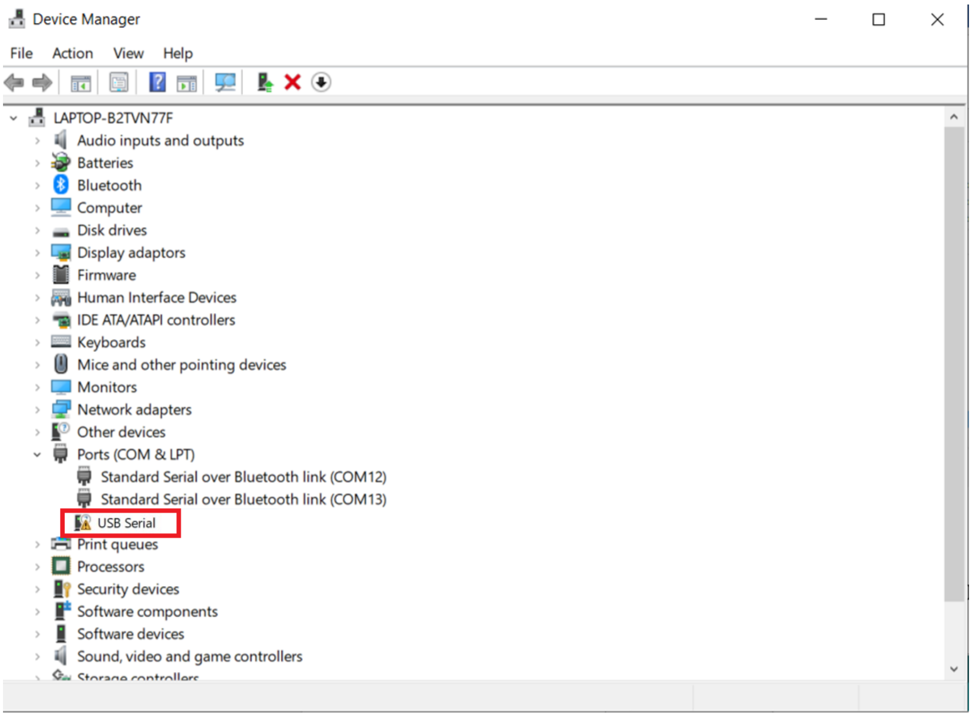
- Connect WDM with PC/Laptop Via USB Cable
- Make ON OFF Switch in WDM to ON Position
- In ArduinoIDE, Go to Tools and select all the settings for ESP32 Dev Module as per below image



- Here It was showing 3 COM Ports. To Identify right COM Port or to check status of Device driver Installation Check Device Manager in your PC/Laptop



- As per above Image, WDM is connected with USB-SERIAL CH340(COM4)
- In case, if the driver is not installed you will get the COM Port as follows (USB Serial Warning)

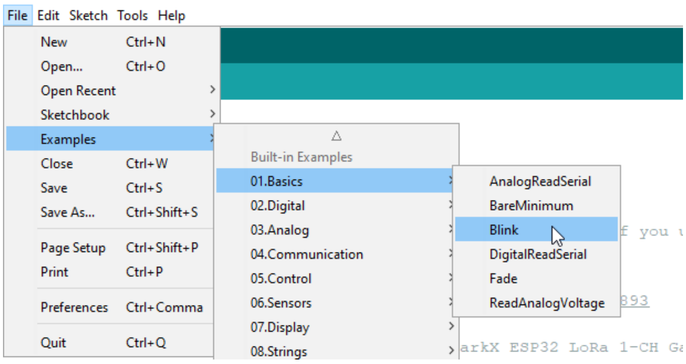


For Installing Driver: Download CH340G Driver for Arduino available at Documents section of https://www.enthutech.in/shop/product/wdm-ets-iot-wdm-1591

- After Installing, Select right port at Tools >> Port

TO UPLOAD SKETCH IN WDM

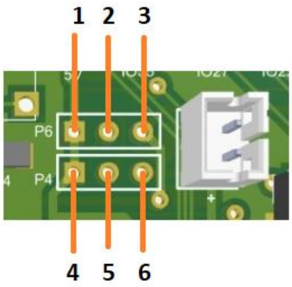
- **Go to Files >> Examples >> Basics >> Blink**



- In Code, replace "LED_BUILTIN" as 2 in all the places. Where Onboard LED is connected to IO2 of ESP32 as below

```
void setup() {
  // initialize digital pin LED_BUILTIN as an output.
  pinMode(2, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(2, HIGH);   // turn the LED on (HIGH is the voltage level)
  delay(1000);                       // wait for a second
  digitalWrite(2, LOW);    // turn the LED off by making the voltage LOW
  delay(1000);                       // wait for a second
}
```

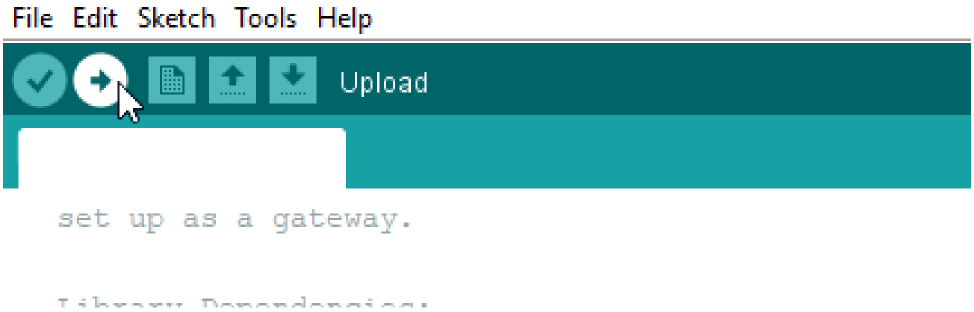
- Before Uploading Code, Check Jumper Option for P6 & P4



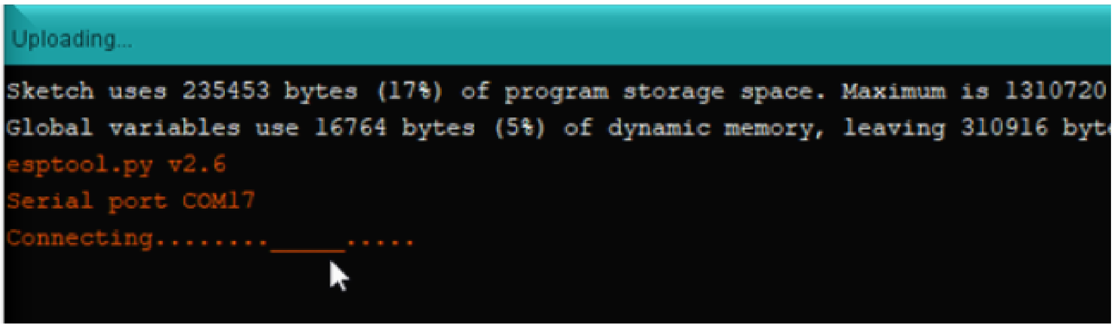
Jumper Position (P4 & P6)	Operation
1-2 (P6)	PWR LED for +5V
2-3 (P6)	PWR LED for +3.3V
4-5 (P4)	USB Power / Programming
5-6 (P4)	Battery Power

Note: Keep P6 Jumper Open to make PWR LED OFF when connected to Battery it will save power.

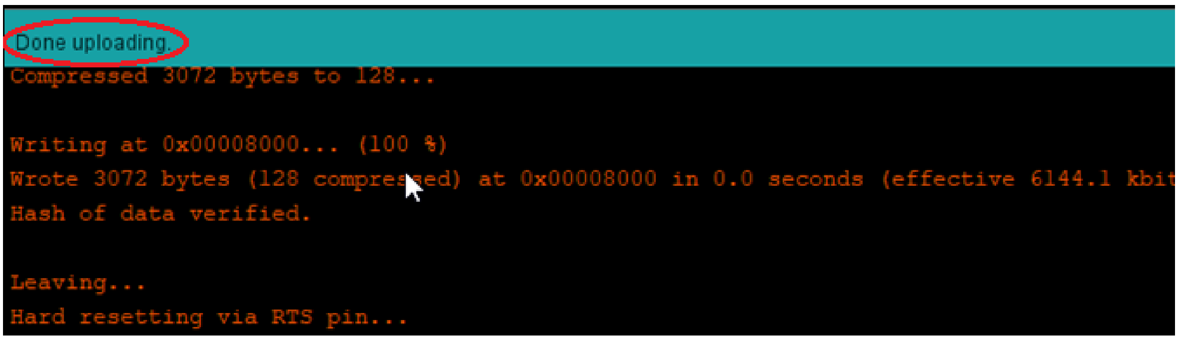
- After Changing above, click the upload icon in the Arduino IDE by clicking Upload Icon as below



- Your code will compile and then it will upload into the WDM module
- While uploading, in the bottom of the Arduino IDE it will show a message as below



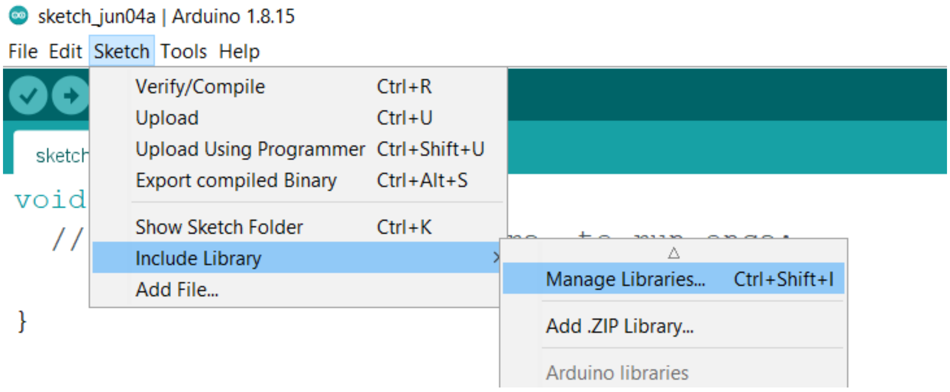
- Once it was trying to connect with Board, press and hold the BOOT button ***(Don't Release)*** and Reset the device by Pressing & Releasing RST Button then release BOOT button after releasing RST Button. If the coding is uploaded to the WDM module it will show **"Done Uploading"**



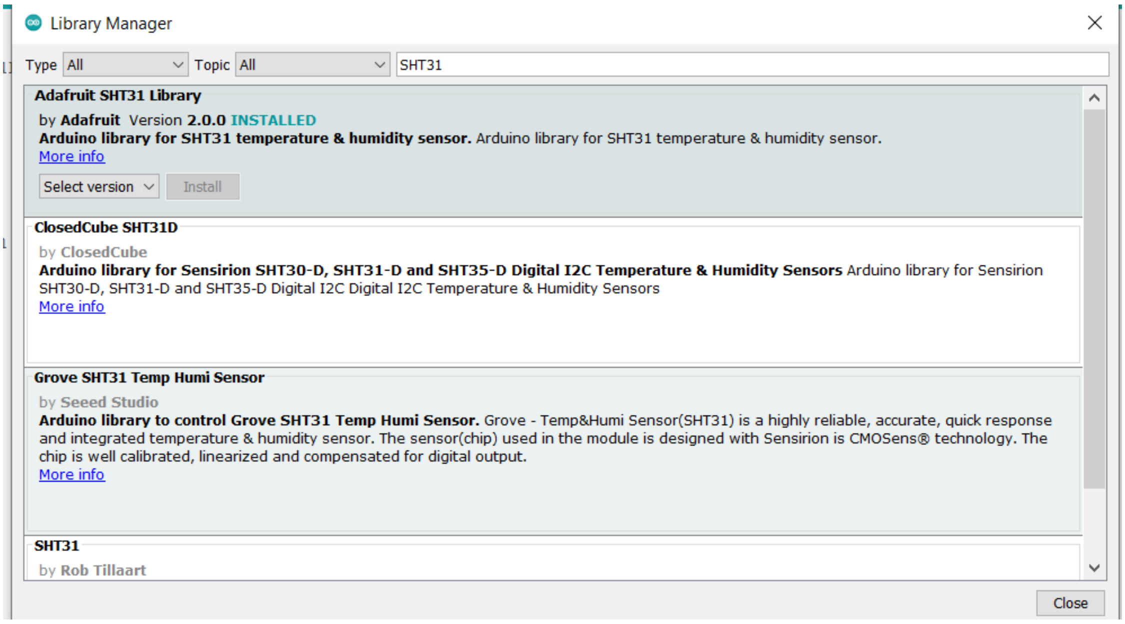
- After Uploading code, press Reset Button in WDM to start executing the code
- Now Check IO2 LED in the WDM board started to Blink as per your code.

Onboard SHT31 Sensor Configuration in WDM

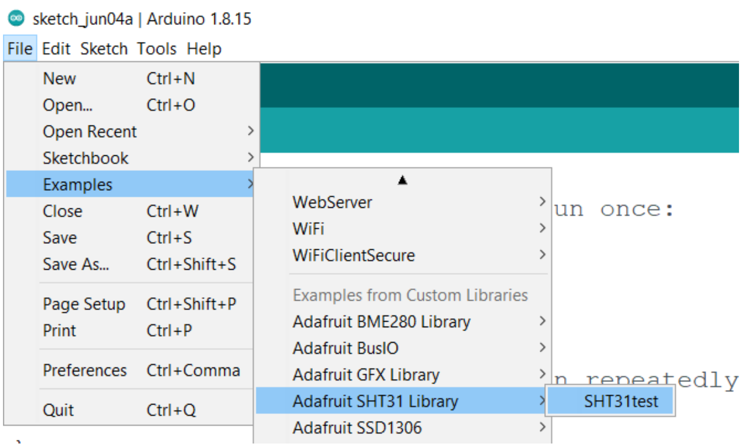
- To Install Library for SHT31 Library, Go to Sketch >> Include Library >> Manage Library



- In Manage Library, Search for SHT31 and Select Adafruit SHT31 Library and Install it.



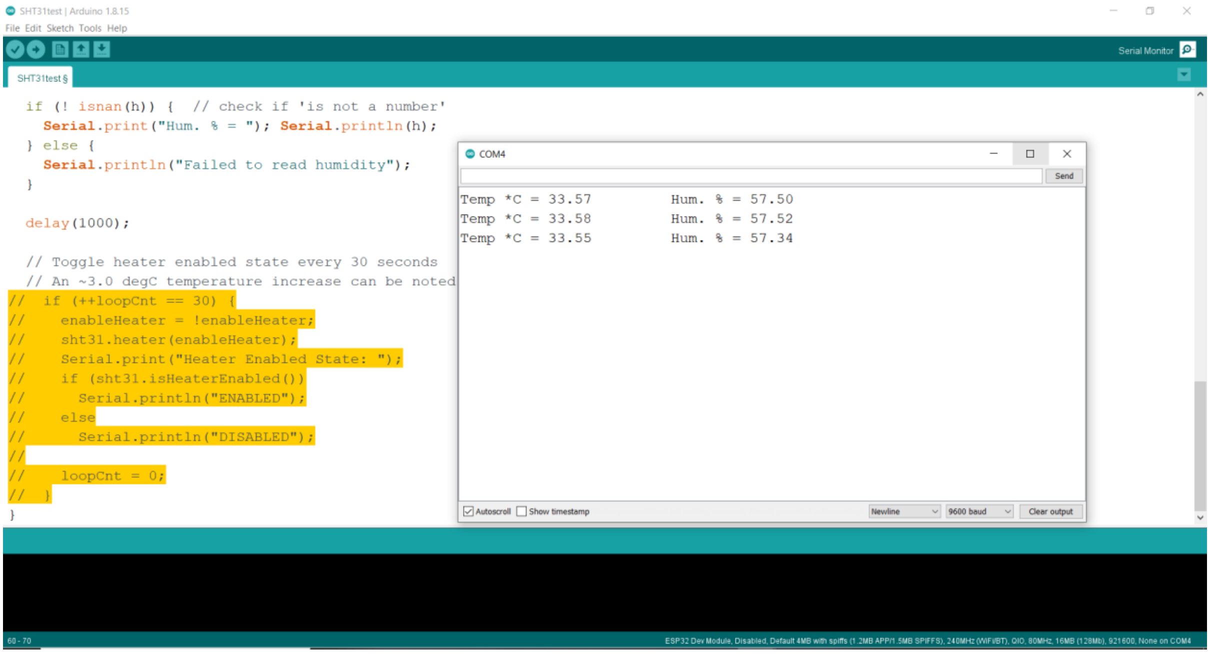
- After Installing, Open SHT31test code from Examples >> Adafruit SHT31 Library



- Comment the lines highlighted to avoid heater enabled test

```
  if (! isnan(h)) {  // check if 'is not a number'
    Serial.print("Hum. % = "); Serial.println(h);
  } else {
    Serial.println("Failed to read humidity");
  }

  delay(1000);

  // Toggle heater enabled state every 30 seconds
  // An ~3.0 degC temperature increase can be noted wh
//  if (++loopCnt == 30) {
//    enableHeater = !enableHeater;
//    sht31.heater(enableHeater);
//    Serial.print("Heater Enabled State: ");
//    if (sht31.isHeaterEnabled())
//      Serial.println("ENABLED");
//    else
//      Serial.println("DISABLED");
//
//    loopCnt = 0;
//  }
}
```

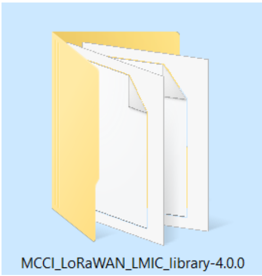
➢ Save & Upload the sketch then press RST Button to see results as below in Serial Monitor. Wait for some time to get stable Temperature & Humidity



LMIC LoRaWAN Library Customization for WDM

- Download LMIC Library from https://www.arduinolibraries.info/libraries/mcci-lo-ra-wan-lmic-library
- Current Version using for this Demo is MCCI_LoRaWAN_LMIC_library-4.0.0.zip

- Extract the zip as Folder



- Go to location …..\MCCI_LoRaWAN_LMIC_library-4.0.0\project_config and open lmic_project_config.h and make changes as follows for Indian Frequency and save it.

```
// project-specific definitions
//#define CFG_eu868 1
//#define CFG_us915 1
//#define CFG_au915 1
//#define CFG_as923 1
// #define LMIC_COUNTRY_CODE LMIC_COUNTRY_CODE_JP   /* for as923-JP */
//#define CFG_kr920 1
#define CFG_in866 1
#define CFG_sx1276_radio 1
//#define LMIC_USE_INTERRUPTS
```

- Go to location …..\MCCI_LoRaWAN_LMIC_library-4.0.0\src\hal and open hal.cpp and find below line

Before Change:

```
static void hal_spi_init () {
    SPI.begin();
}
```

- Make changes in SPI.begin() as follows and save it

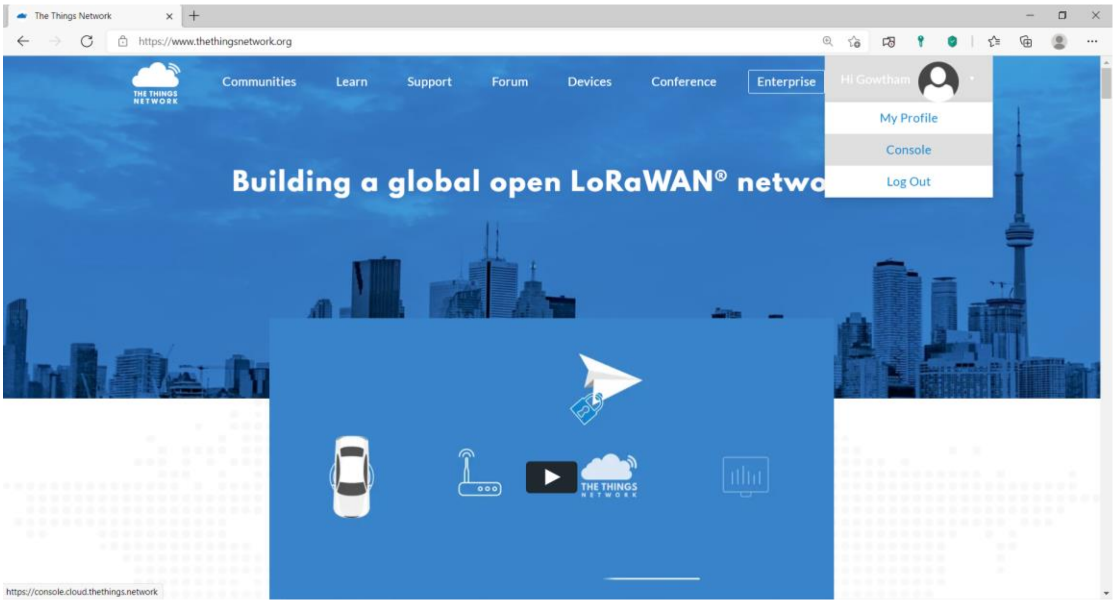
```
static void hal_spi_init () {
    SPI.begin(14,12,13,15);
}
```

Note: The Pin definition for SPI Pins were as follows CLK – 14, MISO – 12, MOSI – 13, NSS – 15

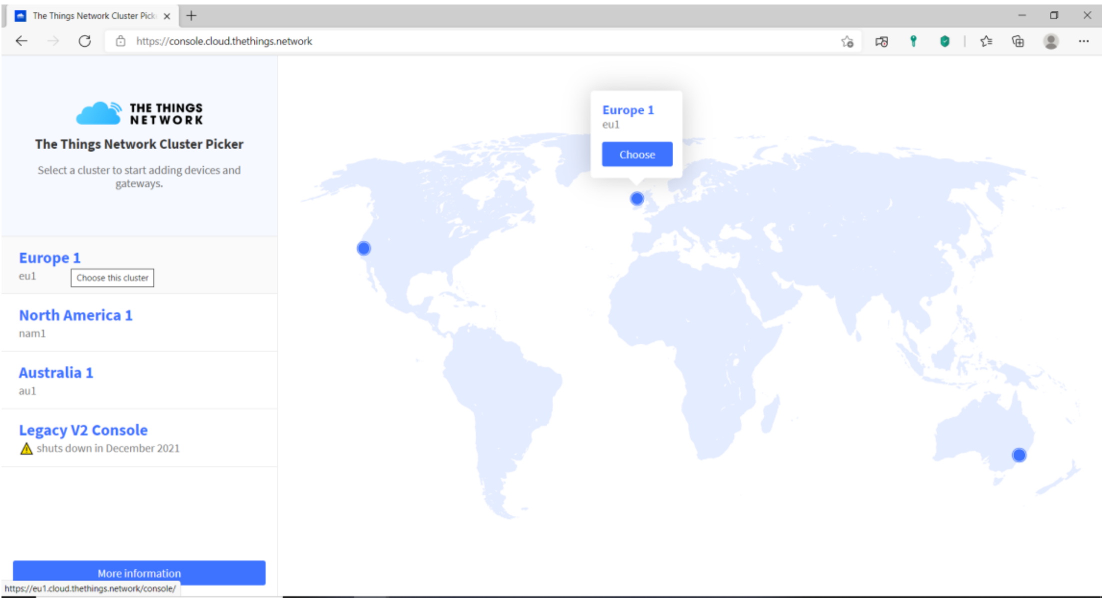
- Copy and paste this folder MCCI_LoRaWAN_LMIC_library-4.0.0 in following location ….\Documents\Arduino\libraries

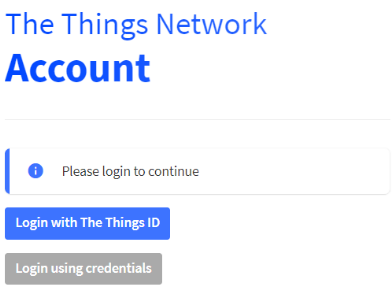
Registering Application & WDM Device in ABP mode with TTN v3

- Create a login in "https://www.thethingsnetwork.org/" and go to console

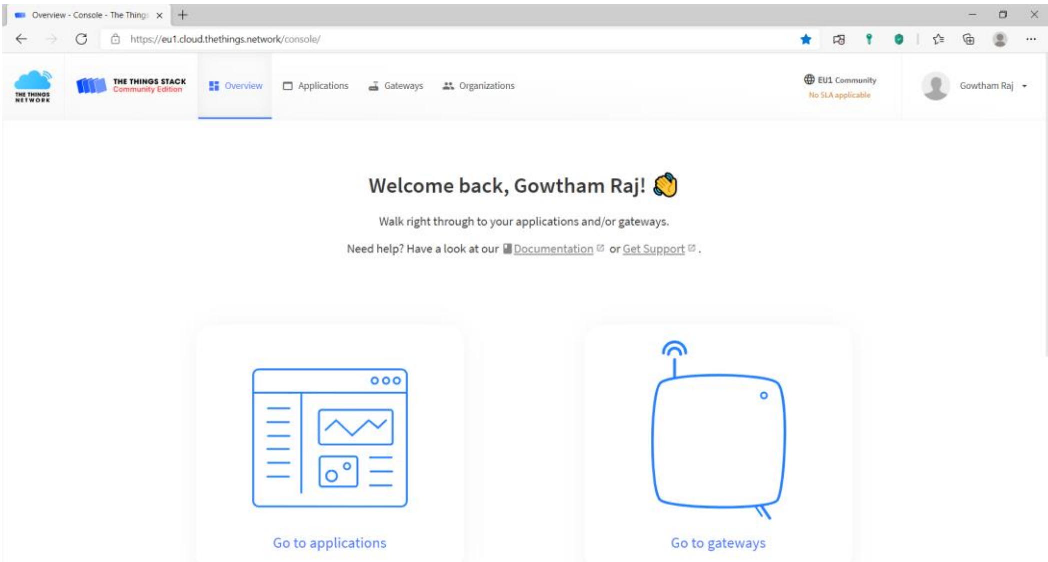


- Choose your cluster. I am going to choose Europe 1 & Login with The ThingsID using your registered.

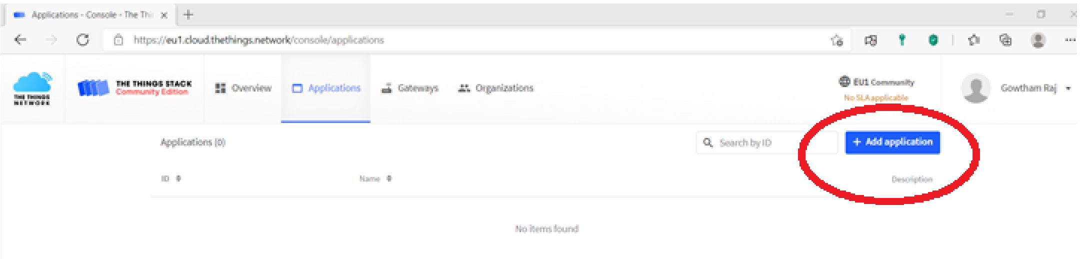




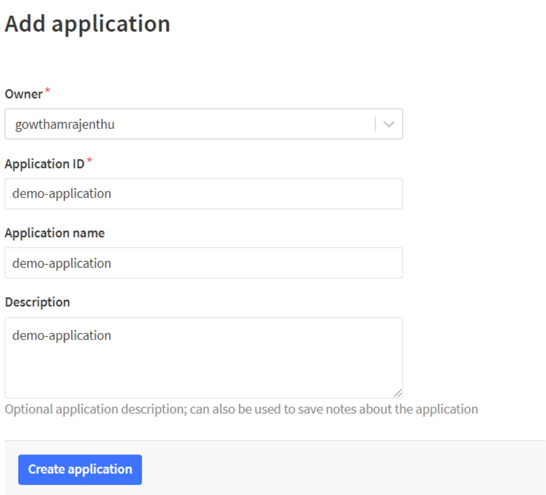
- After Login, enter into “Go to applications”



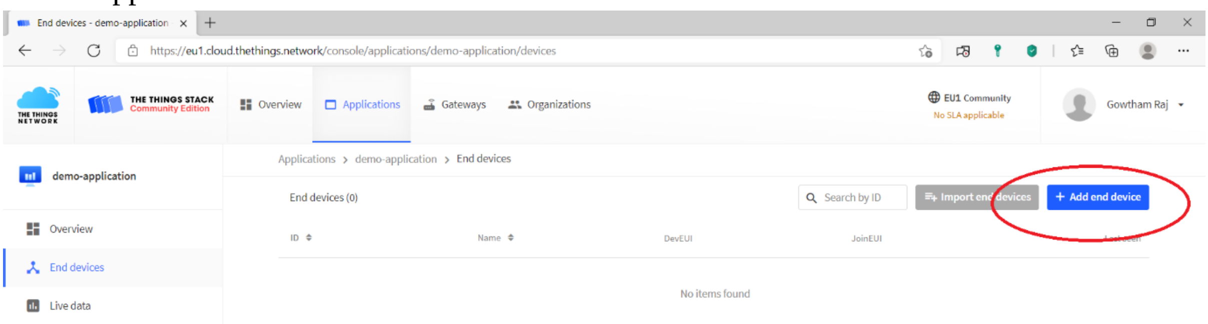
- Click on “Add application” and



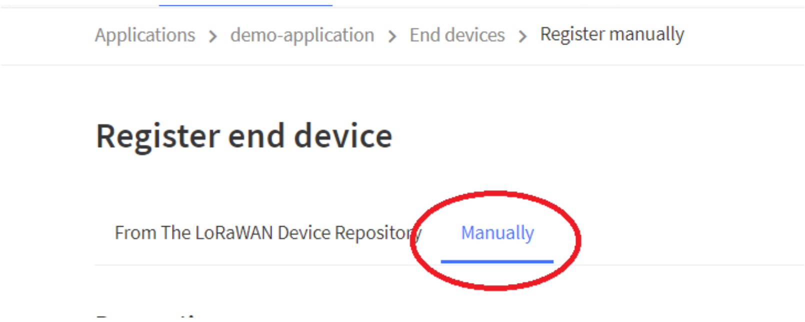
- Give necessary details and create application.



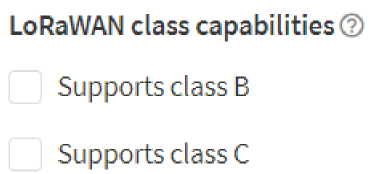
- Inside Applications Go to End Devices and click on “Add end device”



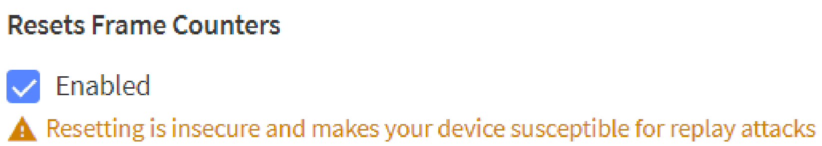
- Go to “Manually” Section



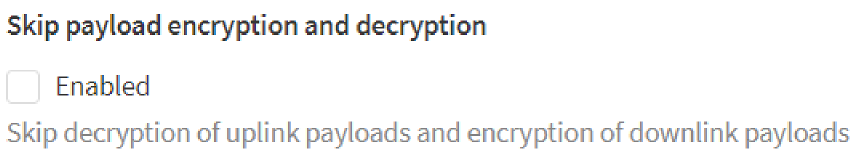
- Give following and click start
  - Select “Activation by personalization (ABP)”
  - LoRaWAN Version: “MAC V1.0.3”
  - Network & Application Server address: “eu1.cloud.thethings.network”
- Enter following details & Enter Network Layer Settings
  - End device ID: <Enter ID for your device> eg.node1
  - DevEUI: <Enter 8byte Unique ID for Device>
  - End Device Name: WDM
  - End Device Description: <give anything for your identification>
- Give Network Layer Settings as follows and Enter Application Layer Settings
  - Frequency Plan: India 865-867 MHz
  - Don’t Select anything for LoRaWAN Class Capabilities. WDM will support only for Class A



  - Generate “Device address” automatically by clicking icon mentioned
  - Generate “NwkSKey” automatically by clicking icon mentioned
  - Go to advanced Settings and enable Reset Frame counters. Keep all other settings default.



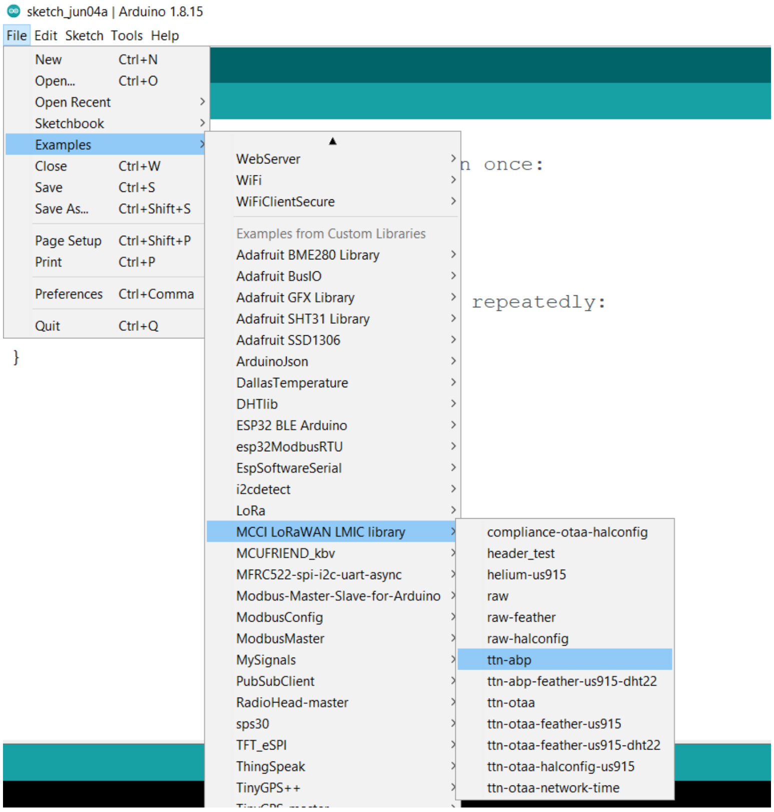
- Enter Application Layer settings as follows and Add End Device
  - Don’t Enable Skip payload encryption and decryption



  - Generate “AppSKey” automatically by clicking icon mentioned
- Now we have Registered the Application & Device with TTN V3.

ABP Uplink With WDM to TTN V3

- Open ArduinoIDE 1.8.15 and go to File >> MCCI_LoRaWAN_LMIC_library >> ttn-abp



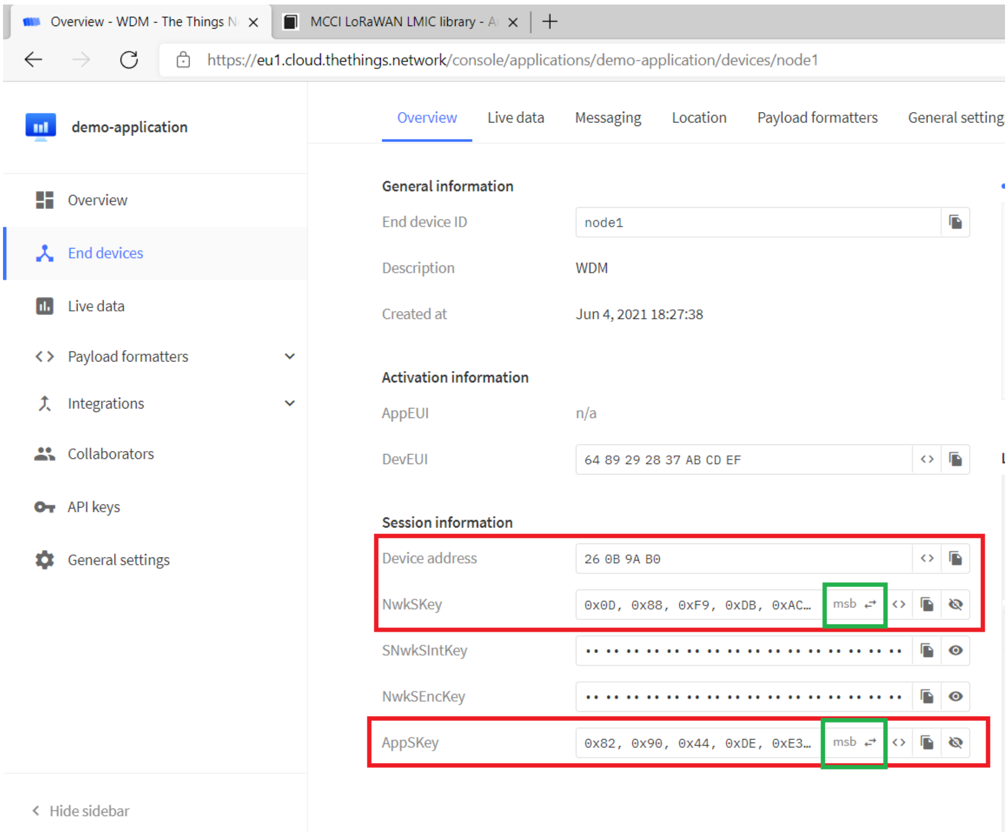
- Need to change the LoRaWAN Keys (NWKSKEY, APPSKEY, DEVADDR) highlighted below

```
// LoRaWAN NwkSKey, network session key
// This should be in big-endian (aka msb).
static const PROGMEM u1_t NWKSKEY[16] = { FILLMEIN };

// LoRaWAN AppSKey, application session key
// This should also be in big-endian (aka msb).
static const u1_t PROGMEM APPSKEY[16] = { FILLMEIN };

// LoRaWAN end-device address (DevAddr)
// See http://thethingsnetwork.org/wiki/AddressSpace
// The library converts the address to network byte order as needed, so this should be in big-endian (aka msb) too.
static const u4_t DEVADDR = FILLMEIN ; // <-- Change this address for every node!
```

- Copy the Keys from TTI V3 Devices Page as below and replace it in code in following format

Note:

- ***Click the eye icon & < > icon to change the view of keys***
- ***While copying NwkSKey & AppSKey Ensure the keys are in MSB Position as highlighted in following image***



- After Changing the LoRaWAN Keys your code should like this,

```
// LoRaWAN NwkSKey, network session key
// This should be in big-endian (aka msb).
static const PROGMEM u1_t NWKSKEY[16] = { 0x0D, 0x88, 0xF9, 0xDB, 0xAC, 0x3E, 0x40, 0x95, 0xD3, 0x58, 0x40, 0x4A, 0xF2, 0xA1, 0x47, 0xE1 };

// LoRaWAN AppSKey, application session key
// This should also be in big-endian (aka msb).
static const u1_t PROGMEM APPSKEY[16] = { 0x82, 0x90, 0x44, 0xDE, 0xE3, 0x5D, 0xD3, 0xB6, 0x4B, 0x73, 0xB2, 0xA7, 0xE3, 0xBC, 0x72, 0x28 };

// LoRaWAN end-device address (DevAddr)
// See http://thethingsnetwork.org/wiki/AddressSpace
// The library converts the address to network byte order as needed, so this should be in big-endian (aka msb) too.
static const u4_t DEVADDR = 0x260B9AB0 ; // <-- Change this address for every node!
```

> ***Note:***
>
> - ***Don't enter the above keys as same. Enter the keys as per your TTN account***

- Next, need to change the pin mapping as per WDM board
  Identify the following lines and change the pin map as follows

```
const lmic_pinmap lmic_pins = {
    .nss = 15,
    .rxtx = LMIC_UNUSED_PIN,
    .rst = 17,
    .dio = {4, 33, 32},


};
```

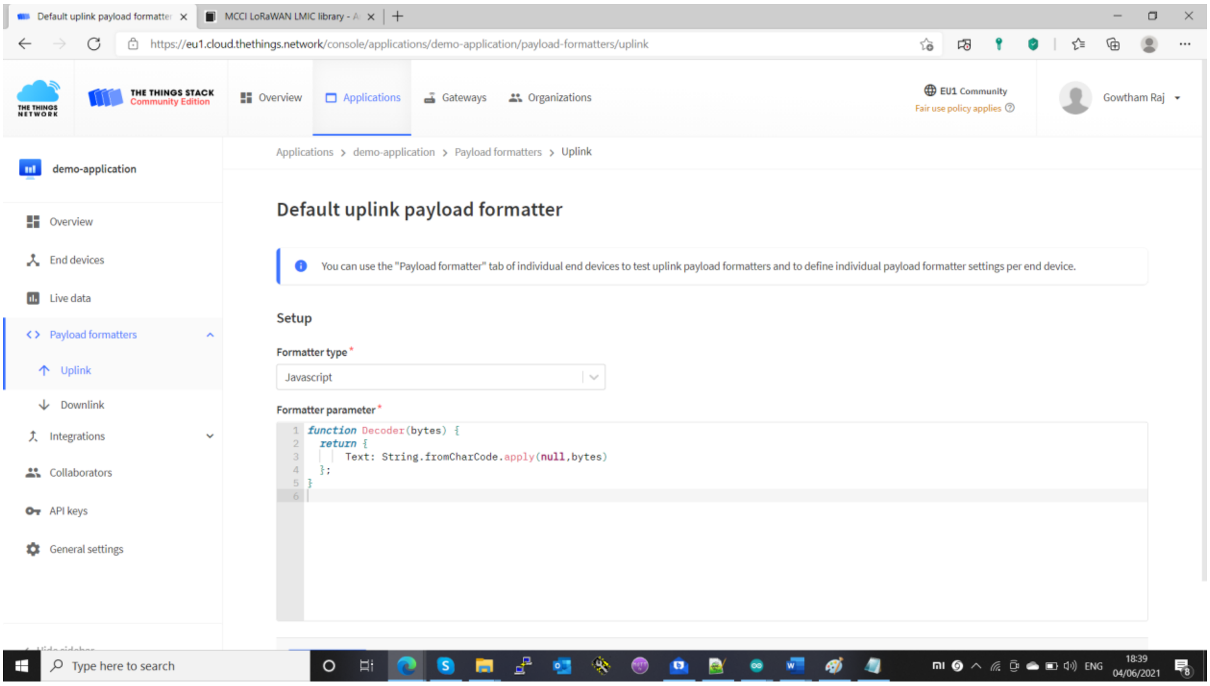
➢ Comment following lines to disable European Frequency

```
#if defined(CFG_eu868)
// Set up the channels used by the Things Network, which corresponds
// to the defaults of most gateways. Without this, only three base
// channels from the LoRaWAN specification are used, which certainly
// works, so it is good for debugging, but can overload those
// frequencies, so be sure to configure the full frequency range of
// your network here (unless your network autoconfigures them).
// Setting up channels should happen after LMIC_setSession, as that
// configures the minimal channel set. The LMIC doesn't let you change
// the three basic settings, but we show them here.
//LMIC_setupChannel(0, 868100000, DR_RANGE_MAP(DR_SF12, DR_SF7),  BAND_CENTI);      // g-band
//LMIC_setupChannel(1, 868300000, DR_RANGE_MAP(DR_SF12, DR_SF7B), BAND_CENTI);      // g-band
//LMIC_setupChannel(2, 868500000, DR_RANGE_MAP(DR_SF12, DR_SF7),  BAND_CENTI);      // g-band
//LMIC_setupChannel(3, 867100000, DR_RANGE_MAP(DR_SF12, DR_SF7),  BAND_CENTI);      // g-band
//LMIC_setupChannel(4, 867300000, DR_RANGE_MAP(DR_SF12, DR_SF7),  BAND_CENTI);      // g-band
//LMIC_setupChannel(5, 867500000, DR_RANGE_MAP(DR_SF12, DR_SF7),  BAND_CENTI);      // g-band
//LMIC_setupChannel(6, 867700000, DR_RANGE_MAP(DR_SF12, DR_SF7),  BAND_CENTI);      // g-band
//LMIC_setupChannel(7, 867900000, DR_RANGE_MAP(DR_SF12, DR_SF7),  BAND_CENTI);      // g-band
//LMIC_setupChannel(8, 868800000, DR_RANGE_MAP(DR_FSK,  DR_FSK),  BAND_MILLI);      // g2-band
// TTN defines an additional channel at 869.525Mhz using SF9 for class B
// devices' ping slots. LMIC does not have an easy way to define set this
// frequency and support for class B is spotty and untested, so this
```

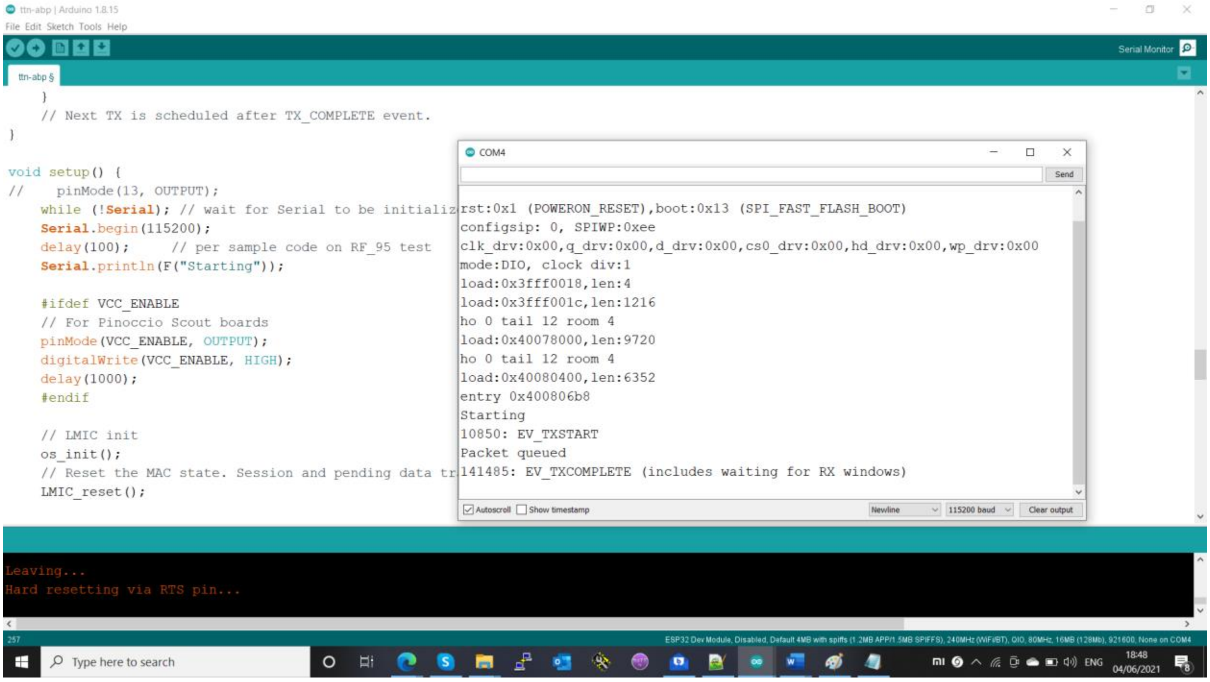
➢ Uncomment Following lines to enable Indian Frequency

```
// ... extra definitions for channels 3..n here.
#elif defined(CFG_in866)
// Set up the channels used in your country. Three are defined by default,
// and they cannot be changed. Duty cycle doesn't matter, but is conventionally
// BAND_MILLI.
 LMIC_setupChannel(0, 865062500, DR_RANGE_MAP(DR_SF12, DR_SF7),  BAND_MILLI);
 LMIC_setupChannel(1, 865402500, DR_RANGE_MAP(DR_SF12, DR_SF7),  BAND_MILLI);
 LMIC_setupChannel(2, 865985000, DR_RANGE_MAP(DR_SF12, DR_SF7),  BAND_MILLI);
```

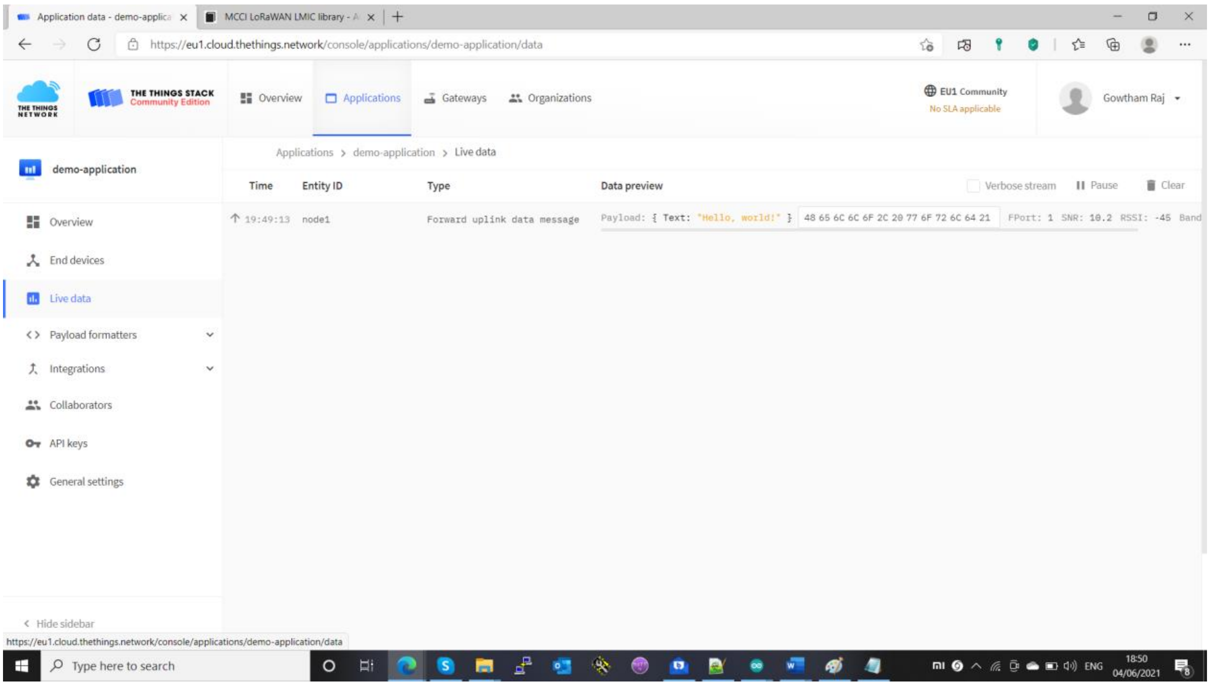
➢ Enter Payload Decoder & save it to Decode the received bytes in TTN V3



- Now Upload the sketch in WDM and Reset the device to get data in TTN V3



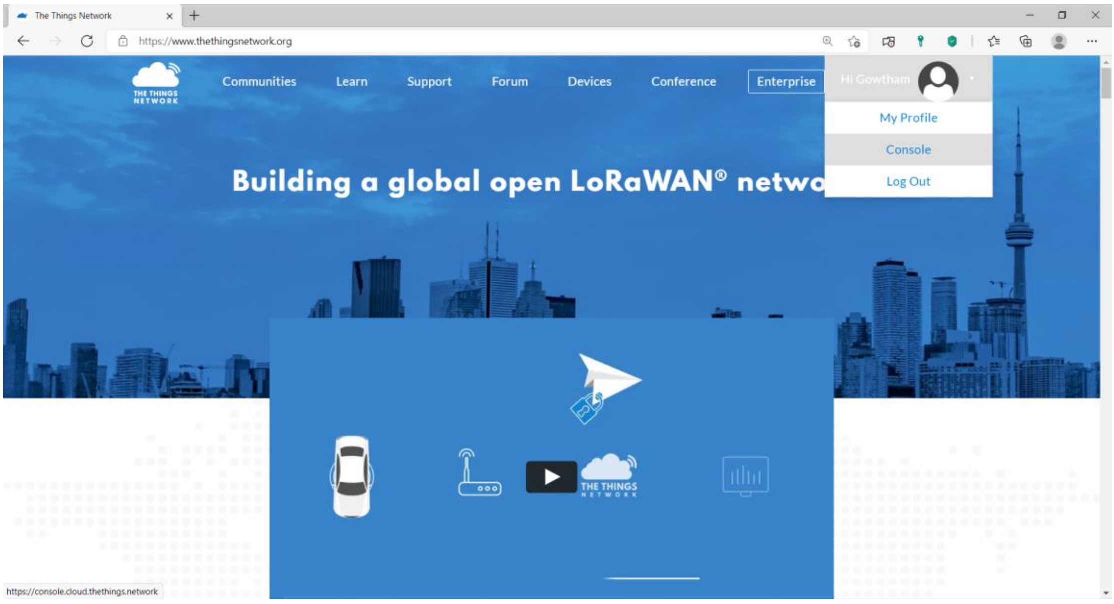
- Results in TTN V3 as follows



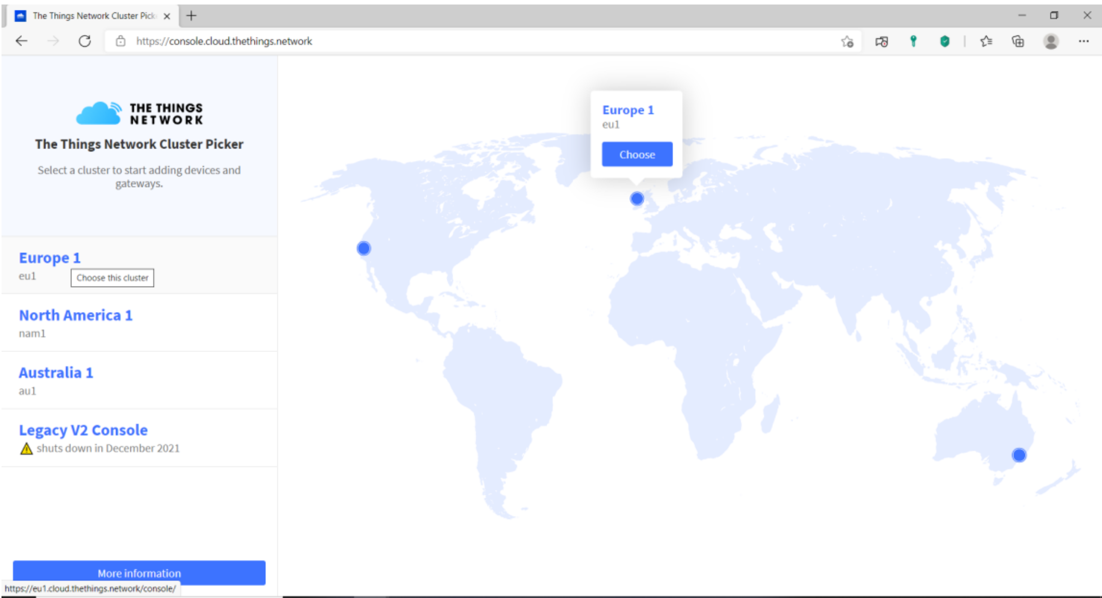
Note: ➢ ***Gateway should be in Coverage, Live & Connected to TTNv3 for getting data as above***

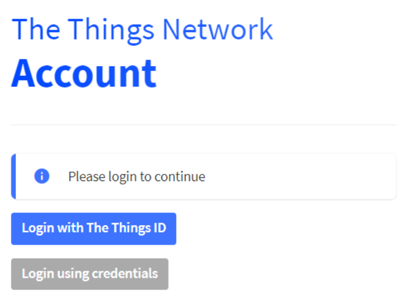
Registering Application & WDM Device in OTAA mode with TTN v3

➢ Create a login in "https://www.thethingsnetwork.org/" and go to console

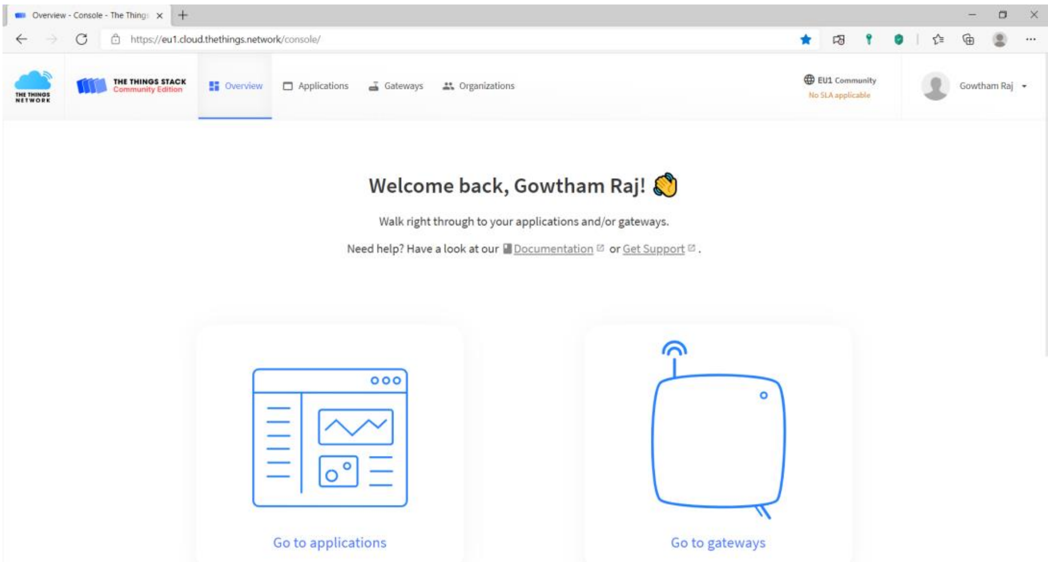


➢ Choose your cluster. I am going to choose Europe 1 & Login with The ThingsID using your registered.

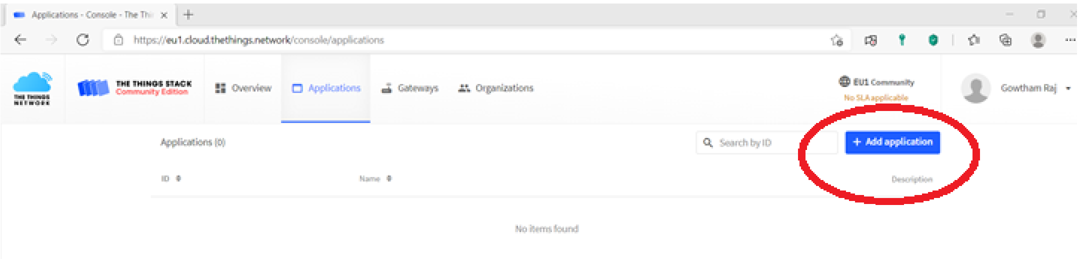




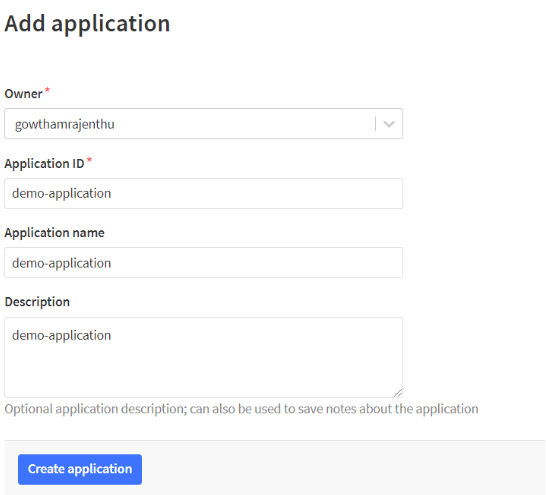
➢ After Login, enter into “Go to applications”



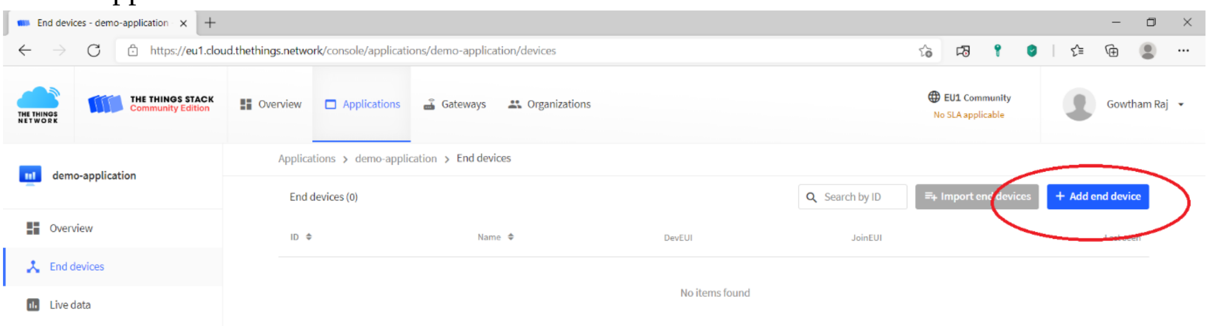
➢ Click on “Add application” and



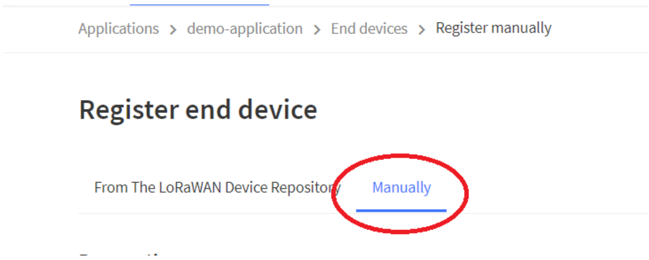
➢ Give necessary details and create application.



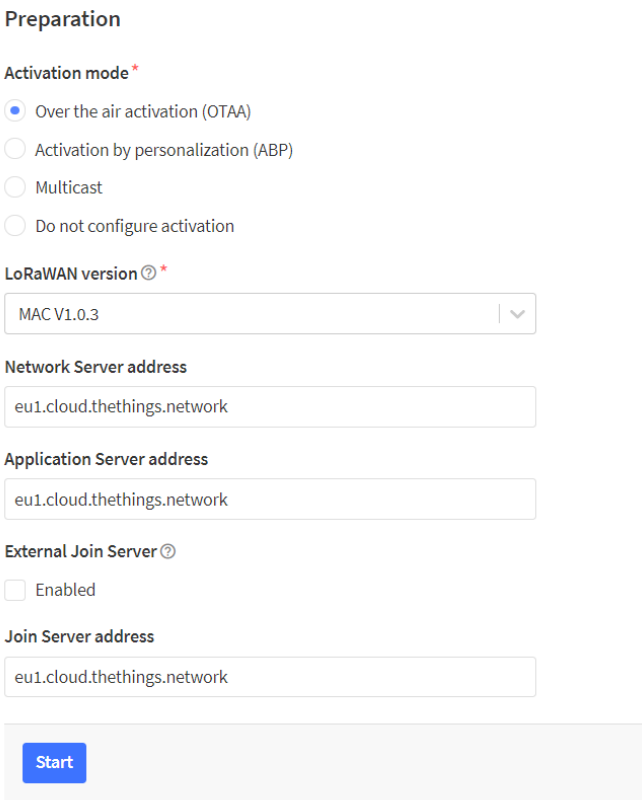
➢ Inside Applications Go to End Devices and click on “Add end device”



➢ Go to "Manually" Section

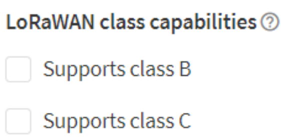


➢ Give following and click start



➢ Enter following details & Enter Network Layer Settings
  - End device ID: <Enter ID for your device> eg.node2
  - DevEUI: <Enter 8byte Unique ID for Device>
  - End Device Name: WDM
  - End Device Description: <give anything for your identification>

➢ Give Network Layer Settings as follows and Enter Join Settings
  - Frequency Plan: India 865-867 MHz
  - Don't Select anything for LoRaWAN Class Capabilities. WDM will support only for Class A

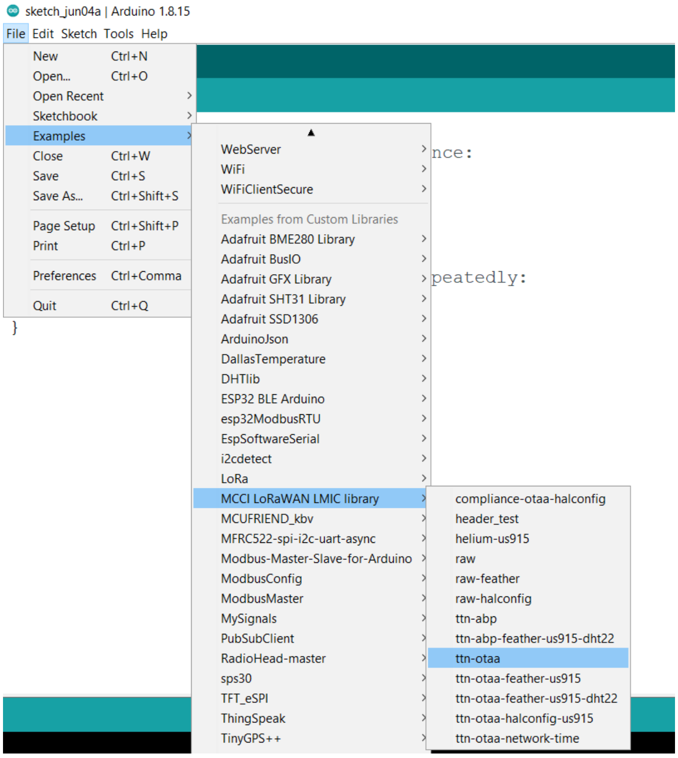


➢ Enter Join settings as follows and Add End Device
  - Generate "AppKey" automatically by clicking icon mentioned

➢ Now we have Registered the Application & Device with TTN V3.

OTAA Uplink With WDM in TTN V3

- Open ArduinoIDE 1.8.15 and go to File >> MCCI_LoRaWAN_LMIC_library >> ttn-otaa

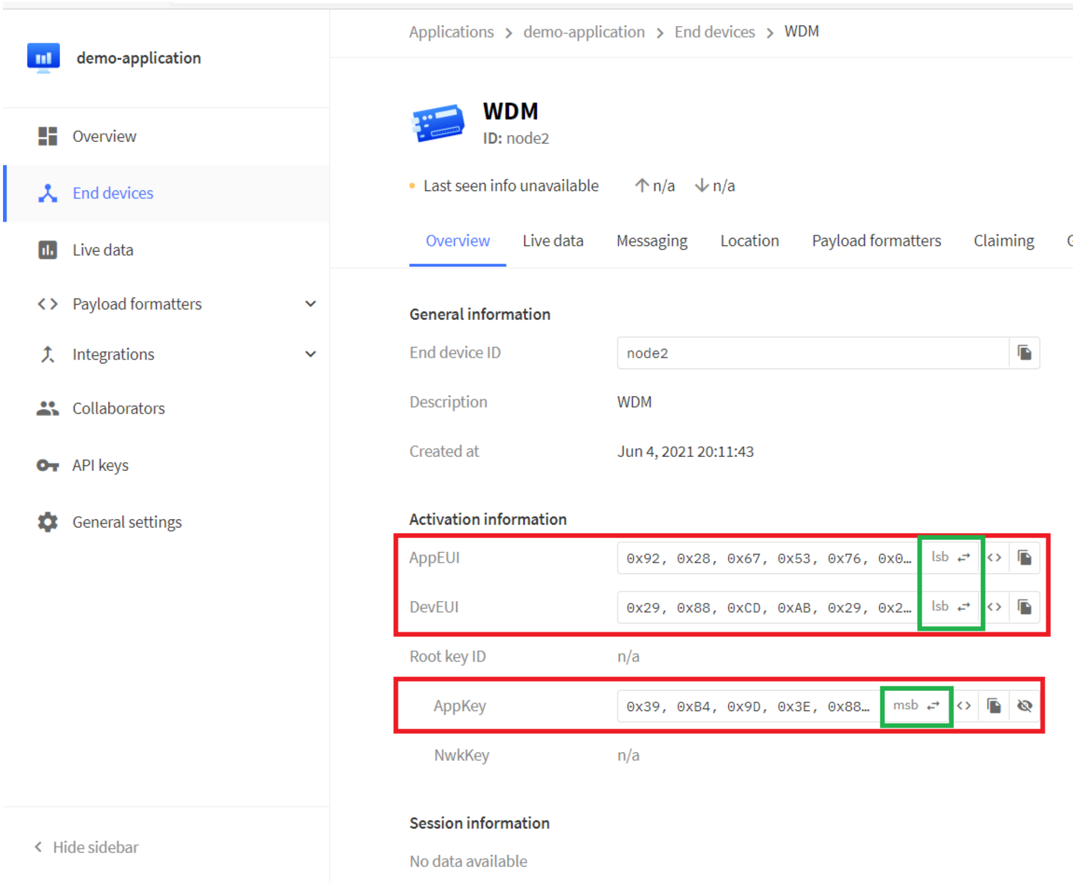


- Need to change the LoRaWAN Keys (APPEUI, DEVEUI, APPKEY) highlighted below

```
// 0x70.
static const u1_t PROGMEM APPEUI[8]={ FILLMEIN };
void os_getArtEui (u1_t* buf) { memcpy_P(buf, APPEUI, 8);}

// This should also be in little endian format, see above.
static const u1_t PROGMEM DEVEUI[8]={ FILLMEIN };
void os_getDevEui (u1_t* buf) { memcpy_P(buf, DEVEUI, 8);}

// This key should be in big endian format (or, since it is not really a
// number but a block of memory, endianness does not really apply). In
// practice, a key taken from ttnctl can be copied as-is.
static const u1_t PROGMEM APPKEY[16] = { FILLMEIN };
void os_getDevKey (u1_t* buf) {  memcpy_P(buf, APPKEY, 16);}
```

- Copy the Keys from TTI V3 Devices Page as below and replace it in code in following format

Note:
- ***Click the eye icon & < > icon to change the view of keys***
- ***While copying APPEUI & DEVEUI Ensure the keys are in LSB Position as highlighted in following image***
- ***While copying APPKEY Ensure the keys are in MSB Position as highlighted in following image***



- After Changing the LoRaWAN Keys your code should like this,

```
static const u1_t PROGMEM APPEUI[8]={ 0x92, 0x28, 0x67, 0x53, 0x76, 0x02, 0x49, 0x67 };
void os_getArtEui (u1_t* buf) { memcpy_P(buf, APPEUI, 8);}

// This should also be in little endian format, see above.
static const u1_t PROGMEM DEVEUI[8]={ 0x29, 0x88, 0xCD, 0xAB, 0x29, 0x20, 0x29, 0x68 };
void os_getDevEui (u1_t* buf) { memcpy_P(buf, DEVEUI, 8);}

// This key should be in big endian format (or, since it is not really a
// number but a block of memory, endianness does not really apply). In
// practice, a key taken from ttnctl can be copied as-is.
static const u1_t PROGMEM APPKEY[16] = { 0x39, 0xB4, 0x9D, 0x3E, 0x88, 0xF8, 0x4F, 0x64, 0xF6, 0x23, 0xB6, 0x4B, 0x33, 0xD1, 0x4A, 0x1F };
void os_getDevKey (u1_t* buf) {  memcpy_P(buf, APPKEY, 16);}
```

> ***Note:***
> - ***Don't enter the above keys as same. Enter the keys as per your TTN account***

- Next, need to change the pin mapping as per WDM board

  Identify the following lines and change the pin map as follows

```
const lmic_pinmap lmic_pins = {
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    .rxtx = LMIC_UNUSED_PIN,
    .rst = 17,
    .dio = {4, 33, 32},


};
```
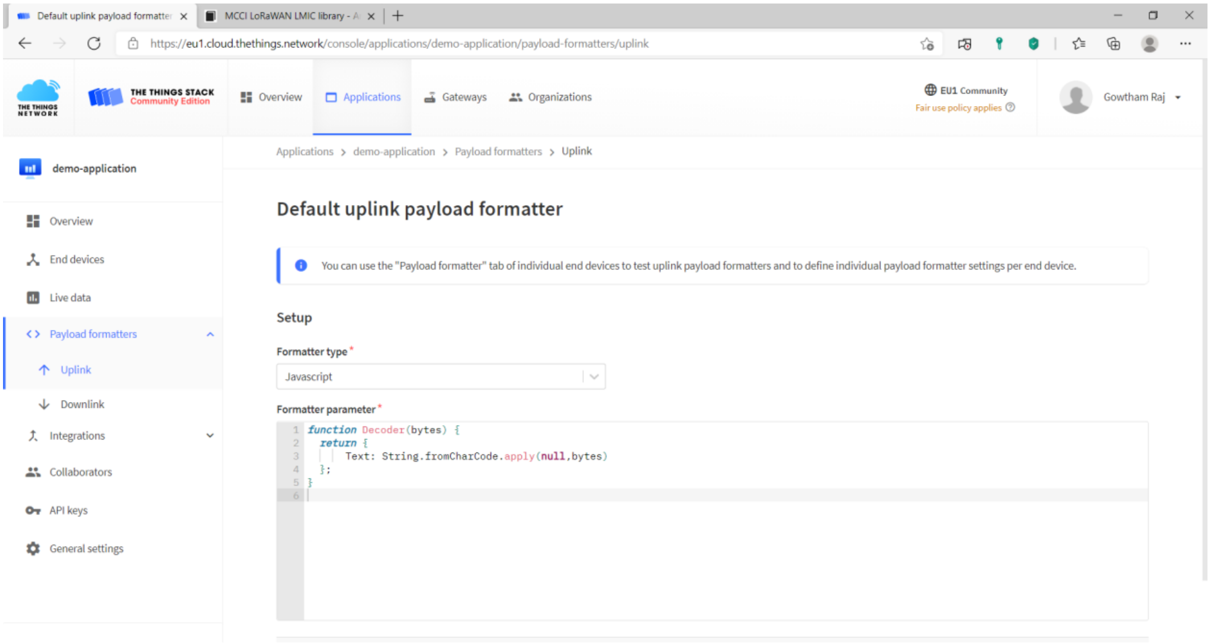
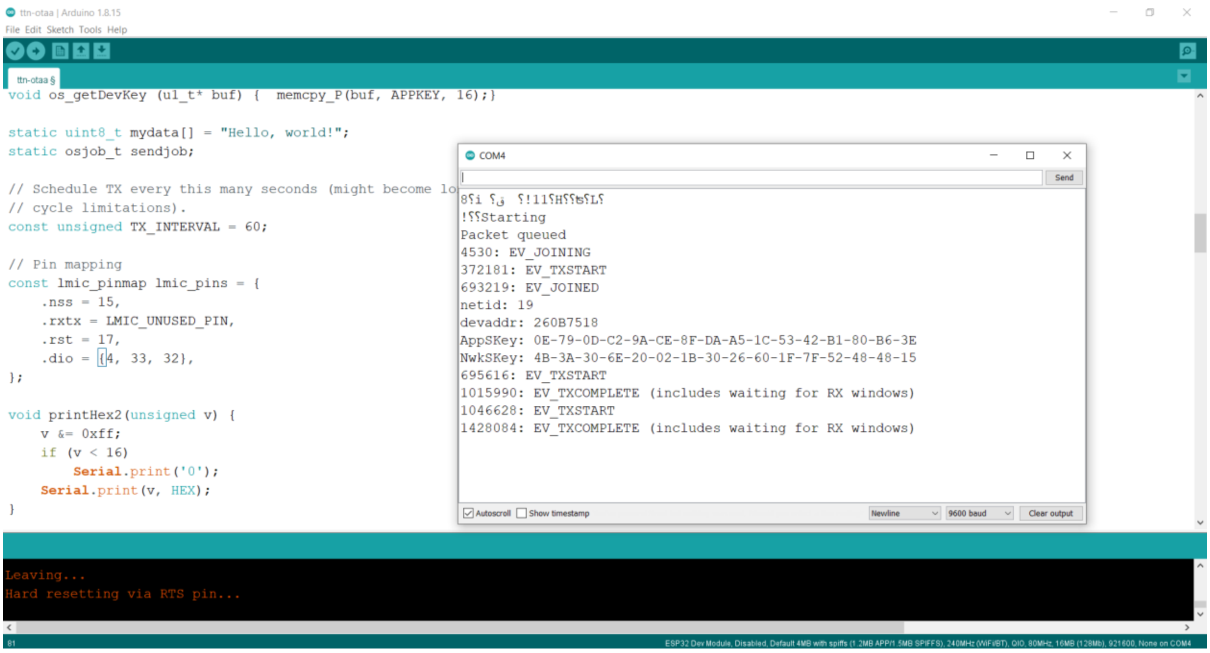
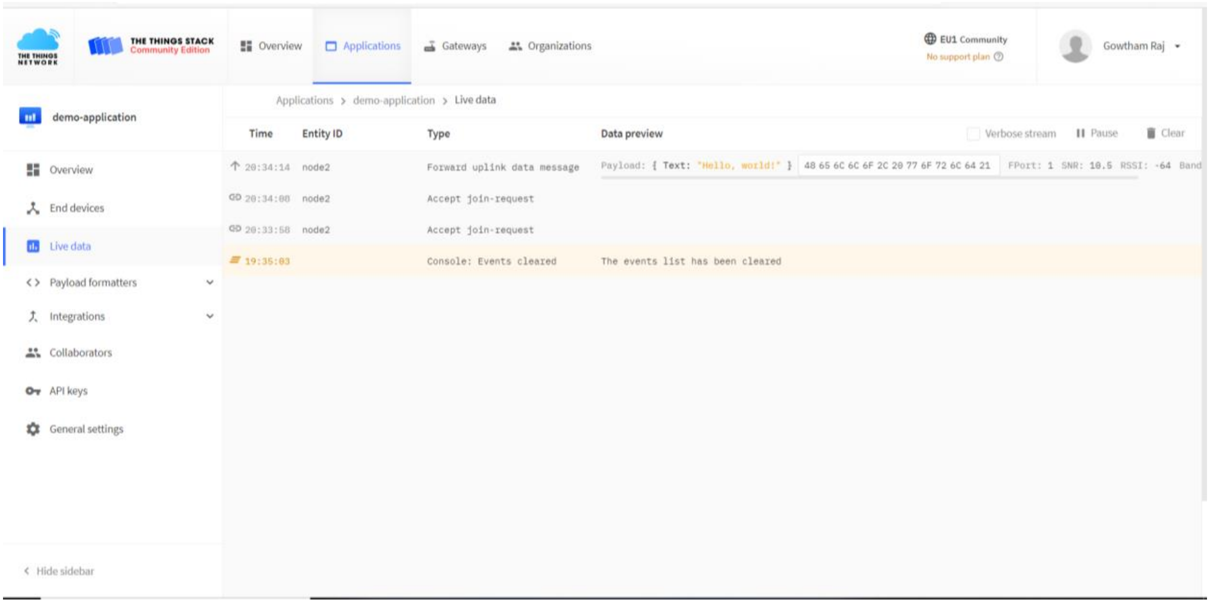

- ➢ Enter Payload Decoder & save it to Decode the received bytes in TTN V3



- ➢ Now Upload the sketch in WDM and Reset the device to get data in TTN V3



- ➢ Results in TTN V3 as follows



Note:

- ***Gateway should be in Coverage, Live & Connected to TTNv3 for getting data as above***