



Intel-IrriS

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

Technical Annex for D1.2a

Low-cost sensor generic platforms for connected
irrigation system

List of hardware part

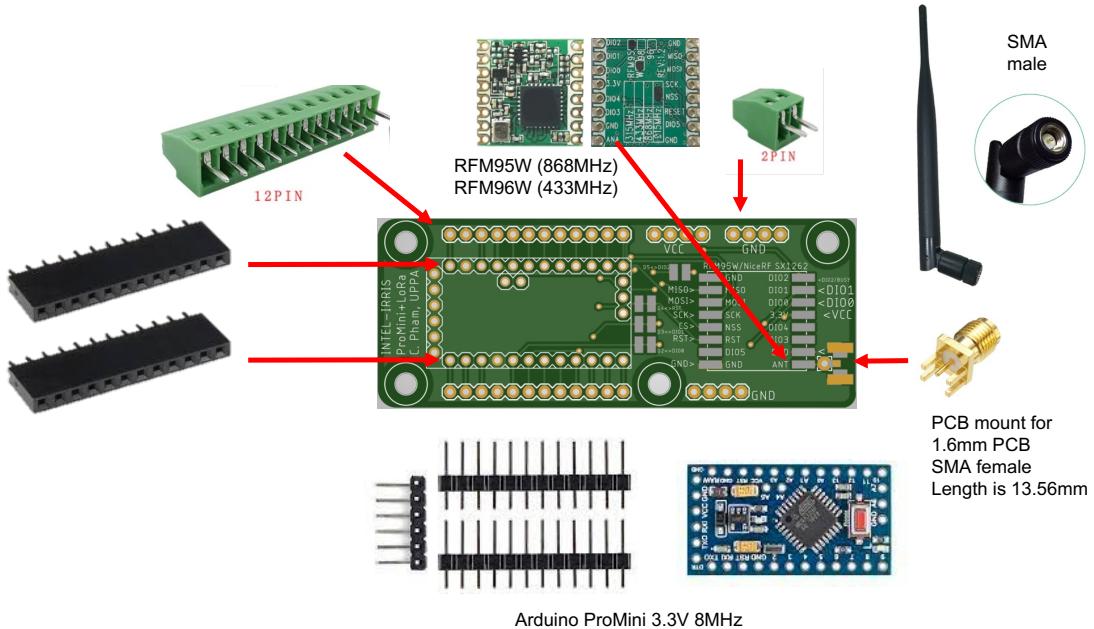
Responsible Editor: UPPA

Version: 1.6

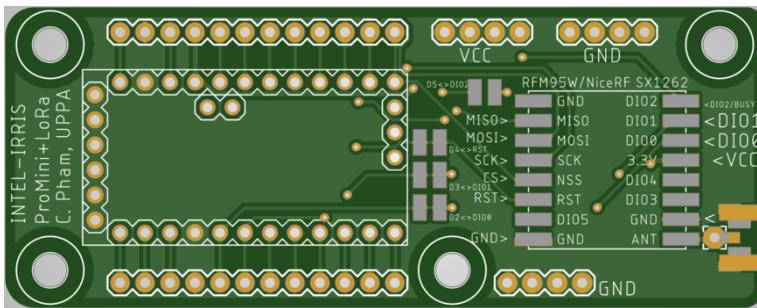
Date: Sep. 27th, 2024

1.BOM FOR INTEL-IRRIS STARTER-KIT

1.1. DEVICE BASED ON THE SIMPLE PCB v2



- The UPPA PCB v2



<https://github.com/CongducPham/PRIMA-Intel-Irris/tree/main/PCBs>

https://github.com/CongducPham/PRIMA-Intel-Irris/raw/main/PCBs/MySecondProMiniLoRaBreakout_2022-01-20.zip

- 12-pin and 2-pin screw terminal block, 4-pin can also be ordered
<https://fr.aliexpress.com/item/4000867583795.html>
- 12-pin female header
<https://fr.aliexpress.com/item/32970948352.html>
- RFM95W (868MHz) or RFM96W (433MHz)
<https://fr.aliexpress.com/item/32844406764.html>
- SMA female PCB connector for 1.6mm PCB
<https://fr.aliexpress.com/item/32948380887.html>

- Arduino ProMini, take 3.3v 8MHz version
<https://fr.aliexpress.com/item/1005001621723982.html>

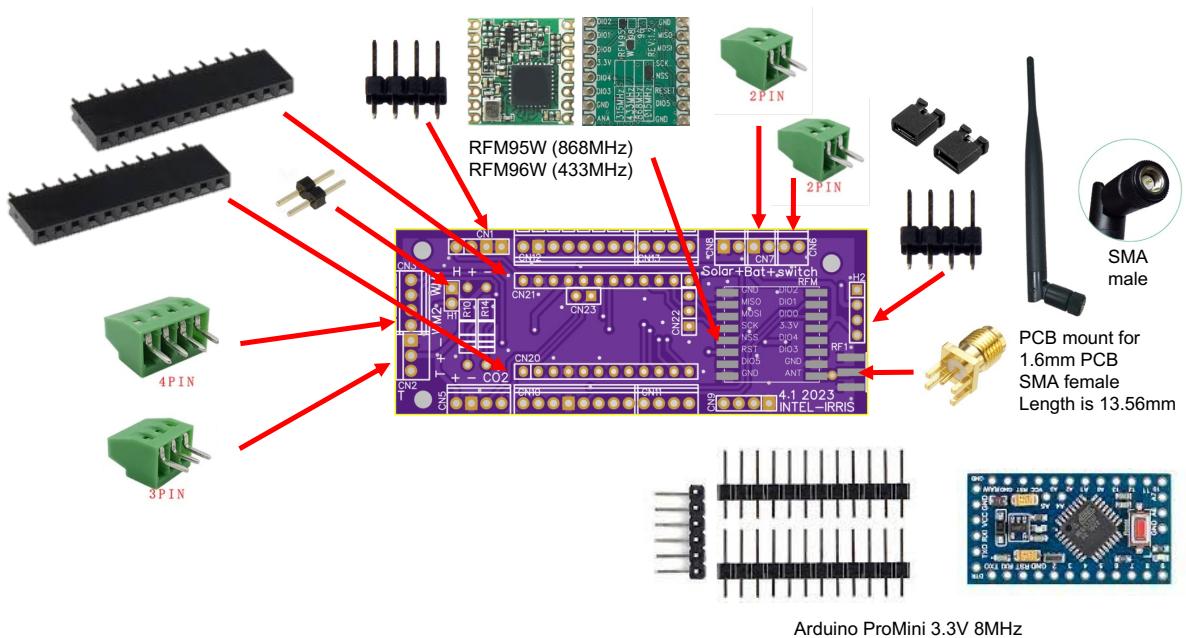


- ABS waterproof enclosure
<https://www.gotronic.fr/art-boitier-abs-etanche-g304m-17977.htm>
- SEN0308 capacitive soil sensor
<https://www.gotronic.fr/art-capteur-d-humidite-capacitif-gravity-sen0308-32249.htm>
- DS18B20 temperature sensor for soil temperature
<https://fr.aliexpress.com/item/32827810300.html>
 you will need a 4.7 kOhm resistor
- Irrrometer Watermark water tension sensor
<https://www.challenge-agriculture.fr/en/product/makers-space/watermark-sensors-for-makers/>
 you will need a resistor from 7kOhm to 14kOhm (we use 10kOhm)

- 2-AA battery holder
<https://fr.aliexpress.com/item/4001008150456.html>
- switch with pre-soldered wires
<https://fr.aliexpress.com/item/4000286754686.html>
- waterproof cap for the switch (select just the cap)
<https://fr.aliexpress.com/item/33022608497.html>
- Cable gland PG7 (select PG7)
<https://fr.aliexpress.com/item/10000132999214.html>
- 3dBi 868MHz or 3dBi 433MHz antenna
868MHz: <https://fr.aliexpress.com/item/32964912902.html>
433MHz: <https://fr.aliexpress.com/item/32963197821.html>
- Flat-face seal for outer antenna junction (6x11x0.8mm), left figure
<https://fr.aliexpress.com/item/4000368310126.html>
- Flat-face seal for inner antenna junction (14x5x0.5 mm), right figure
<https://fr.aliexpress.com/item/1005004643934924.html> (optional)



1.2. DEVICE BASED ON THE IRD PCB (v4.1)

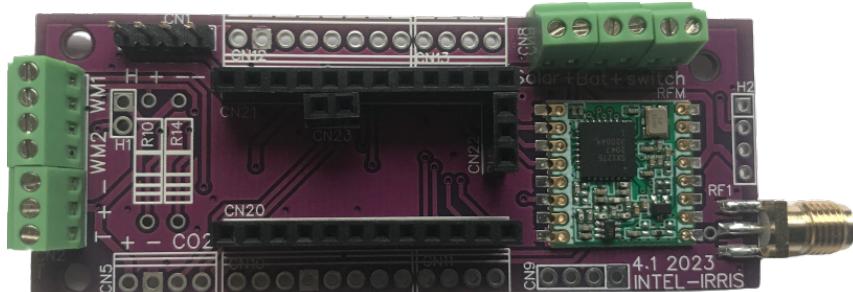


Additional components for the raw PCB version (not fully assembled):

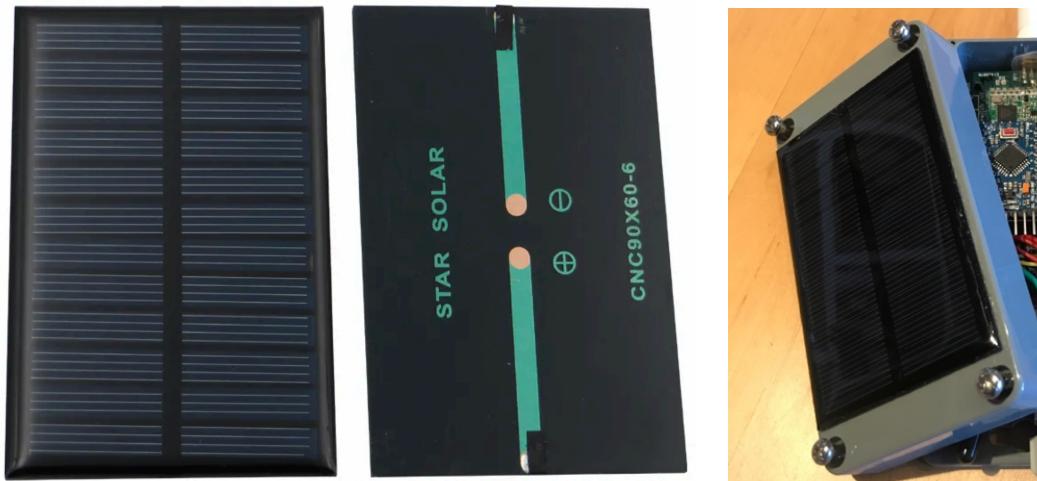
- 2.54mm male header pin to break at suitable size
<https://fr.aliexpress.com/item/1005006034877497.html>
- 4-pin and 3-pin screw terminal
<https://fr.aliexpress.com/item/4000867583795.html>
- or, 7-pin screw terminal
<https://fr.aliexpress.com/item/4000867583795.html>
- 2-pin jumper
<https://fr.aliexpress.com/item/1005007336923103.html>

For the PCBA version, all components come already assembled, for instance, there is no need of the RFM95W radio module.

Additional components for fully assembled PCB version (PCBA), to have the solar panel and solar charging version:



- Mini solar panel 6 V 0.6 W 100 mA 60x90mm
<https://fr.aliexpress.com/item/32881044659.html>



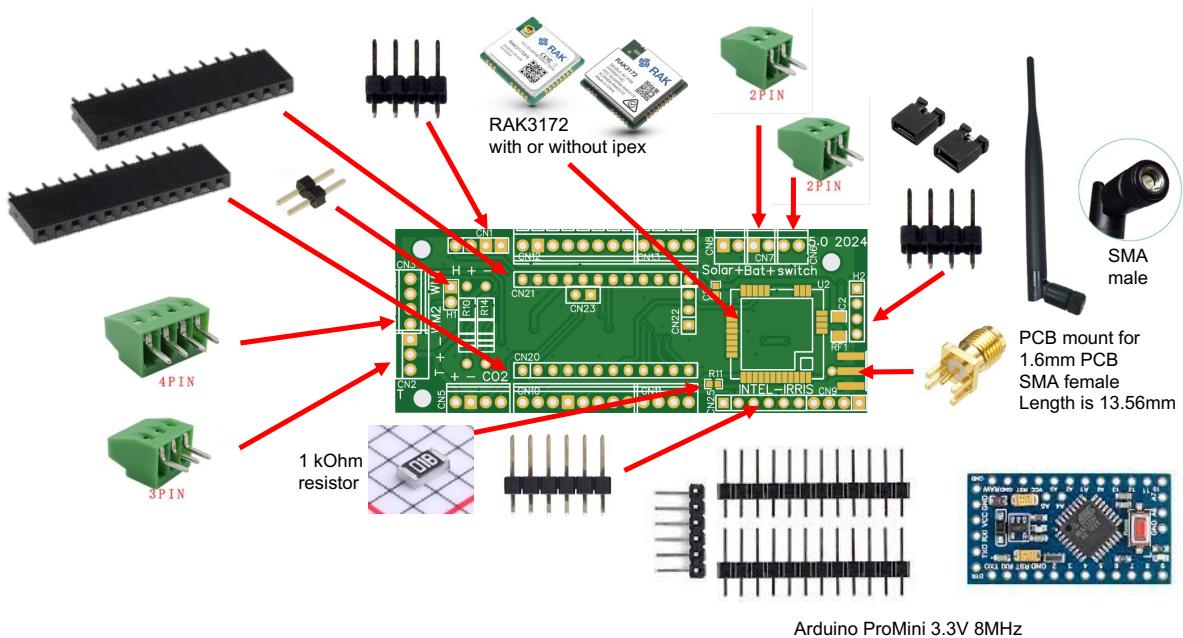
- NiMh rechargeable batteries (**do not take Li-Ion batteries**)
<https://fr.aliexpress.com/item/1005003197882188.html>



- or, 3xAAA battery holder and rechargeable NiMh AAA batteries
<https://fr.aliexpress.com/item/1005005787955456.html>
<https://fr.aliexpress.com/item/1005007489715032.html>

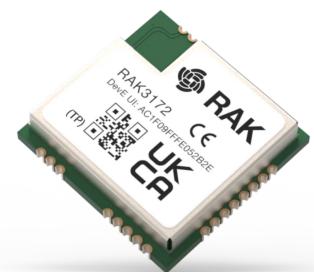


1.3. DEVICE BASED ON THE IRD PCB (v5)

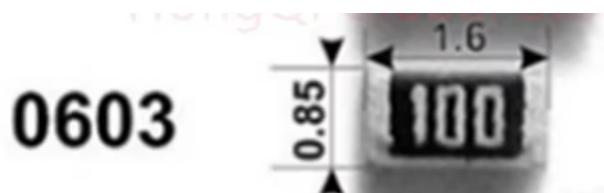


Additional components for the raw PCB version (not fully assembled):

- All the additional components of the IRD PCB v4.1
- RAK3172 radio module, chose your frequency band, take the version WITHOUT the IPEX connector for the antenna
<https://store.rakwireless.com/products/wisduo-lpwlan-module-rak3172?variant=44068554571974>



- 1 KOhm SMD (Surface Mounted Device) 603 resistor
<https://fr.aliexpress.com/item/1005001793547200.html>



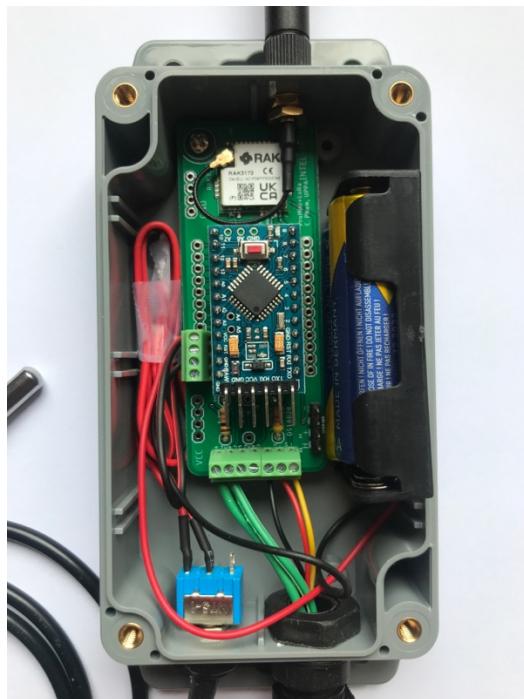
1.4. DEVICE BASED ON THE RAK3172 PCB

This version is obsoleted by IRD PCB v5

- RAK3172 radio module, chose your frequency band, take the version with the IPEX connector for the antenna
<https://store.rakwireless.com/products/wisduo-lpwan-module-rak3172?variant=40014759329990>



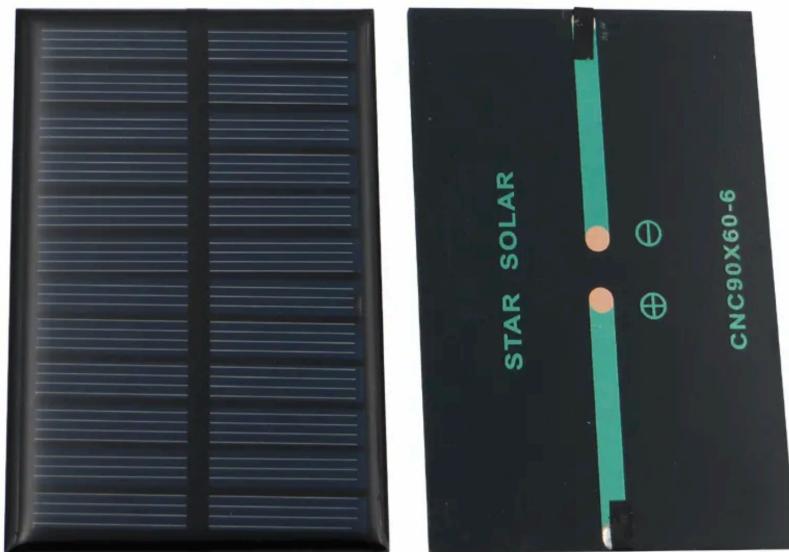
- UFL/ u.FL/ IPX/IPEX to SMA female, take 5cm is enough
<https://fr.aliexpress.com/item/4000848776660.html>



1.5. DEVICE BASED ON THE WAZISENSE V2

Additional components for the solar panel version:

- Mini solar panel 6 V 0.6 W 100 mA 60x90mm
<https://fr.aliexpress.com/item/32881044659.html>



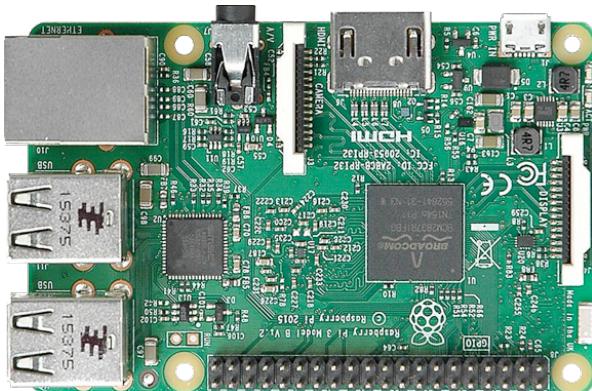
- Li-ion or Li-Po 3.7v battery (from 1200mAh)
<https://fr.aliexpress.com/item/1005002919536938.html>



- UFL/ u.FL/ IPX/IPEX to SMA female, take 5cm is enough
<https://fr.aliexpress.com/item/4000848776660.html>
same as for the RAK3172 PCB

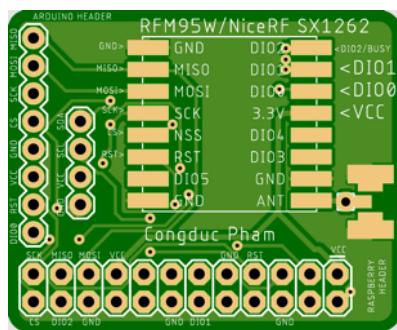
1.6. FOR THE INTEL-IRRIS WAZIGATE

- Raspberry: we recommend RPI3B. RPI3B+/4B could also be used.



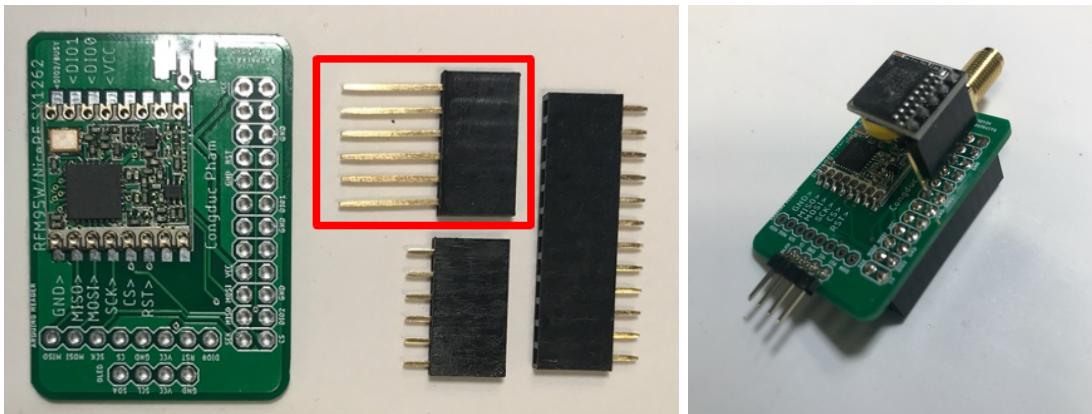
You also need an 8GB or 16GB or 32GB SD card **class 10**
RPI3B/3B+/4B have built-in WiFi

- The UPPA RFM95W breakout to make the LoRa hat



https://github.com/CongducPham/LowCostLoRaGw/blob/master/PBs/RFM95Breakout_2020-11-14.zip

- RFM95W (868MHz) or RFM96W (433MHz)
<https://fr.aliexpress.com/item/32844406764.html>
- Longer SMA female PCB connector for 1.6mm PCB
<https://fr.aliexpress.com/item/32964875181.html>
- Longer 6-pin header
<https://fr.aliexpress.com/item/4001351715019.html>
- Regular 6-pin and 12-pin female header
<https://fr.aliexpress.com/item/32970948352.html>



- Male header 90 degree, take R1 B6 type
<https://fr.aliexpress.com/item/32887929634.html>



- ABS case for RPI3B/3B+ (take just the case)
<https://fr.aliexpress.com/item/32718435597.html>
 - ABS case for RPI4B (if you use RPI4, take just the case)
<https://fr.aliexpress.com/item/1005004207618033.html>



- 0.96" OLED screen
<https://fr.aliexpress.com/item/32920071528.html>
- RTC module for Raspberry gateway
<https://fr.aliexpress.com/item/32317422637.html>



XHCRF®



433MHz/LoRa ANTENNA

- Indoor higher gain antenna base for N-connector antenna
take SMA male connector to connect to gateway's radio module
<https://fr.aliexpress.com/item/1005005302454558.html>
- Higher gain antenna with N-connector male, this is one example
<https://fr.aliexpress.com/item/1005005514194604.html>
there are plenty of models (choose either 433MHz or 868MHz)



- Alternatively to the base for N-connector antenna, an extension or pig-tail cable SMA male to N-connector female can be used. Take the shortest cable length (e.g. 15cm, 30cm or 50cm) to limit attenuation



<https://fr.aliexpress.com/item/1005003319310524.html>

<https://fr.aliexpress.com/item/1005006385279232.html>

2. EXPECTED RESULTS



3. ADDITIONAL LIST OF USEFUL COMPONENTS

The following list are the components and part that you may find useful to have in your lab for various projects.

USB-SERIAL

You will also need the FTDI breakout (3.3v version) to program the board. You need only one to program all your boards. Original product from Sparkfun is here: <https://www.sparkfun.com/products/9873>



We tested a Chinese one (on the right) that can be set either at 5v or 3.3v. Much cheaper! <https://fr.aliexpress.com/item/32648254875.html>

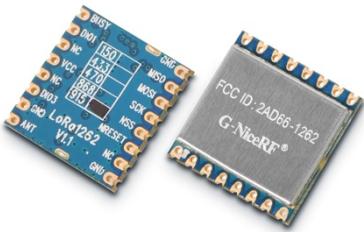
LORA RADIO MODULES

- The RFM95W (868MHz) and RFM96W (433MHz) LoRa module from HopeRF are very popular modules that you can buy from many Chinese manufacturers. It requires a breakout board as it is very small. Its advantage is to be easily integrated on a PCB board

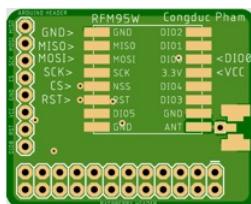


<https://fr.aliexpress.com/item/32844406764.html>
(choose frequency for the correct model)

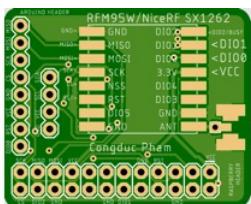
- The NiceRF SX1262, NiceRF SX1268 and NiceRF SX1280 LoRa modules from NiceRF embed the newest LoRa SX1262 (868MHz), SX1268 (433MHz) and SX1280 (2.4GHz) chips from Semtech. They have the same footprint than the RFM95W so same PCB breakout can be used with little modifications



NiceRF SX1262

SX1262: <https://fr.aliexpress.com/item/32959012033.html>SX1280: <https://fr.aliexpress.com/item/32946774361.html>**UPPA PCBs**

Old RFM95W breakout



RFM95W/NiceRF SX1262 breakout



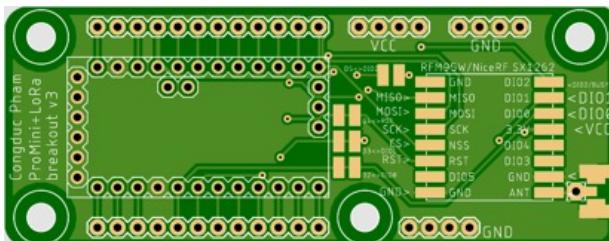
NiceRF SX1280 breakout



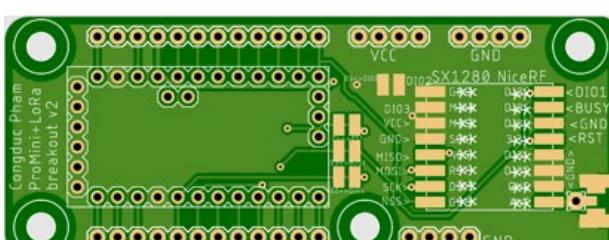
RFM95W, SX1276



NiceRF SX1262

NiceRF SX1280
LoRa 2.4GHzProMini LoRa RFM95W
can work with NiceRF SX1262

RFM95W, SX1276 NiceRF SX1262



ProMini LoRa NiceRF SX1280

NiceRF SX1280
LoRa 2.4GHz

PCBs from UPPA:

<https://github.com/CongducPham/LowCostLoRaGw/tree/master/PCBs>

<https://github.com/CongducPham/PRIMA-Intel-Irris/tree/main/PCBs>

Displays

- 0.96" small OLED displays

<https://fr.aliexpress.com/item/32920071528.html>



Antenna and related components

- Simple whip (monopole) antenna for both devices and gateway

433MHz -

5dBi <https://fr.aliexpress.com/item/32806809309.html>

3dBi <https://fr.aliexpress.com/item/32963197821.html>

868MHz -

5dBi <https://fr.aliexpress.com/item/32921480326.html>

3dBi <https://fr.aliexpress.com/item/32964912902.html>



- Specific antennas for gateway

Ground plane, $\frac{1}{2}$ wave dipole (e.g. sleeve dipole, center-fed), or fiberglass antennas are best choice for the gateway if you need a cable extension to put the antenna outdoor.

<https://fr.aliexpress.com/item/32801738509.html>



<https://www.lextronic.fr/antennes/507-antenne-868-mhz-ground-plane-pour-base.html>

- If the antenna must be placed on a higher position, you would need an extension coaxial cable. Take an RG58 cable, SMA male to SMA female.



<https://www.aliexpress.com/item/1005002733346503.html>

at the end of an extension cable, the simple 1/4 whip (~ monopole) antenna is not really suitable. A dipole antenna, or a compact sleeve dipole antenna is necessary (see <https://www.youtube.com/watch?v=wcho1gJ2xEQ>).

- SMA female PCB connector for 1.6mm PCB



<https://fr.aliexpress.com/item/32955045280.html>

- Pigtail RG316 SMA male to SMA female



<https://fr.aliexpress.com/item/1005002462162713.html>

- or this one to solder directly on the PCB board without the SMA female PCB connector



<https://fr.aliexpress.com/item/1005001475479079.html>

If you want to build your own antenna or adjust the length of the antenna cable, then you will need the following items.

- SMA connectors (for cable model RG58) for custom antenna cable.



SMA Female



SMA

Male

- Coax crimping tool (with RG58 format) and RG58 coax cable



SIMPLE PHYSICAL SENSOR FOR TEST AND DEMONSTRATION

- Soil moisture sensors: Capacitive Gravity SEN0193 (left) & Gravity SEN0308 (middle), water tension Irrrometer Watermark (right)



WIRES, CASING, AND VARIOUS ADDITIONAL PARTS

- Breadboard/Dupont cables: need both M-F and F-F



take those that are about 10cm to 20cm maximum.

- Water-proof cases: electric out-door cases for instance



from <https://www.polycase.com/> or <https://www.gotronic.fr/art-boitier-abs-etanche-g304m-17977.htm> or any water-proof casing you can find suitable from your local hardware/electric stores.

- You may need your own cable gland to have a real customized case



we take PG7 size for device case

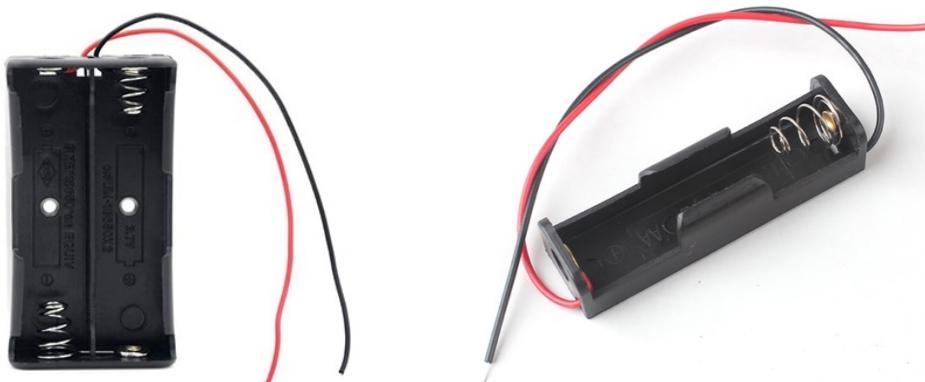
<https://fr.aliexpress.com/item/10000132999214.html>

- Some standoffs/spacer and associated screws for the gateway



take 10mm to 20mm maximum

2-AA battery couplers for the IoT device, or 1-AA slot one for 3.6V



2xAA: <https://fr.aliexpress.com/item/4001008150456.html>

- Small waterproof toggle switch



MTS-102, ON-ON switch

<https://fr.aliexpress.com/item/33022608497.html>

however, it more convenient to get those with the wired already attached.



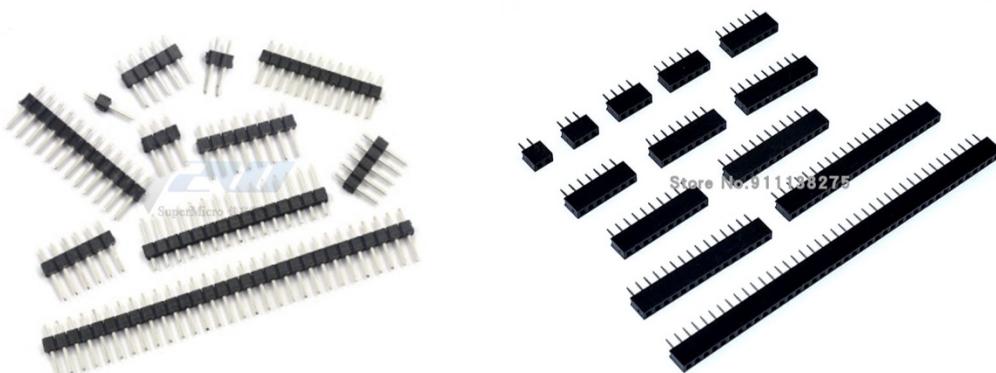
<https://fr.aliexpress.com/item/4000286754686.html> and buy the waterproof cap separately:
<https://fr.aliexpress.com/item/33022608497.html>

There is another provider of pre-wired waterproof small switch but it is a bit more expensive.



<https://www.superbrightleds.com/moreinfo/rocker-pushbutton-remote-switches/mini-onoff-toggle-switch-wired/1356/3109/>

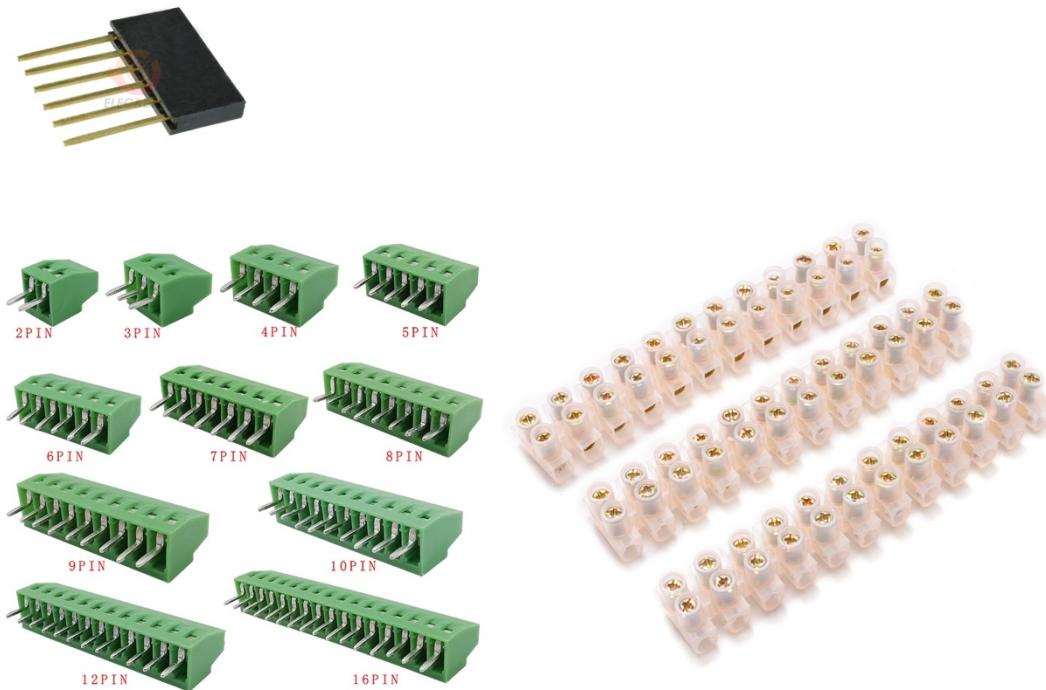
Various 2.54mm pin headers (male, female), 2.54mm screw terminal, screw block connection strips



Female header pin: <https://fr.aliexpress.com/item/32970948352.html>

The most used female header is the 12-pins.

It is also useful to have female header with longer pins such as these ones: <https://fr.aliexpress.com/item/4001351715019.html>



Screw terminal: <https://fr.aliexpress.com/item/4000867583795.html>

SOLDERING MATERIALS THAT ARE NOT MANDATORY BUT ARE ALWAYS GOOD TO HAVE!

- A simple soldering iron with thin solder wire



- or a good soldering station if you want to invest, much recommended



<https://fr.aliexpress.com/item/4000845052069.html>

- A set of heat-shrink tubes to isolate wires / silicon for joints



(*) provided web links to some vendors are only given as example.
You can search from other vendor to optimize cost.

4. ANNEX

- <https://pc-industriel.anteor.com/pc-durcis/575-pc-modulaire-compact-mb1-10ap.html>
- <https://www.giga-concept.fr/produit/antenne-868-mhz-iot-lpwa-ism-omnidirectionnelle-mat-murale-3dbi/>