INTEL-IRRIS

Intelligent Irrigation System for Low-cost Autonomous Water Control in Small-scale Agriculture

This project is part of the PRIMA Programme supported by the European Union

Intel-IrriS

PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

Intelligent Irrigation System for Low-cost Autonomous Water Control in Small-scale Agriculture

Intel-IrriS

Building the INTEL-IRRIS LoRa IoT platform Part 1: soil sensor device

(annex for IRD PCB v5 – RAK3172)

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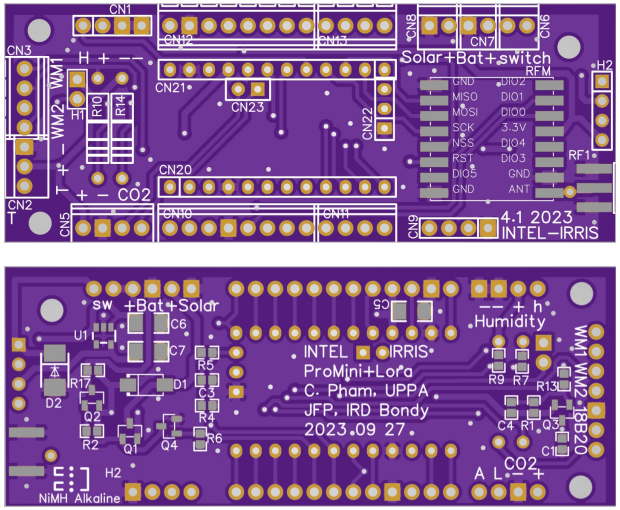
UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

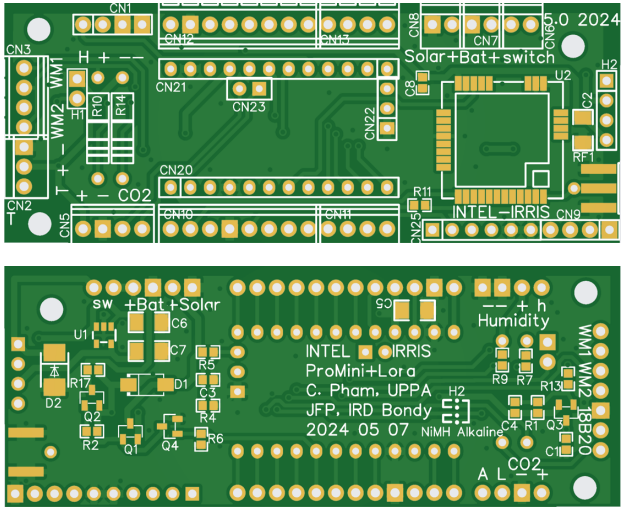
LIUPPA

WAZIUP
IoT – from idea to reality
WAZIHUB

Important

- This tutorial is an update for the IRD PCB v5 based on the RAK3172 radio module
- Reader MUST first look at the tutorial presenting the IRD PCB v4.1
- This tutorial only presents the differences between the 2 versions





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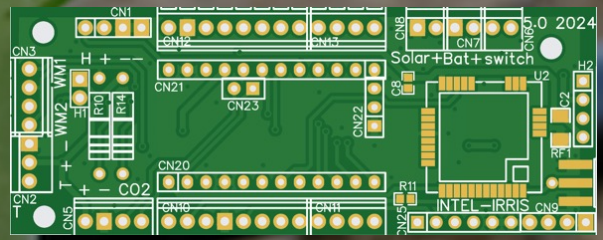
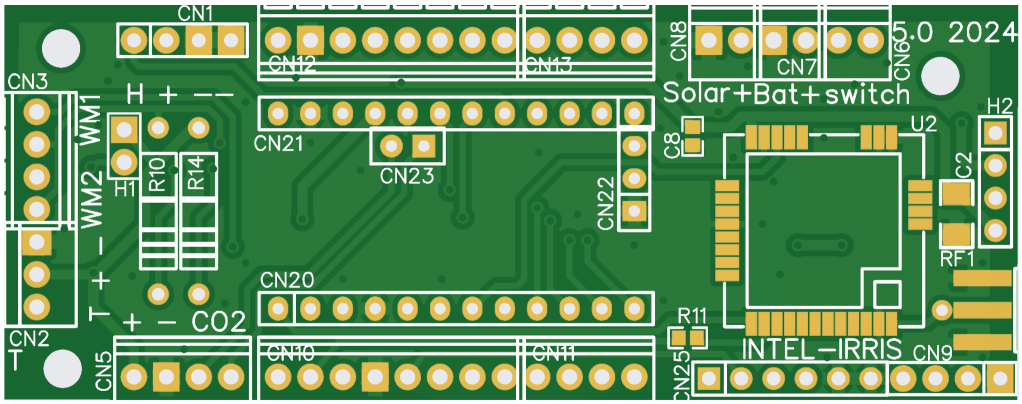
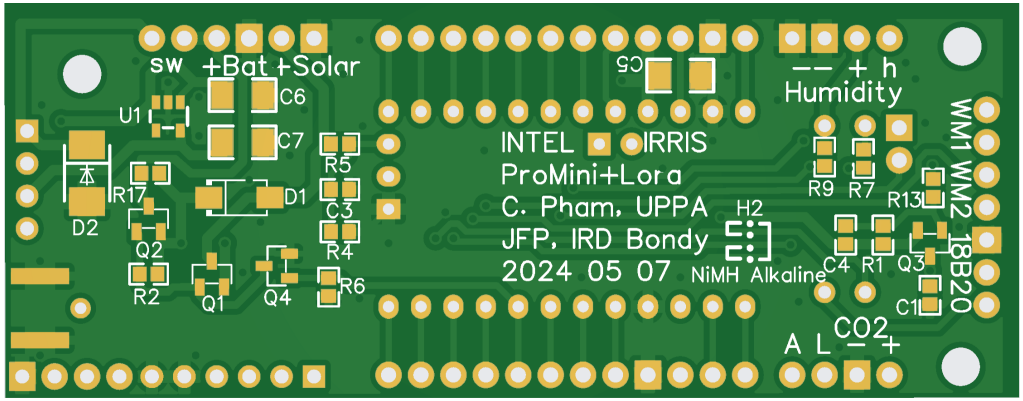
IRD PCB v5



The IRD PCB v5 – raw version

- You can order the raw version of the IRD PCB, which means only the PCB, without any electronic components soldered by the manufacturer
- It is the so-called DIY approach
- The raw version is not intended to have solar charging capabilities





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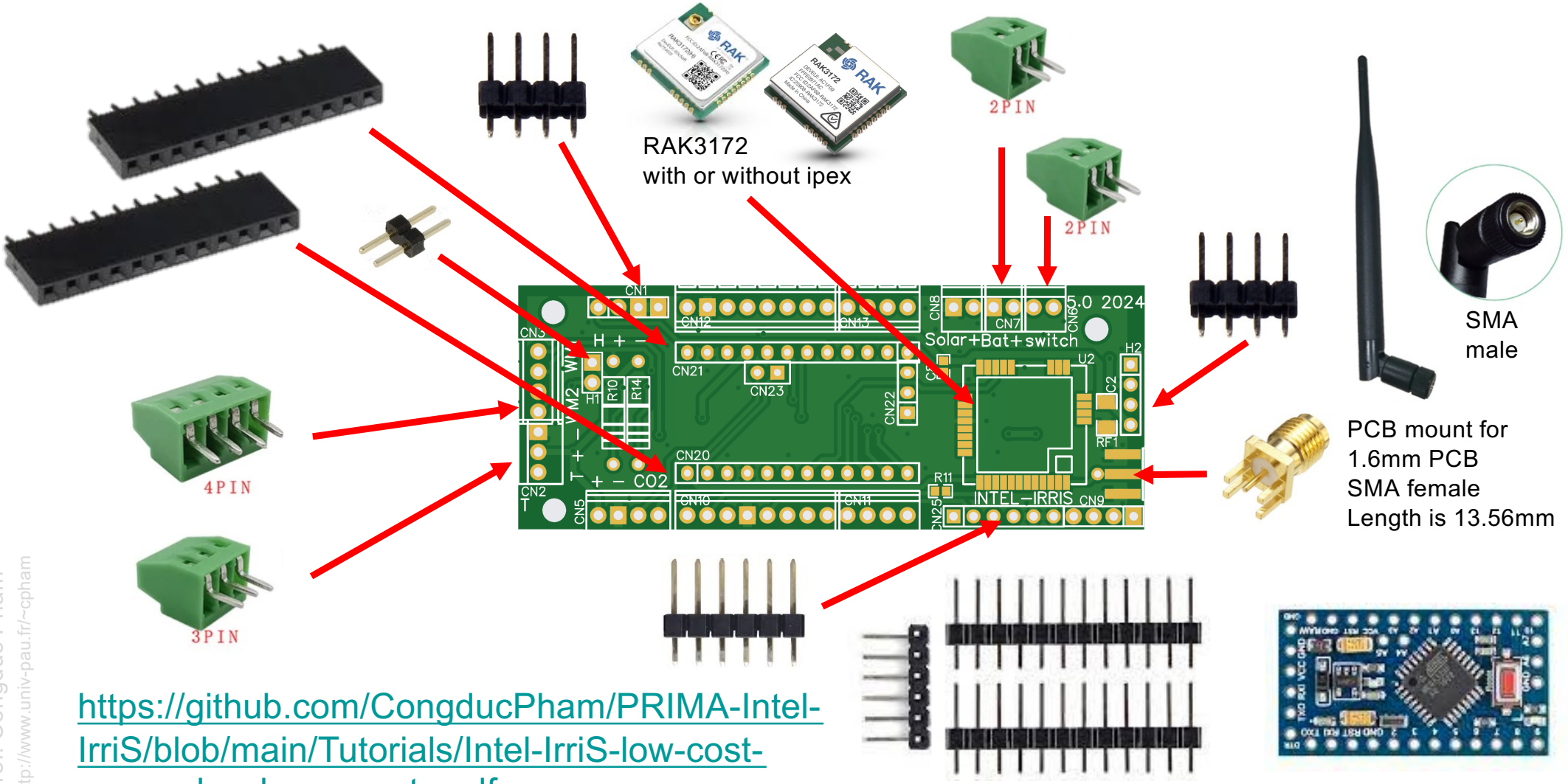
Electronic parts - starter-kit version



https://github.com/CongducPham/PRIMA-Intel-IrriS/blob/main/Tutorials/Intel-IrriS-low-cost-sensor-hardware-parts.pdf

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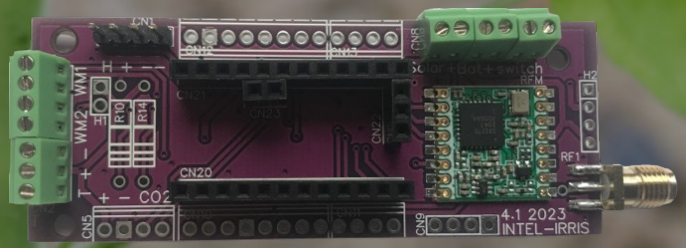
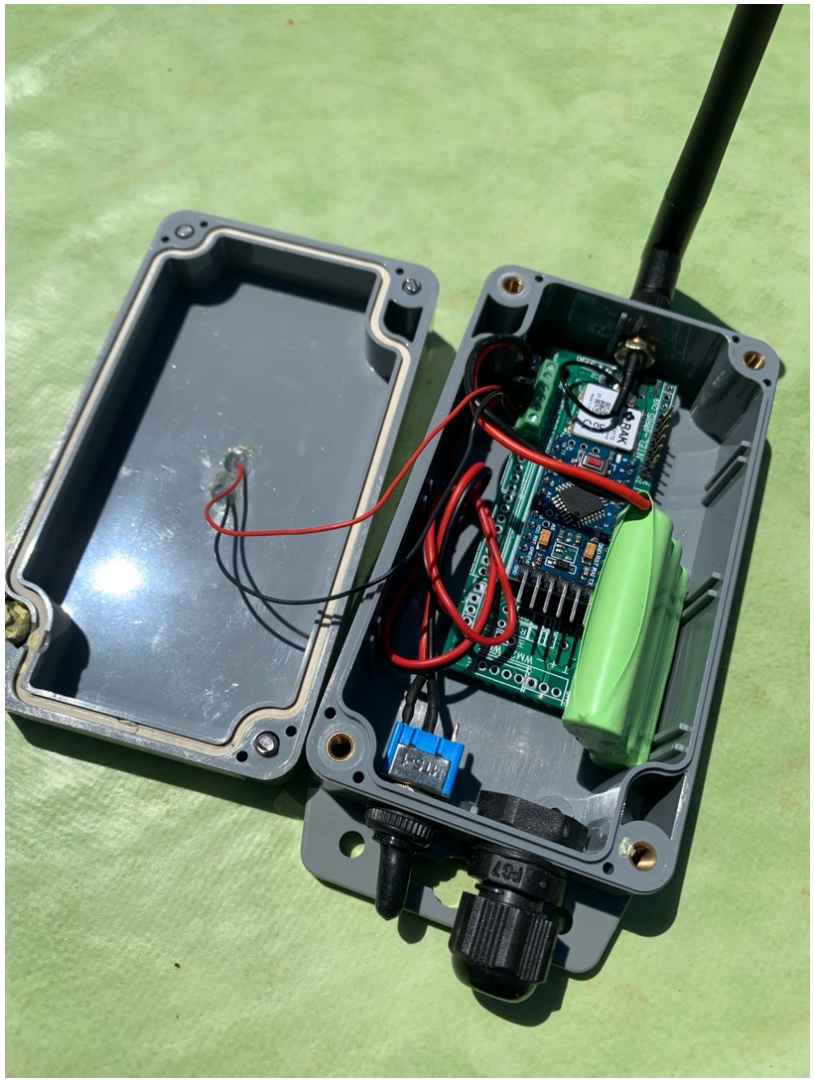


THE IRD PCBA v5

Soil device with PCBA v5, final result



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in Small-scale Agriculture
PROGRAM THE
ARDUINO

Config for IRD PCB v5 (1)

- For raw version, uncomment `IRD_PCB` in BoardSettings.h

```
//uncomment for WAZISENSE v2 board
//#define WAZISENSE

//uncomment for IRD PCB board
#define IRD_PCB
```

- For PCBA version, also uncomment `IRD_PCBA`

```
////////////////////////////////////////////////////////////////////
//uncomment for IRD PCB board
#define IRD_PCB
//also uncomment for IRD PCB board fully assembled by manufacturer
//with all components, including solar circuit
#define IRD_PCBA
```

- ONLY for solar version, uncomment `SOLAR_BAT`

```
////////////////////////////////////////////////////////////////////
// uncomment only if the IRD PCB is running on solar panel
// MUST be commented if running on alkaline battery
// code for SOLAR_BAT has been written by Jean-François Printanier from IRD
#define SOLAR_BAT
// do not change if you are not knowing what you are doing
#define NIMH
```

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Config for IRD PCB v5 (2)

- Uncomment `SOFT_SERIAL_DEBUG` in BoardSettings.h

```
//////////////////////////////////////////
// uncomment for IRD PCB RAK version where
#define SOFT_SERIAL_DEBUG
```

- Uncomment `RAK3172` in RadioSettings.h

```
//////////////////////////////////////
// please uncomment only 1 choice
//#define SX126X
//#define SX127X
//#define SX128X
#define RAK3172
//////////////////////////////////////
```

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Serial monitor with IRD PCB v5

- After flashing the Arduino, it is usually desirable to watch at the text output from the Arduino IDE serial monitor to check that everything went OK
- With IRD PCB v5, the RAK radio module is controlled by AT commands received on its serial port and sent by the Arduino on its serial port (baud rate is normally set to 38400)
- Therefore, Arduino's TX/RX pins are connected to the RAK3172 and the serial monitor used traditionally to look at text output can not use the default Arduino TX/RX pins
- The IRD PCB v5 uses a software defined serial port for the text output where only TX is defined on digital pin 2

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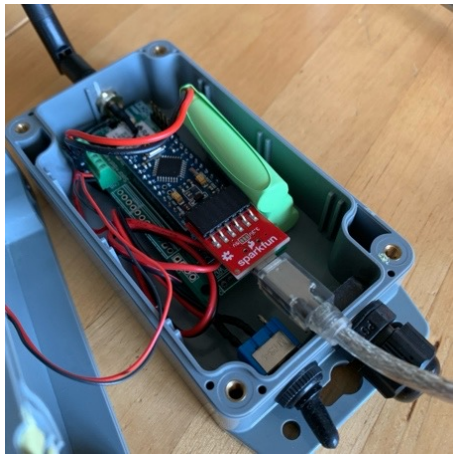
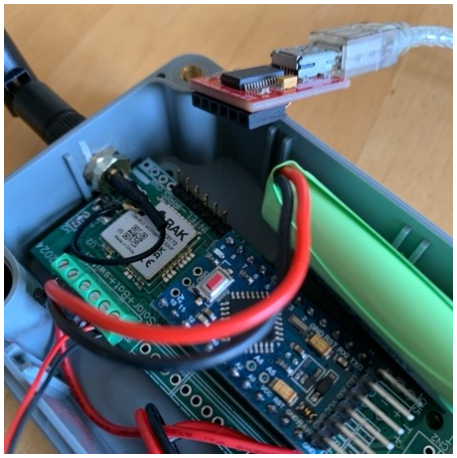
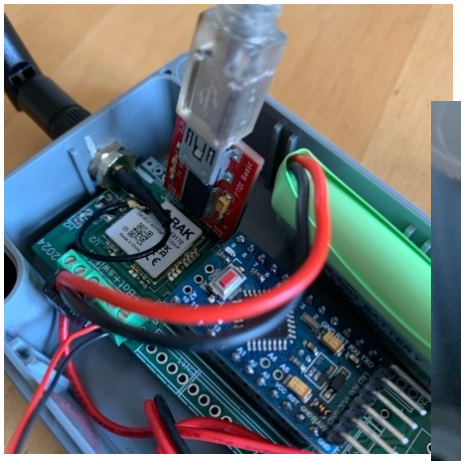
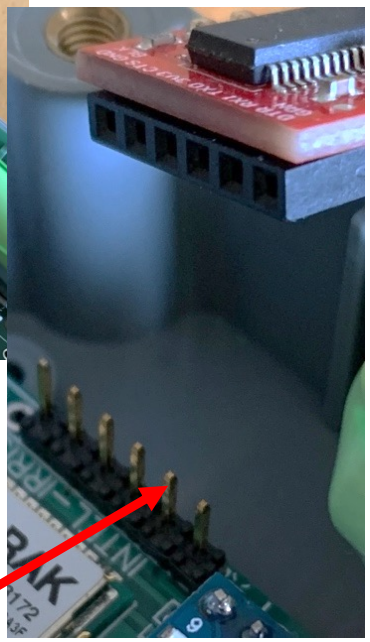
Connect the FTDI USB-Serial

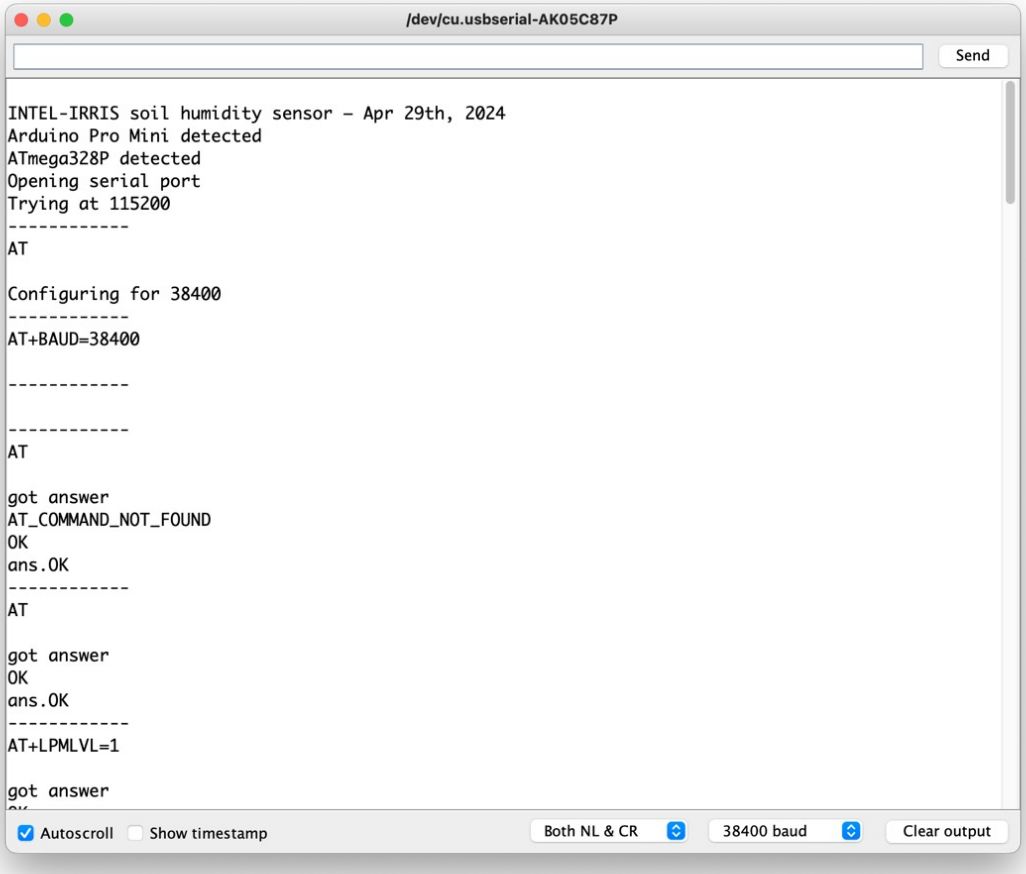
- After flashing the Arduino with the FTDI USB-Serial cable (left photo), unplug it in order to plug it again on the dedicated debug header on the IRD PCB v5 (middle & right photo)

- Battery should be connected, but switch is on OFF
- Be sure to connect the RX pin of the FTDI USB-Serial to the TX pin of the debug header on the IRD PCB v5

Getting text output from the board

- Order of steps is important!



Open serial monitor, you should see nothing

Set baud rate to 38400

Switch ON the board

See output from board

Check that transmission is OK

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Annex: RAK3172 baud rate

- Latest version of RAK3172 is using by default (factory setting) a baud rate of 115200, which is too fast (mostly for RX) for the Arduino Pro mini based on ATMega328P microcontroller
- The INTEL-IRRIS code is actually reprogramming the RAK3172 to use a baud rate of 38400, therefore you do not need to worry about setting the correct baud rate for RAK3172, especially with the fully assembled version of the PCB where the RAK3172 is provided by the PCB manufacturer

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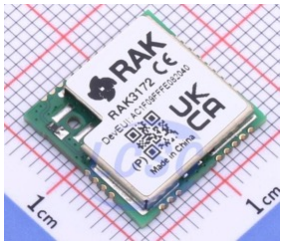
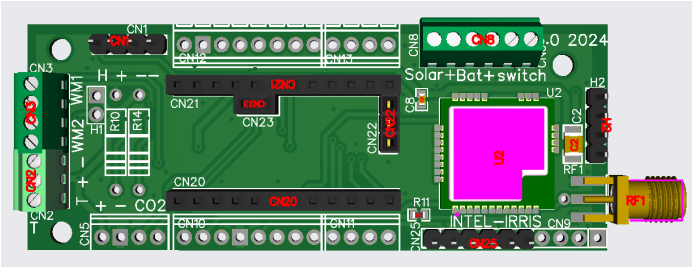
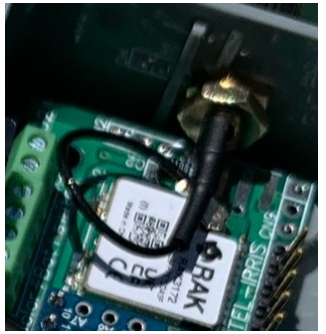
Annex: IPEX or not IPEX?

- The BOM file for the PCBA fully assembled is using the RAK3172 without the IPEX connector because we prefer to have a robust soldered RF connector





- For the raw version of the PCB, you can use and solder the version with the IPEX if you want and connect the antenna with an IPEX-female to SMA female short pigtail



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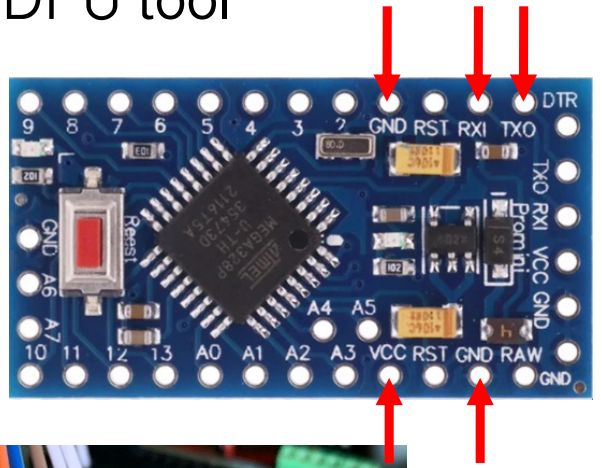
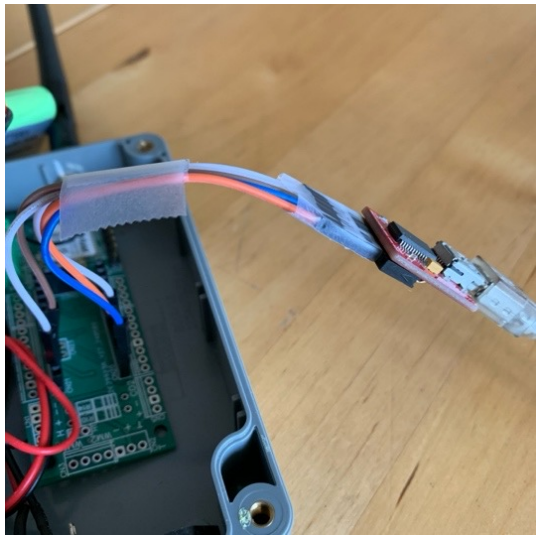
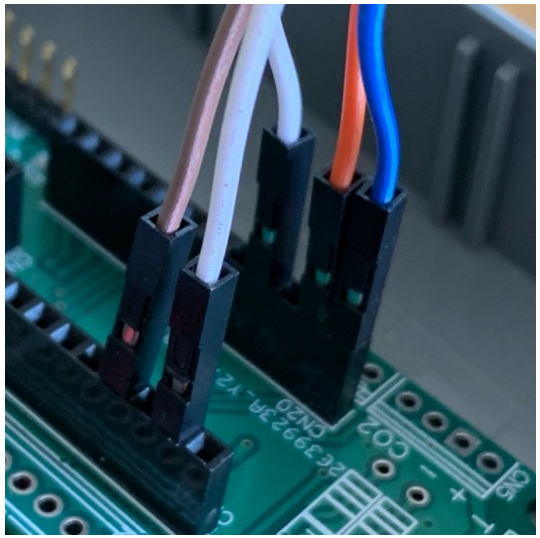
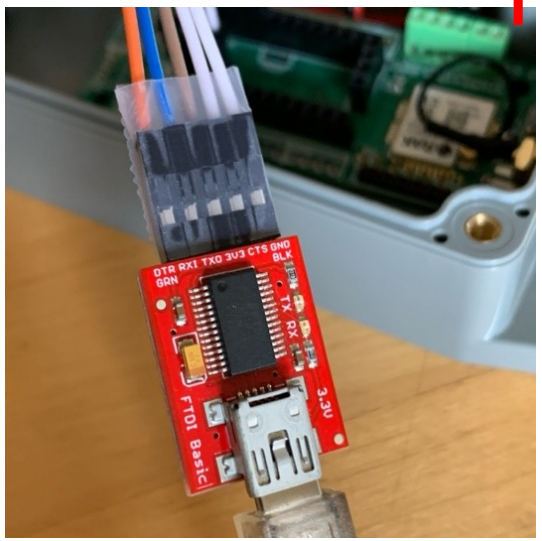
Annex: update firmware of RAK3172

- The RAK3172 can be upgraded with the RAK DFU tool
- You can use Dupont wires to directly connect VCC, GND, RX and TX of the FTDI USB-serial cable to corresponding pins on the female headers after removing the Arduino Pro Mini from its socket. DTR is not connected



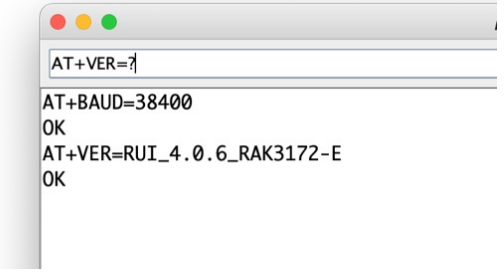


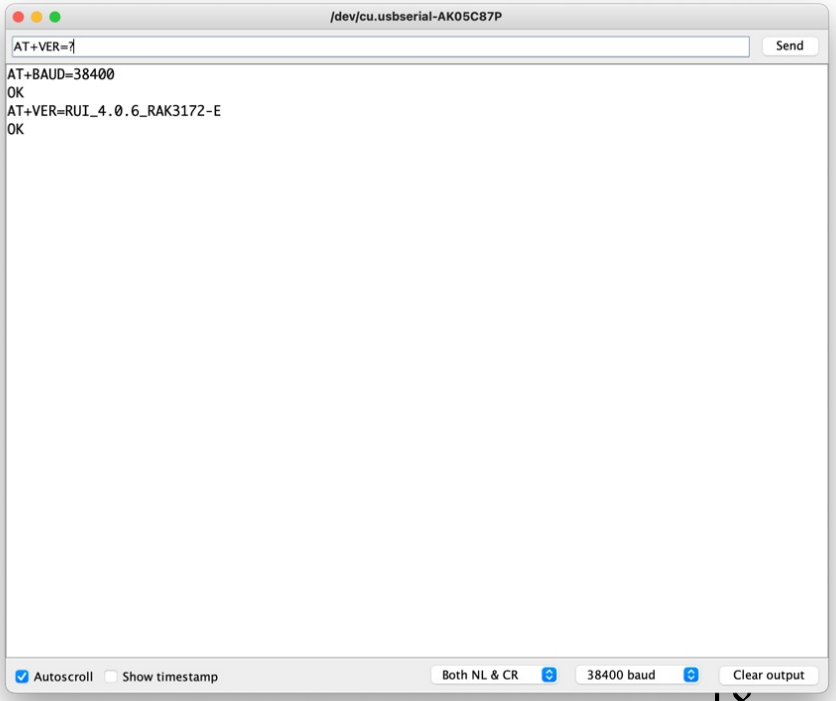




Annex: send direct AT commands

- With the FTDI USB-serial cable connected to the PCB v5 without the Arduino Pro Mini, as show on the previous slide, you can directly communicate with the RAK3172 to send AT commands for test purposes
- Any serial communication tool can be used, including the Arduino IDE serial monitor
- RAK also proposes the WisToolBox software to communicate with RAK components





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Annex: AT commands for INTEL-IRRIS

- Here is the list of AT commands used by INTEL-IRRIS code
- During setup(), for ABP mode in EU868 band, for capacitive
  - AT+BAUD=38400
  - AT+LPMLVL=1
  - AT+LPM=0
  - AT+LPM=? ; AT+VER=? ; AT+BAND=? ; AT+ADR=? ; AT+NJM=? ; AT+DEVADDR=?; AT+NWKSKEY=? ; AT+APPSKEY=?
  - AT+NJM=0 ; AT+CLASS=A ; AT+BAND=4 ; AT+ADR=0
  - AT+DEVADDR=26011DAA
  - AT+NWKSKEY=23158D3BBC31E6AF670D195B5AED5525
  - AT+APPSKEY=23158D3BBC31E6AF670D195B5AED5525
  - AT+LPMLVL=2
  - AT+LPM=1
- On wake up, to transmit (898.0 and 3.45 for instance)
  - AT+SEND=1:0067231406020159
  - AT+SLEEP

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