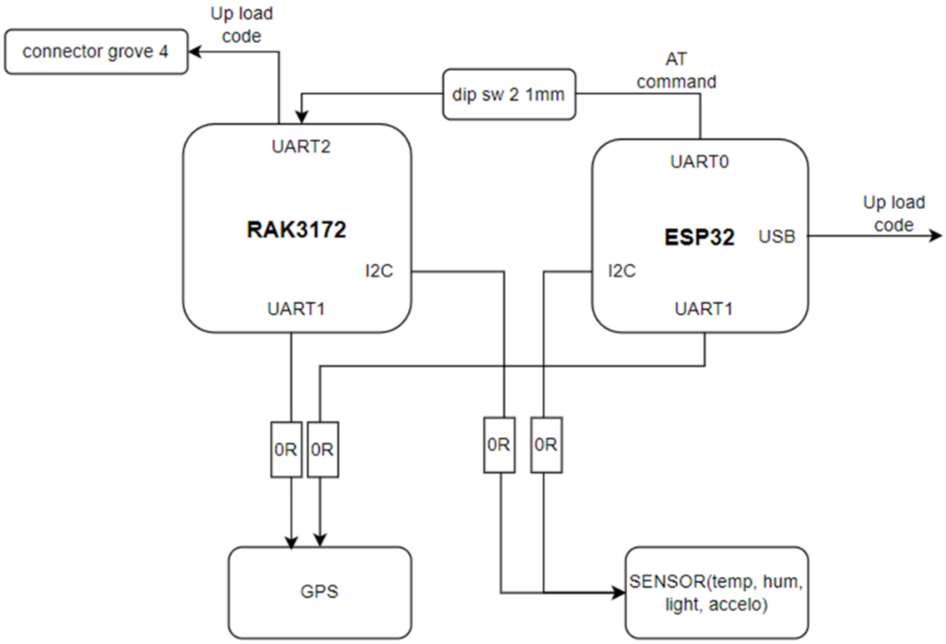
Tutorial for RF210

1. Overview of RF210

- RF210 uses MCU ESP32C3 as main MCU. Directly control RAK3172 with AT COMMAND to perform LoRaWAN packet sending.
- Sensors and GPS are connected to RAK3172. RAK3172 receives data and transmits it to ESP32C3

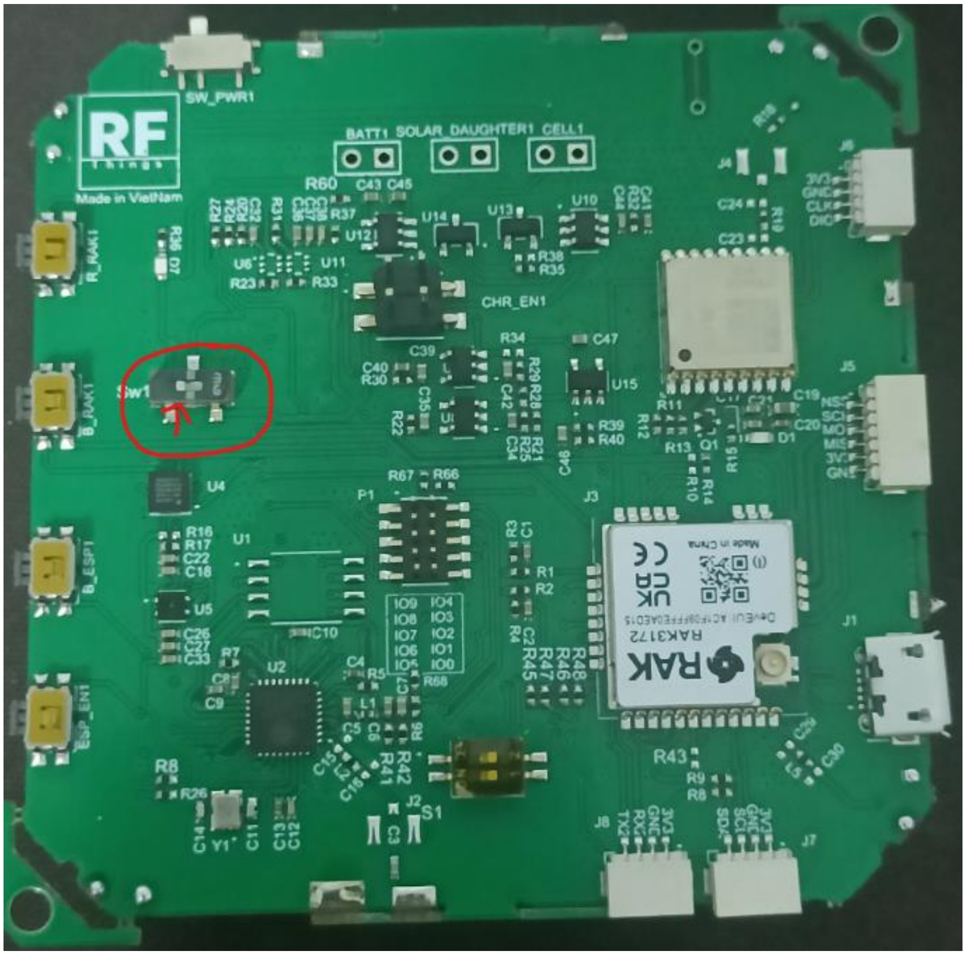
2. System overview diagram

- Below is a system overview diagram

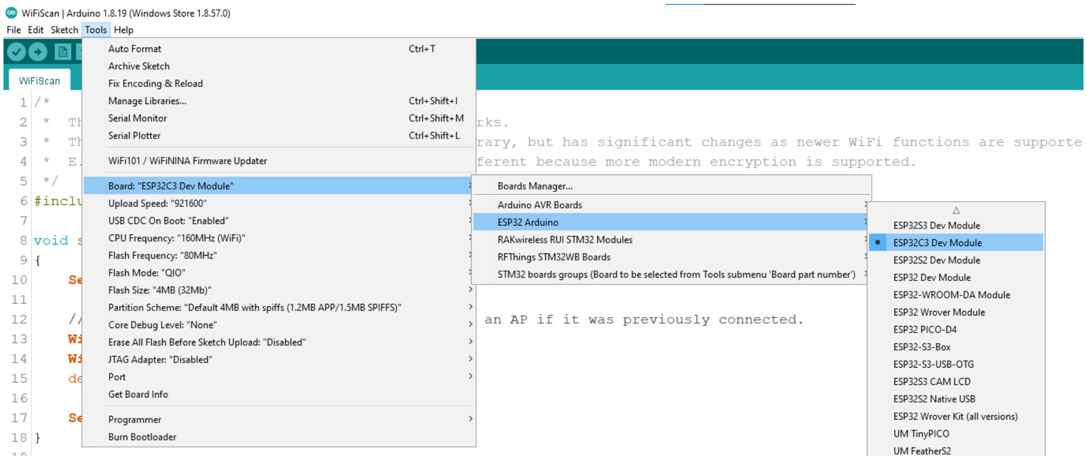


3. Use ESP32C3 with BLE, WiFi

- Before using, lever the left direction switch to be able to supply USB power to the circuit board



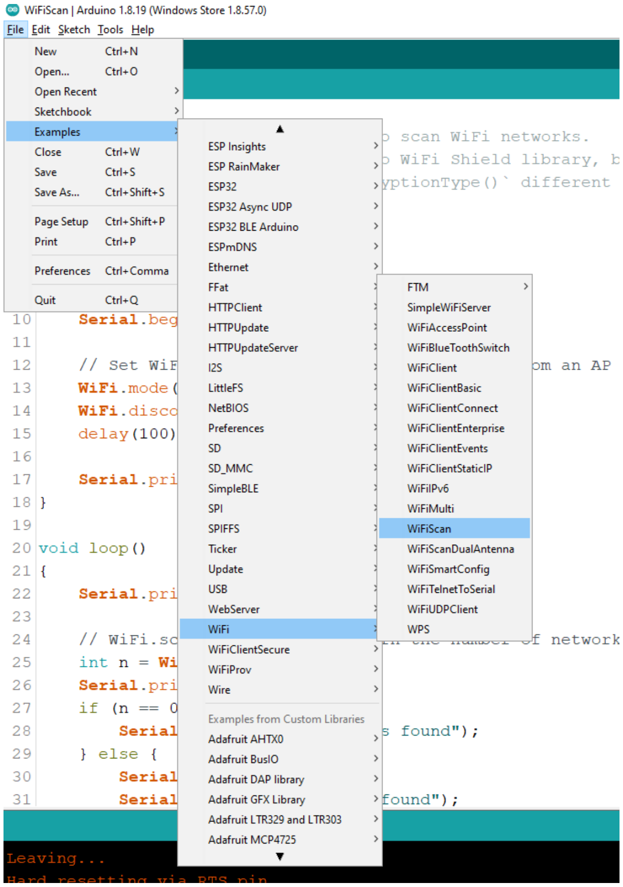
- Using Arduino IDE to load code:
- For WiFi Scan:
    - Select board ESP32C3 dev module



```
/*
 *  Th                                    rks.
 *  Th                                    rary, but has significant changes as newer WiFi functions are supporte
 *  E.                                    ferent because more modern encryption is supported.
 */
#inclu

void s
{
    Se

    //                                      an AP if it was previously connected.
    Wi
    Wi
    de

    Se
}
```

Board: "ESP32C3 Dev Module"
Upload Speed: "921600"
USB CDC On Boot: "Enabled"
CPU Frequency: "160MHz (WiFi)"
Flash Frequency: "80MHz"
Flash Mode: "QIO"
Flash Size: "4MB (32Mb)"
Partition Scheme: "Default 4MB with spiffs (1.2MB APP/1.5MB SPIFFS)"
Core Debug Level: "None"
Erase All Flash Before Sketch Upload: "Disabled"
JTAG Adapter: "Disabled"

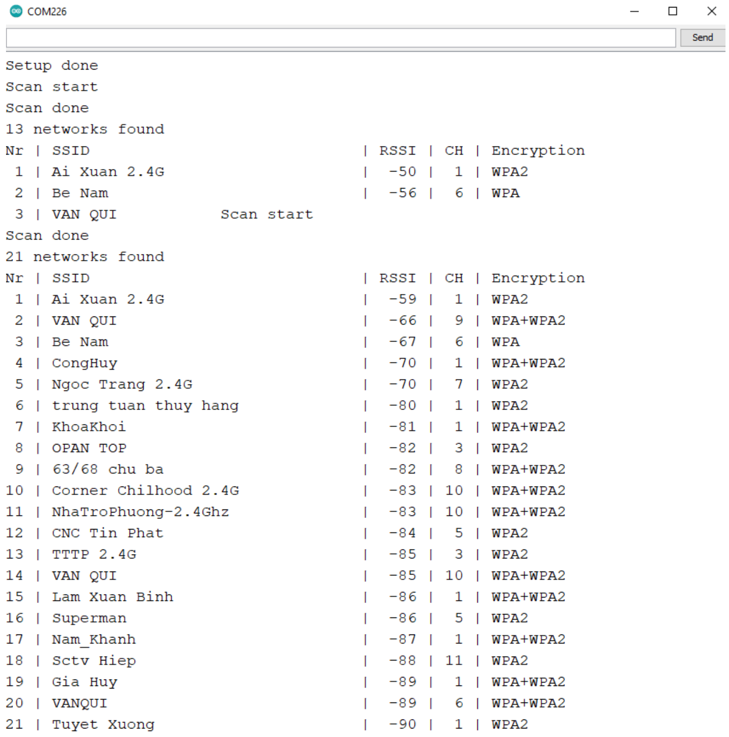
- Open example for WiFi ESP32



```
o scan WiFi networks.
o WiFi Shield library, b
yptionType()` different

    Serial.beg

    // Set WiF                                     om an AP
    WiFi.mode(
    WiFi.disco
    delay(100)

    Serial.pri
}

void loop()
{
    Serial.pri

    // WiFi.sc                          the number of network
    int n = Wi
    Serial.pri
    if (n == 0
        Serial                          s found");
    } else {
        Serial
        Serial                          found");
```

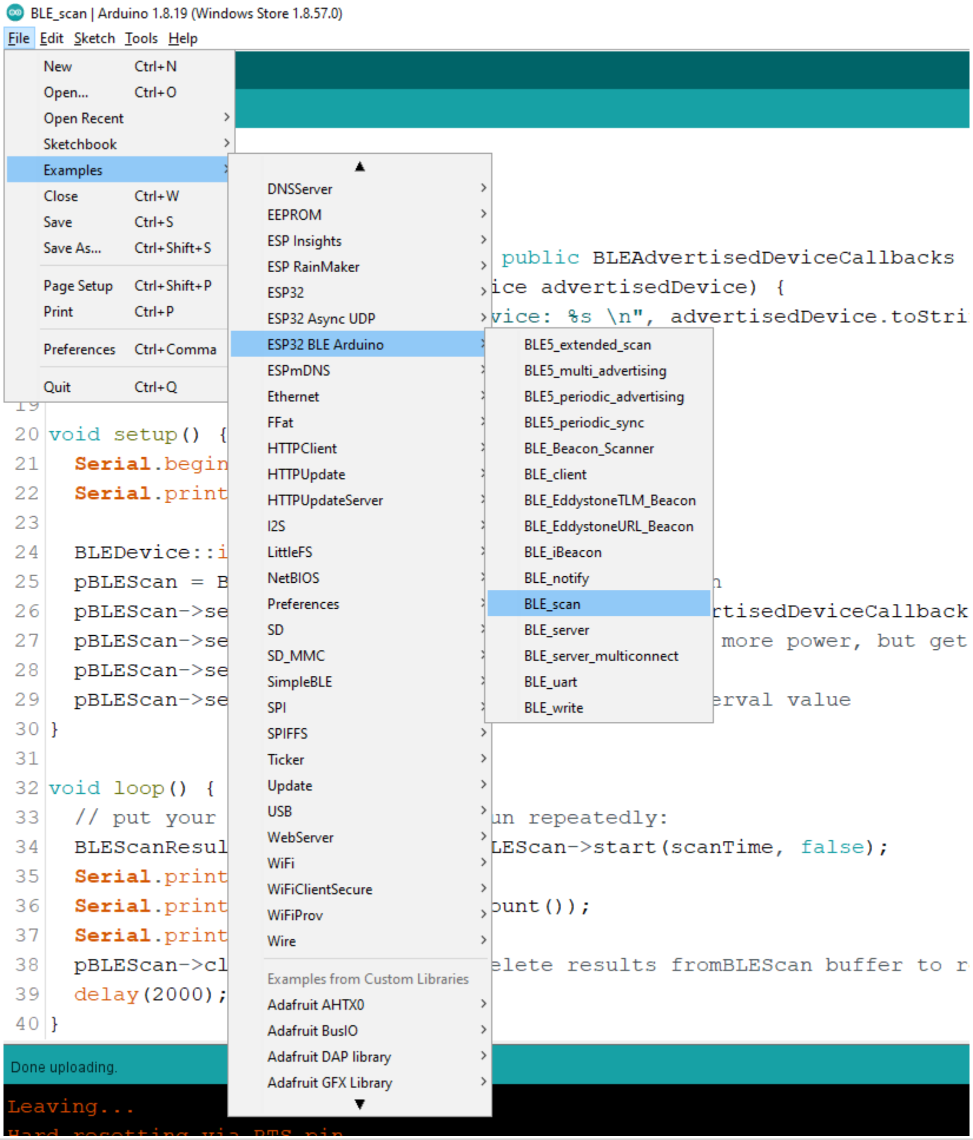
```
Leaving...
Hard resetting via RTS pin...
```

- Upload code, after you can view the detected WiFi displayed on the serial monitor



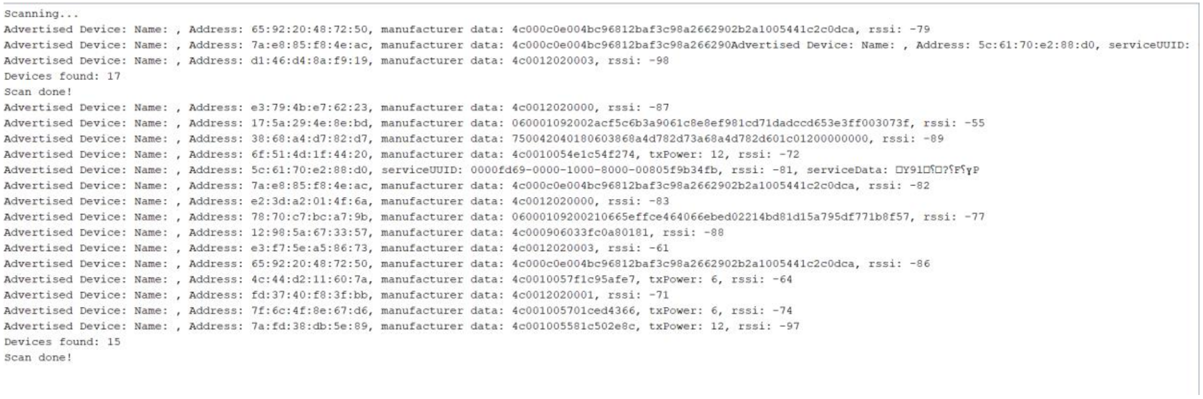
```
Setup done
Scan start
Scan done
13 networks found
Nr | SSID                             | RSSI | CH | Encryption
 1 | Ai Xuan 2.4G                     |  -50 |  1 | WPA2
 2 | Be Nam                           |  -56 |  6 | WPA
 3 | VAN QUI            Scan start
Scan done
21 networks found
Nr | SSID                             | RSSI | CH | Encryption
 1 | Ai Xuan 2.4G                     |  -59 |  1 | WPA2
 2 | VAN QUI                          |  -66 |  9 | WPA+WPA2
 3 | Be Nam                           |  -67 |  6 | WPA
 4 | CongHuy                          |  -70 |  1 | WPA+WPA2
 5 | Ngoc Trang 2.4G                  |  -70 |  7 | WPA2
 6 | trung tuan thuy hang             |  -80 |  1 | WPA2
 7 | KhoaKhoi                         |  -81 |  1 | WPA+WPA2
 8 | OPAN TOP                         |  -82 |  3 | WPA2
 9 | 63/68 chu ba                     |  -82 |  8 | WPA+WPA2
10 | Corner Chilhood 2.4G             |  -83 | 10 | WPA+WPA2
11 | NhaTroPhuong-2.4Ghz              |  -83 | 10 | WPA+WPA2
12 | CNC Tin Phat                     |  -84 |  5 | WPA2
13 | TTTP 2.4G                        |  -85 |  3 | WPA2
14 | VAN QUI                          |  -85 | 10 | WPA+WPA2
15 | Lam Xuan Binh                    |  -86 |  1 | WPA+WPA2
16 | Superman                         |  -86 |  5 | WPA2
17 | Nam_Khanh                        |  -87 |  1 | WPA+WPA2
18 | Sctv Hiep                        |  -88 | 11 | WPA2
19 | Gia Huy                          |  -89 |  1 | WPA+WPA2
20 | VANQUI                           |  -89 |  6 | WPA+WPA2
21 | Tuyet Xuong                      |  -90 |  1 | WPA2
```

- For **BLE scan**: Similar to the wifi example, we also receive BLE signals



```
 public BLEAdvertisedDeviceCallbacks
ice advertisedDevice) {
vice: %s \n", advertisedDevice.toStri

void setup() {
  Serial.begin
  Serial.print

  BLEDevice::i
  pBLEScan = B
  pBLEScan->se                     n
  pBLEScan->se                     rtisedDeviceCallback
  pBLEScan->se                      more power, but get
  pBLEScan->se
  pBLEScan->se                     erval value
}

void loop() {
  // put your                      un repeatedly:
  BLEScanResul                     LEScan->start(scanTime, false);
  Serial.print
  Serial.print                     ount());
  Serial.print
  pBLEScan->cl                     elete results fromBLEScan buffer to r
  delay(2000);
}
```

```
Done uploading.

Leaving...
Hard resetting via RTS pin
```

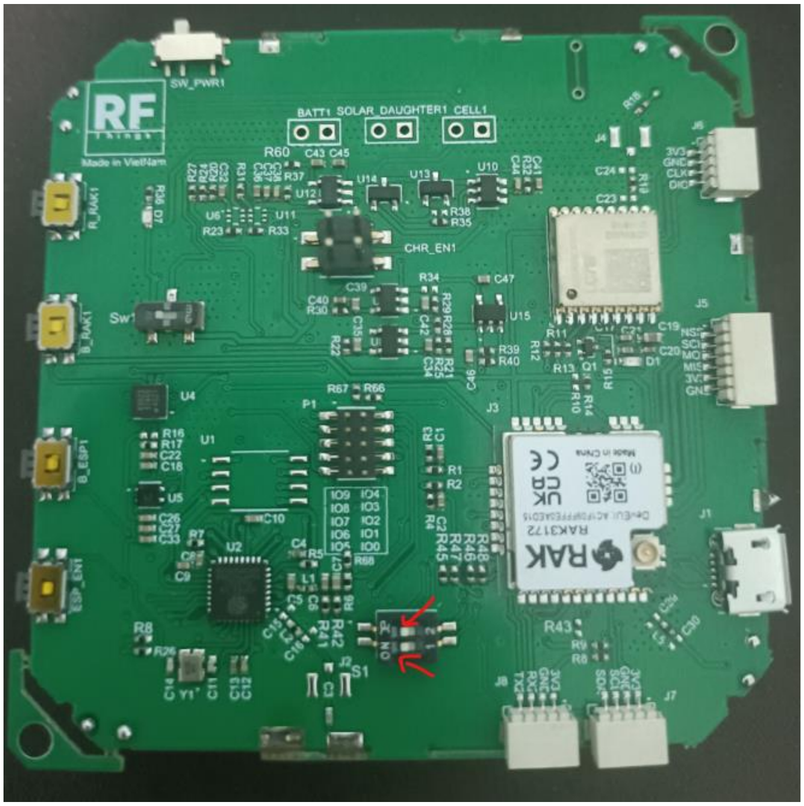


```
Scanning...
Advertised Device: Name: , Address: 65:92:20:48:72:50, manufacturer data: 4c000c0e004bc96812baf3c98a2662902b2a1005441c2c0dca, rssi: -79
Advertised Device: Name: , Address: 7a:e8:85:f8:4e:ac, manufacturer data: 4c000c0e004bc96812baf3c98a266290Advertised Device: Name: , Address: 5c:61:70:e2:88:d0, serviceUUID:
Advertised Device: Name: , Address: d1:46:d4:8a:f9:19, manufacturer data: 4c0012020003, rssi: -98
Devices found: 17
Scan done!
Advertised Device: Name: , Address: e3:79:4b:e7:62:23, manufacturer data: 4c0012020000, rssi: -87
Advertised Device: Name: , Address: 17:5a:29:4e:8e:bd, manufacturer data: 060001092002acf5c6b3a9061c8e8ef981cd71dadccd653e3ff003073f, rssi: -55
Advertised Device: Name: , Address: 38:68:a4:d7:82:d7, manufacturer data: 750042040180603868a4d782d73a68a4d782d601c01200000000, rssi: -89
Advertised Device: Name: , Address: 6f:51:4d:1f:44:20, manufacturer data: 4c0010054e1c54f274, txPower: 12, rssi: -72
Advertised Device: Name: , Address: 5c:61:70:e2:88:d0, serviceUUID: 0000fd69-0000-1000-8000-00805f9b34fb, rssi: -81, serviceData: □Y91□ʕ□?ʕFʕɣP
Advertised Device: Name: , Address: 7a:e8:85:f8:4e:ac, manufacturer data: 4c000c0e004bc96812baf3c98a2662902b2a1005441c2c0dca, rssi: -82
Advertised Device: Name: , Address: e2:3d:a2:01:4f:6a, manufacturer data: 4c0012020000, rssi: -83
Advertised Device: Name: , Address: 78:70:c7:bc:a7:9b, manufacturer data: 06000109200210665effce464066ebed02214bd81d15a795df771b8f57, rssi: -77
Advertised Device: Name: , Address: 12:98:5a:67:33:57, manufacturer data: 4c000906033fc0a80181, rssi: -88
Advertised Device: Name: , Address: e3:f7:5e:a5:86:73, manufacturer data: 4c0012020003, rssi: -61
Advertised Device: Name: , Address: 65:92:20:48:72:50, manufacturer data: 4c000c0e004bc96812baf3c98a2662902b2a1005441c2c0dca, rssi: -86
Advertised Device: Name: , Address: 4c:44:d2:11:60:7a, manufacturer data: 4c0010057f1c95afe7, txPower: 6, rssi: -64
Advertised Device: Name: , Address: fd:37:40:f8:3f:bb, manufacturer data: 4c0012020001, rssi: -71
Advertised Device: Name: , Address: 7f:6c:4f:8e:67:d6, manufacturer data: 4c001005701ced4366, txPower: 6, rssi: -74
Advertised Device: Name: , Address: 7a:fd:38:db:5e:89, manufacturer data: 4c001005581c502e8c, txPower: 12, rssi: -97
Devices found: 15
Scan done!
```

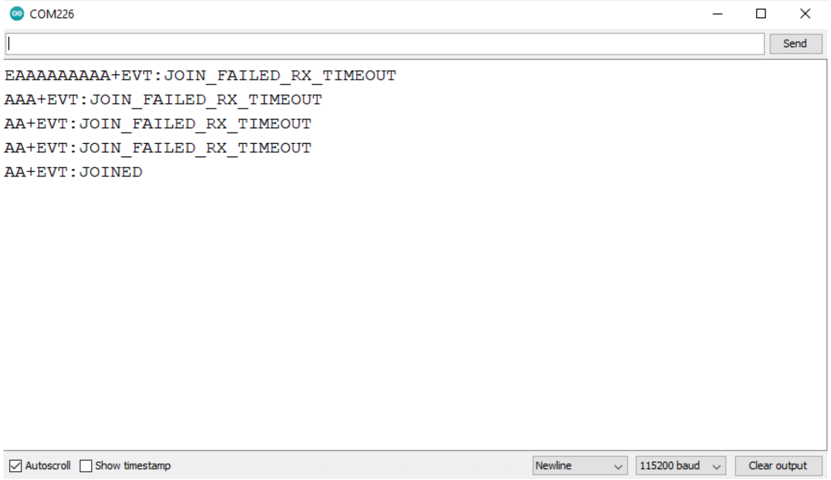
Note: for new esp32 boards, you need to hold down B_ESP and press ESP_EN to enter boot mode

4. At command ESP32 to RAK3172 using lora

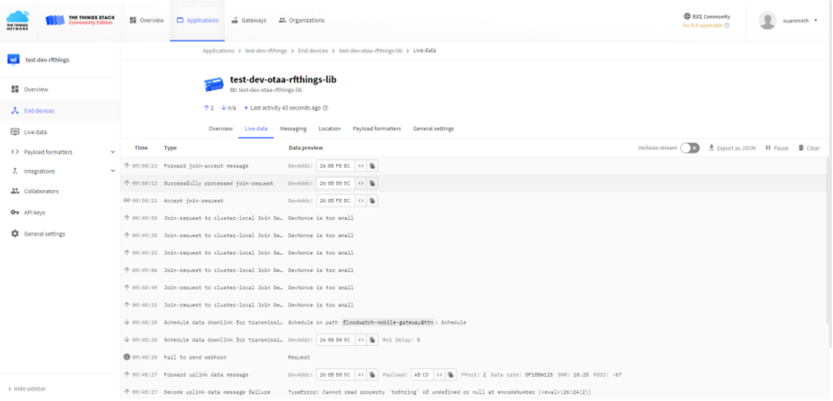
- Before using this function, you need to move the 2 uart switches to the left to connect the ESP32 to the RAK3172.



- Load code **esp32_rak_lora_otaa.ino**



```
EAAAAAAAAA+EVT:JOIN_FAILED_RX_TIMEOUT
AAA+EVT:JOIN_FAILED_RX_TIMEOUT
AA+EVT:JOIN_FAILED_RX_TIMEOUT
AA+EVT:JOIN_FAILED_RX_TIMEOUT
AA+EVT:JOINED
```

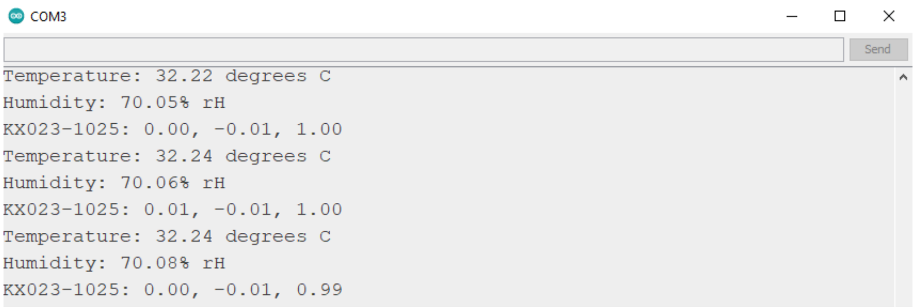


test-dev-otaa-rfthings-lib
ID: test-dev-otaa-rfthings-lib
↑2 ↓n/a • Last activity 43 seconds ago

```
Time      Type                                 Data preview
09:50:13  Forward join-accept message          DevAddr: 26 0B FE BC
09:50:12  Successfully processed join-request  DevAddr: 26 0B B8 BC
09:50:11  Accept join-request                  DevAddr: 26 0B FE BC
09:49:55  Join-request to cluster-local Join Se…  DevNonce is too small
09:49:38  Join-request to cluster-local Join Se…  DevNonce is too small
09:49:22  Join-request to cluster-local Join Se…  DevNonce is too small
09:49:06  Join-request to cluster-local Join Se…  DevNonce is too small
09:48:49  Join-request to cluster-local Join Se…  DevNonce is too small
09:48:33  Join-request to cluster-local Join Se…  DevNonce is too small
09:48:28  Schedule data downlink for transmissi…  Schedule on path floodwatch-mobile-gateway@ttn : Schedule
09:48:28  Schedule data downlink for transmissi…  DevAddr: 26 0B B8 BC  Rx1 Delay: 6
09:48:28  Fail to send webhook                 Request
09:48:27  Forward uplink data message          DevAddr: 26 0B B8 BC  Payload: AB CD  FPort: 2 Data rate: SF10BW125 SNR: 10.25 RSSI: -67
09:48:27  Decode uplink data message failure   TypeError: Cannot read property 'toString' of undefined or null at encodeNumber (<eval>:26:24(2))
```

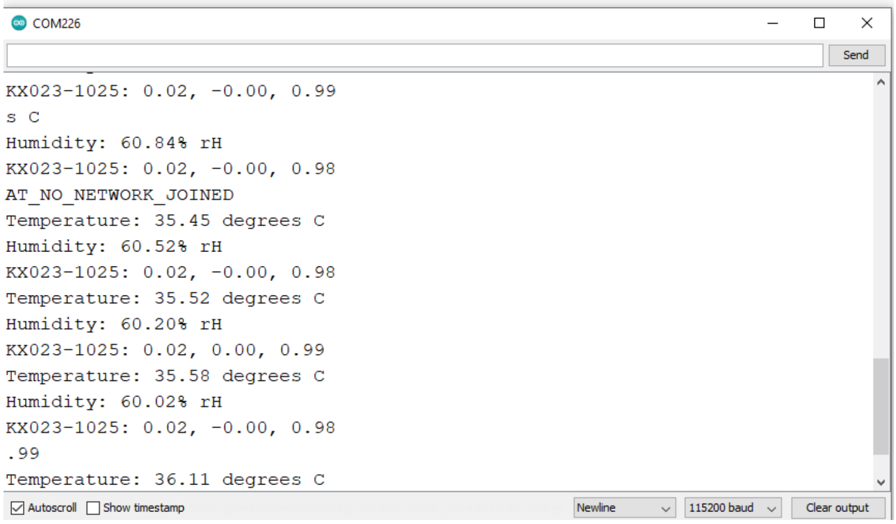
5. Get value sensor from RAK3172 send data to ESP32

- To get the value of the sensor via ESP32, you need to load the **rak_sensor.ino** code for RAK using USB uart.
- After loading the code, you will receive the value of the sensors



```
Temperature: 32.22 degrees C
Humidity: 70.05% rH
KX023-1025: 0.00, -0.01, 1.00
Temperature: 32.24 degrees C
Humidity: 70.06% rH
KX023-1025: 0.01, -0.01, 1.00
Temperature: 32.24 degrees C
Humidity: 70.08% rH
KX023-1025: 0.00, -0.01, 0.99
```

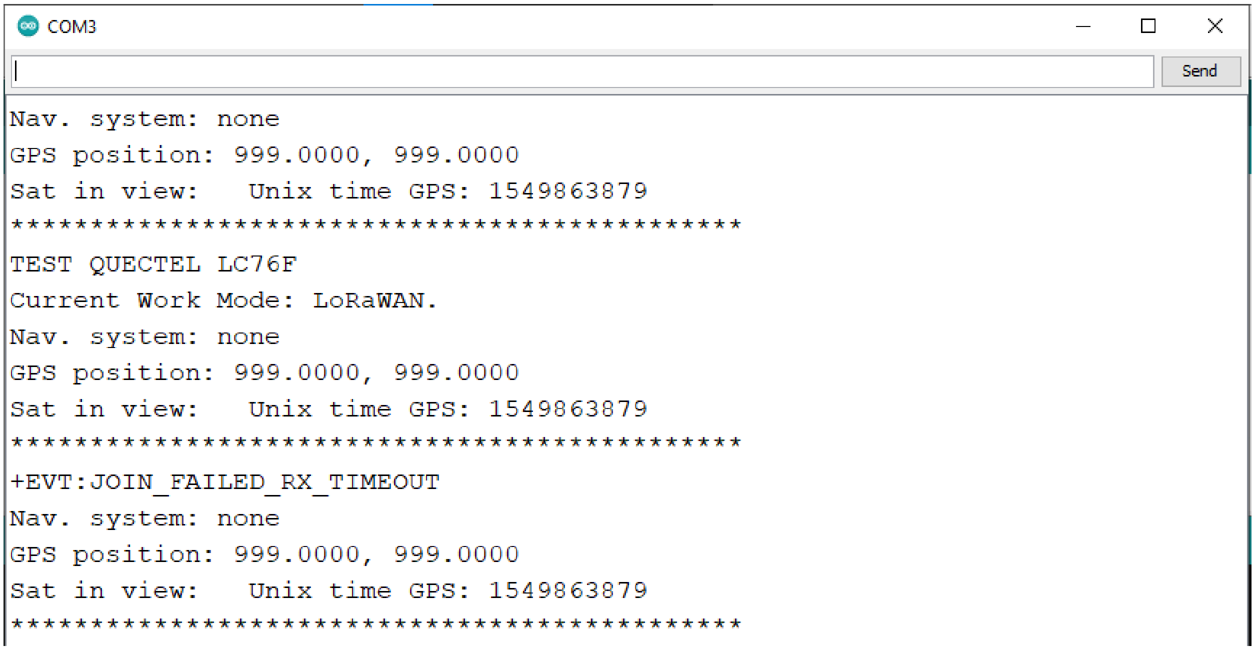
- When getting the value from the sensor, use ESP32 to get the sensor value from the sensor. The picture below is the sensor value read from the serial number of the ESP32.



```
KX023-1025: 0.02, -0.00, 0.99
s C
Humidity: 60.84% rH
KX023-1025: 0.02, -0.00, 0.98
AT_NO_NETWORK_JOINED
Temperature: 35.45 degrees C
Humidity: 60.52% rH
KX023-1025: 0.02, -0.00, 0.98
Temperature: 35.52 degrees C
Humidity: 60.20% rH
KX023-1025: 0.02, 0.00, 0.99
Temperature: 35.58 degrees C
Humidity: 60.02% rH
KX023-1025: 0.02, -0.00, 0.98
.99
Temperature: 36.11 degrees C
```

6. Read GPS

- Load code **rak_gps.ino** to read GPS signal



```
Nav. system: none
GPS position: 999.0000, 999.0000
Sat in view:   Unix time GPS: 1549863879
***********************************************
TEST QUECTEL LC76F
Current Work Mode: LoRaWAN.
Nav. system: none
GPS position: 999.0000, 999.0000
Sat in view:   Unix time GPS: 1549863879
***********************************************
+EVT:JOIN_FAILED_RX_TIMEOUT
Nav. system: none
GPS position: 999.0000, 999.0000
Sat in view:   Unix time GPS: 1549863879
***********************************************
```