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# ATIM Cloud Wireless

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## Digital temperature sensor with contact probe TM1D-HP

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### User Guide



Concerned models :

ACW/LW8-TM1D-HP  
ACW/LW8-TM1D-HP-5  
ACW/SF8-TM1D-HP  
ACW/SF8-TM1D-HP-5



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## Document version history

Version	Date	Description	Author
0.1	12/11/2015	Created document	YL
0.2	25/11/2015	Created overview	YL
0.3	18/05/2016	Added network	YL
0.4	02/06/2016	Corrections	YL
0.5	10/06/2016	Corrections	YL
0.6	12/12/2017	Added downlink and energy saver mode	CB
0.7	23/01/2018	Update visuals for labels / Sigfox / ACW config	YM
1.0	26/03/2018	Error codes addition + startup sequences precision + decoding examples of received frames	CB
1.1	24/10/2019	Upgrade from TM2D to TM2D-HP (batteries modification + PCB unit visual + USB port)	ER
1.2	09/01/2020	Corrections	MD

## Disclaimer

The information contained in this document is subject to change without warning and does not represent a commitment on the part of ATIM radiocommunications. ATIM radiocommunications provides this document 'as-is' with no warranty of any kind, express or implied, including but not limited to implied warranties of merchantability or fitness for a particular purpose. ATIM radiocommunications may make changes and/or improvements to this manual or to the product(s) or program(s) described in this manual, at any time.

## Trademarks and copyright

ATIM radiocommunications®, ACW ATIM Cloud Wireless® and ARM Advanced Radio Modem® are registered trademarks of ATIM SARL in France. The other trademarks mentioned in this document are the property of their respective owners.

## Declaration of compliance

All ACW Atim Cloud Wireless® products comply with the regulatory requirements of the R&TTE Directive (1999/5/EC), article 3:



### **1 SAFETY** (Article 3.1a of the 1999/5/EC Directive)

NF EN60950-1 Ed. 2006/A1:2010/A11:2009/A12:2011 (health)

EN62479: 2010 (power <20mW) or EN62311:2008 (power > 20mW)

### **2 Electromagnetic compatibility** (Article 3.1b of the 1999/5/EC Directive)

EN 301489-3 v1.4.1, EN 301489-1 V1.9.2

### **3 Efficient use of the radio frequency spectrum** (Art.3.2 of the 1999/5/EC Directive)

ETSI EN300 220-2 v2.4.1 and EN300 220-1 v2.4.1

## Environmental recommendations

### **a. Explosive atmosphere**

Except for the ACW-ATEX line specifically intended for this purpose, do not use ACW radio modems in the presence of flammable gases or fumes. Using the equipment in such an environment constitutes a safety hazard.

### **b. Environment**

Respect the temperature ranges for storage and operation of all products. Failing to respect these guidelines could disrupt device operation or damage the equipment. ACW products in IP65 water- and dust-resistant housings may be placed outdoors but must not be submerged under any circumstances.

Follow the instructions and warnings provided below to ensure your own safety and that of the environment and to protect your device from any potential damage.



**General hazard** – Failure to follow the instructions presents a risk of equipment damage.



**Electrical hazard** – Failure to follow the instructions presents a risk of electrocution and physical injury.



Direct-current symbol



**WARNING:** do not install this equipment near any source of heat or any source of humidity.



**WARNING:** for your safety, it is essential that this equipment be switched off and disconnected from mains power before carrying out any technical operation on it.



**WARNING:** the safe operation of this product is ensured only when it is operated in accordance with its intended use. Maintenance may only be performed by qualified personnel.



Waste disposal by users in private households within the European Union. This symbol appears on a product or its packaging to indicate that the product may not be discarded with another household waste. Rather, it is your responsibility to dispose of this product by bringing it to a designated collection point for the recycling of electrical and electronic devices. Collection and recycling waste separately at the time you dispose of it helps to conserve natural resources and ensure a recycling process that respects human health and the environment. For more information on the recycling center closest to your home, contact your closest local government office, your local waste management service or the business from which you purchased the product.



### c. Radio

Modems in the ACW line are radio-communication modems that use the ISM (industrial, scientific and medical) bands, which may be used freely (at no cost and with no authorization required) for industrial, scientific and medical applications.

## Technical specifications

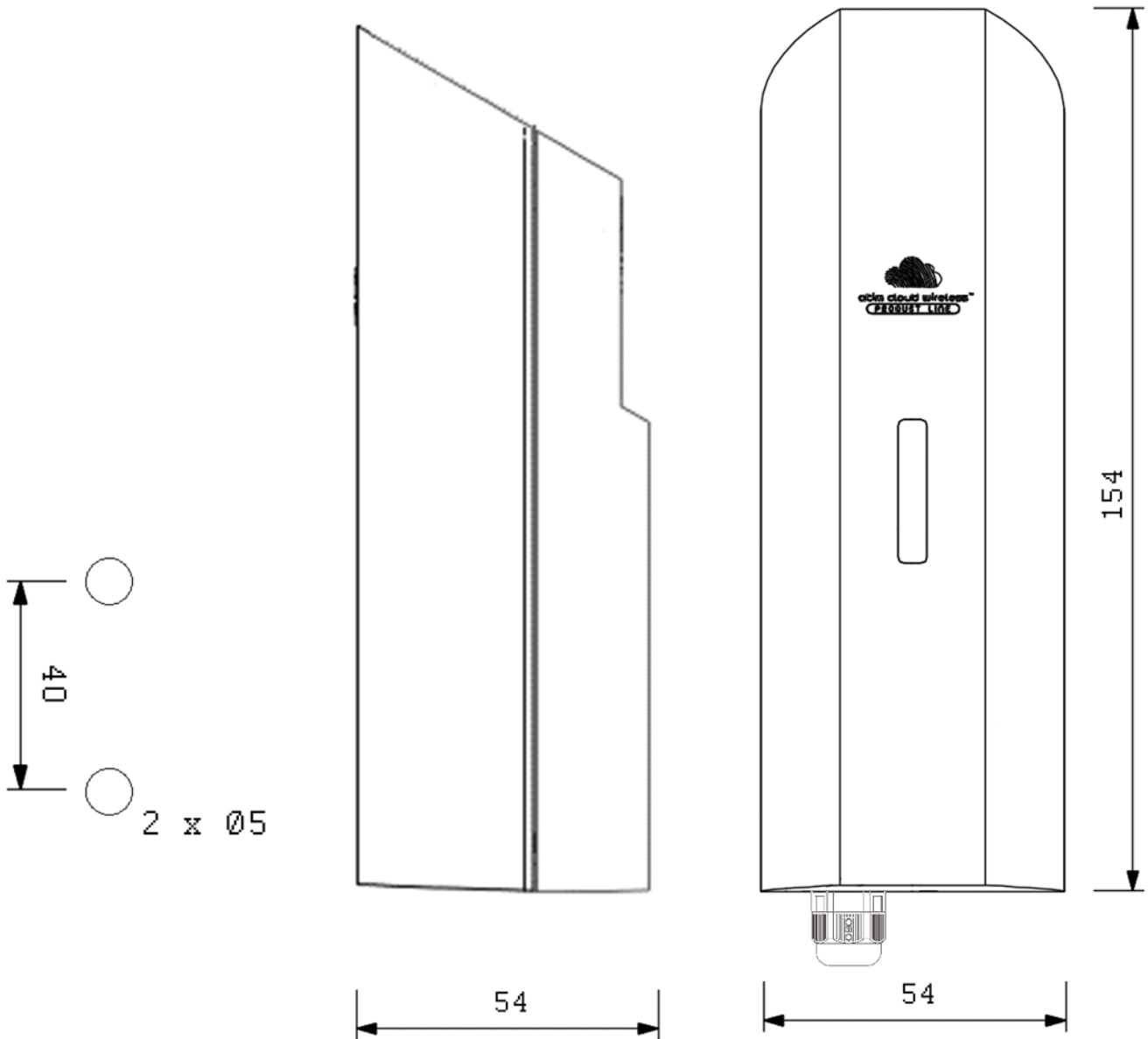
Dimensions	160 x 53 x 53 mm	
Antenna	Integrated (¼ wave)	
Temperature probe	Digital – Cable length: 2 m	
Temperature	-20°C to +55°C (operation) -40°C to +70°C (storage)	
Mounts to	Wall, tube or pole, DIN rail	
Housing	IP65	
Power supply	2x battery-packs (14,4 Ah)	
Weight	210 g	
Frequency	865 – 870 MHz	
Power	25 mW (14 dBm)	
Transfer rate	Sigfox: 100 bps LoRaWAN: 300 bit/s to 10 kbit/s	
Current draw	Sigfox*:	LoRaWAN:
Tx mode	60 mA	50 mA
Standby mode	7 µA	7 µA
Rx mode	35 mA	18 mA

\* Note that the ACW-TM1D modem is certified class U0 by Sigfox.

Temperature	Range	-55°C   +125°C
	Resolution	0.5°C (9 bits)
	Precision from -10°C to +85°C	+/- 0.5°C
	Precision from -55°C to -10°C Precision from +85°C to +125°C	+/- 2°C

# Housing

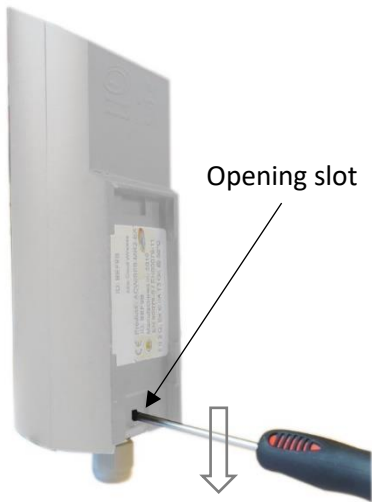
## a. Space requirements



Maximum cable diameter through cable gland: 7 mm



### b. Opening the ACW housing



The housing must be opened to access both the terminal block and the mini-USB port used to configure the module.

To do this, insert a screwdriver into the slot and tilt it downward to lift the inside tab (see photo). Then pull on the back panel to separate the two parts of the housing.

### c. Mounting to a support

ACW modems can be mounted on a flat wall, a tube or pole or a DIN rail, depending on the type of installation you require.

These three types of support frames attach to the rear of the housing.

Mounting on a flat wall (provided):



Installation on a tube:



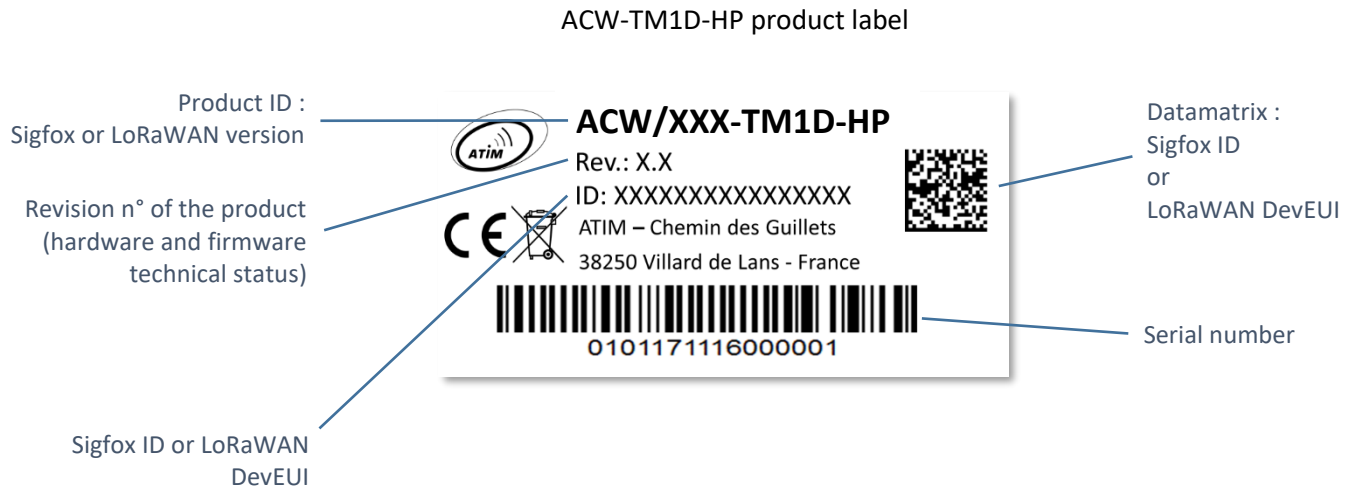
Mounting on a DIN rail:



#### d. Identification

The Sigfox or LoRaWAN product identifier is visible on the exterior label on the back of the device, on the electronic card inside and in the status bar in the ACW configuration tool.

For LoRaWAN modems, the communication keys are automatically provided by the network (pairing via 'Over The Air Activation', or OTAA).



Each ATIM ACW product line has a QR Code label visible either on the side or on the front of the product.

This QR code can be easily read with any 2D barcode reader application on a smartphone.

QR Code label of an ACW-TM1D-HP:



Reading this code indicates the following information:

ATIM|ACW/XXX-TM1D-HP|X.X|190114|1|3.0|5.11|XXXXXXXXXXXXXXXXXX

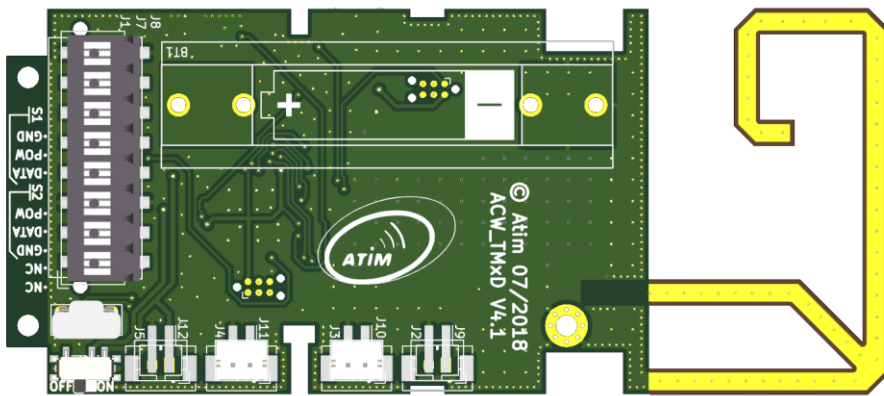
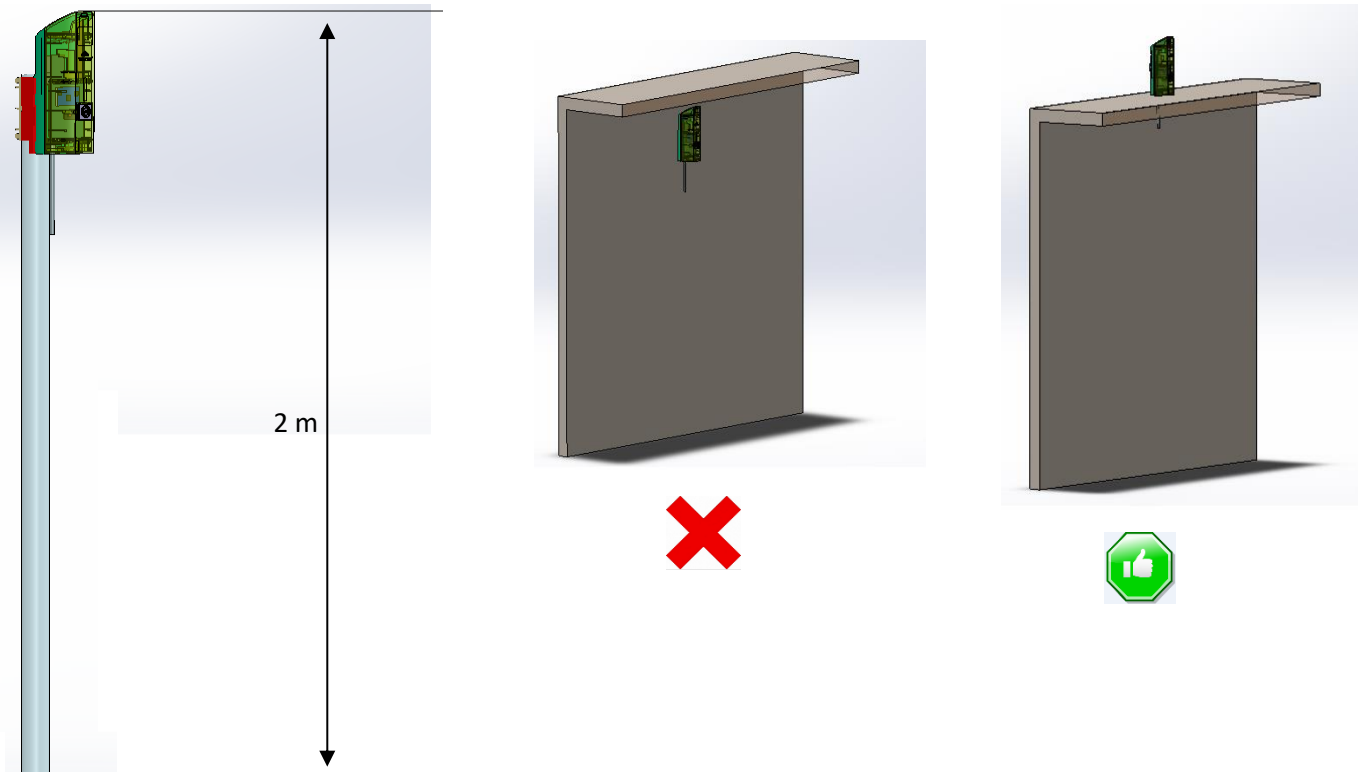
Interpretation:

ATIM	ACW/XXX-TM1D-HP	X.X	190114	1	3.0	5.11	XXXXXXXXXXXXXXXXXX
Manufacturer name	Device reference	Revision version	Date of manufacture	Site of manufacture	Hardware version	Application firmware version	Sigfox ID or LoRaWAN DevEUI

### e. Placement and installation

Install the modem at least 2 m above the ground and not right against the wall — ideally at least 20 cm away. The cables must be no longer than 10 m and must be shielded.

For optimal results, we recommend that you place it high up and at least 1 metre away from all metallic objects if possible (see diagrams below). Note that the antenna is integrated into the housing.



To power on the product, set the switch to the ON position.

## Operation

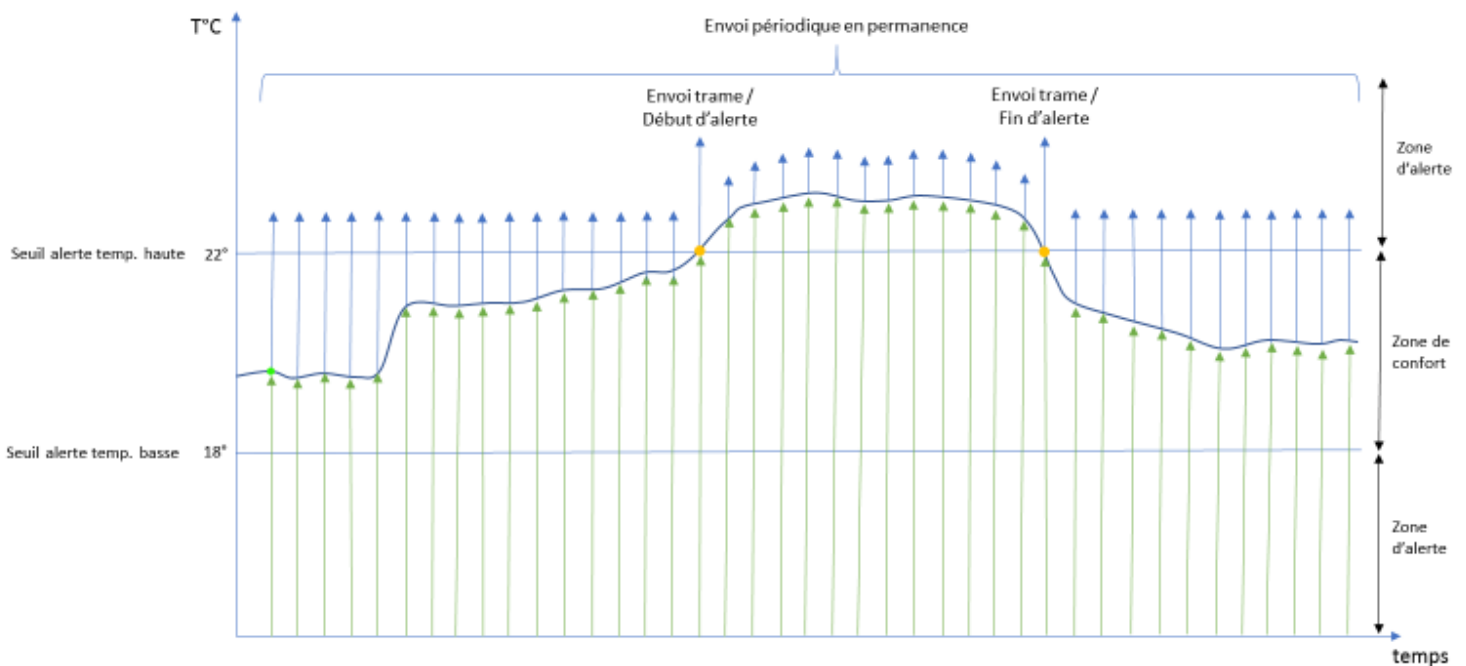
The ACW-TM1D measures temperature at time 't' and sends the data by radio on the associated Sigfox or LoRaWAN network, depending on which model you use.

Two modes of operation are available: Periodic or Energy Saver.

### a. Periodic mode (shown as 'Periodical' in the configuration tool)

To ensure the most complete telemetry possible, temperature readings are sent on a regular and periodic basis. This makes it possible to obtain a very precise monitoring curve. In this mode, each reading is sent out by the ACW-TM1D. In other words, the sampling period is equal to the statement period (= interval at which readings are sent out). This sampling and statement period is user-configurable, with a minimum value of 10 minutes.

Example of operation in Periodic mode:



On the other hand, because this mode involves regular (and potentially very frequent) radio transmissions, this mode of operation may consume large amounts of energy, leading to reduced battery life.

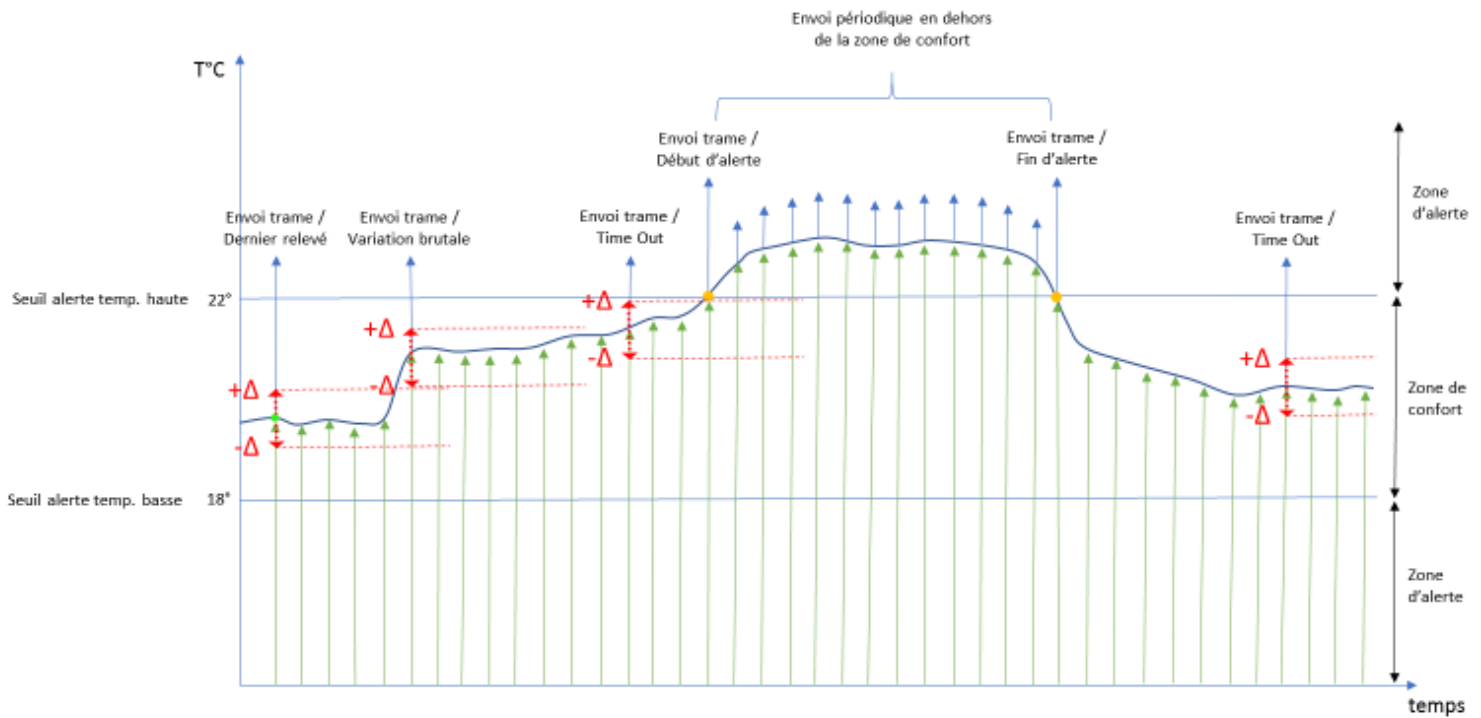
## b. Energy Saver mode

This mode of operation aims to minimize energy consumption and maximize battery life.

This mode can be configured to send out frames only under certain conditions:

- If temperature readings are stable: a frame is sent out only after a specified period has elapsed (timeout).
- If the temperature variation (in °C) between two consecutive readings is larger than the maximum value specified by the user.
- If an alert threshold is crossed: a frame is sent out when the temperature

Example of operation in Energy Saver mode:



### Phases of operation:

- from 0 to 3 sec: general initialization + USB initialization.
- from 3 to 4 sec: radio initialization.
- from 1 min to 5 min: send out a test frame once per minute.
- at 6 min: send out a keep-alive frame (battery information).
- at 7 min: send out a temperature frame.

Mode of operation (periodic or energy saver) specified by user

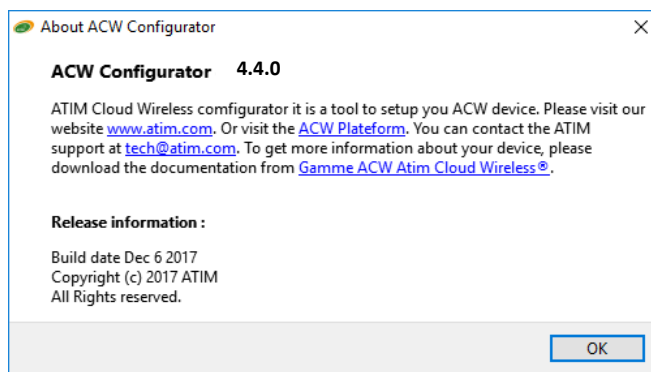
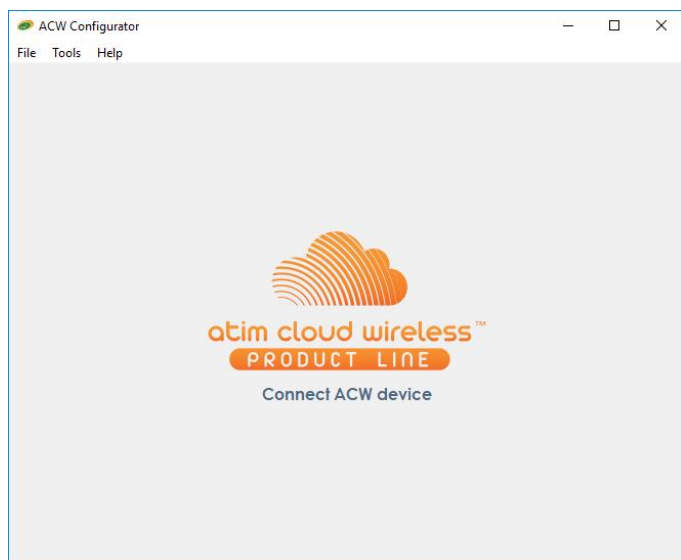
# ACW configuration tool

a. What version of the ACW configuration tool should you use?

For a TM1D with application software version:	Use ACW configuration tool version:
Sigfox: v5.1 or earlier LoRaWAN: v5.3 or earlier	V3.7.15
Sigfox: v7.1 or earlier LoRaWAN: v7.1 or earlier	V4.4.0

Download and install the configuration tool 'setupACW.exe' at:

<https://www.atim.com/download/7887/>



When the ACW Configuration Tool is started, the stand-by window appears on the screen.

Click 'Help' at the top left of the window, then click 'About' to view the version number of the ACW Configuration Tool.

Then open the plastic case of your ACW-TM1D-HP module and connect it to your computer with a micro-USB cable.

The product restarts when the USB cable is connected to communicate with the ACW Configurator on your PC. By disconnecting the USB cable, the product enters its normal operating phase and ends its start phase previously started.

## b. Configuring the LoRaWAN network pairing mode:

*Applies only to ACW/LW8-TM1D-HP version.*

On LoRaWAN networks, there are two pairing methods by which a module can connect to the network.

**OTAA (Over The Air Activation):**

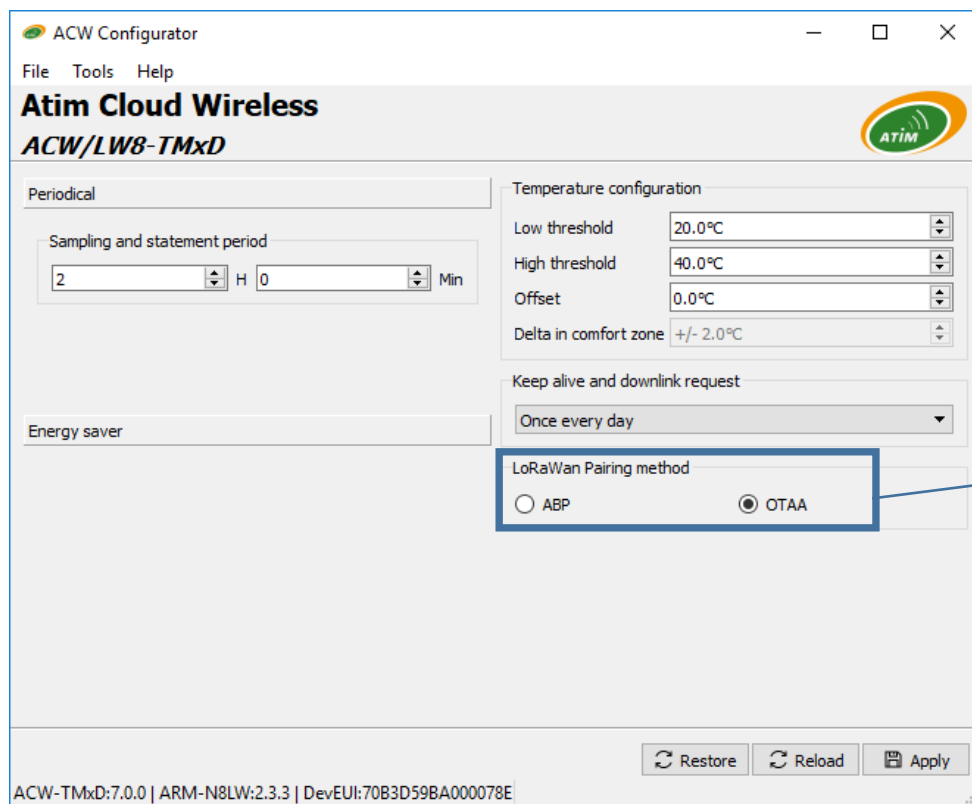
In this mode, the communication keys are assigned and transmitted over the network every time the module starts up or requests a connection. This is the mode that is configured by default.

**ABP (Activation By Personalization):**

In this mode, the communication keys used are the ones loaded on the module at the factory. Every time the module starts up, these same keys are used.

When you connect the ACW/LW8-TM1D-HP via USB, the ACW configuration tool automatically detects the module's factory settings and displays them in the following window:

The default factory setting uses the OTAA mode.



Select LoRaWAN network pairing method



c. Configuring the Energy Saver mode:

The screenshot shows the ACW Configurator window for 'Atim Cloud Wireless ACW/LW8-TMxD'. The interface is divided into several sections:

- Mode Selection:** A dropdown menu is set to 'Energy saver' (with 'Periodical' also visible).
- Temperature Configuration:**
  - Low threshold: 20.0°C
  - High threshold: 40.0°C
  - Offset: 0.0°C
  - Delta in comfort zone: +/- 2.0°C
- Sampling and Statement Periods:**
  - Sampling period: 0 H 10 Min
  - Statement period: Outside comfort zone: 2 H 0 Min; Inside comfort zone: 8h
- Keep alive and downlink request:** Set to 'Once every day'.
- LoRaWAN Pairing method:** Radio buttons for 'ABP' and 'OTAA' (selected).

At the bottom, a status bar displays: 'ACW-TMxD:7.0.0 | ARM-N8LW:2.3.3 | DevEUI:70B3D59BA000078E'. Below this are three buttons: 'Restore', 'Reload', and 'Apply'.

Callouts from the left side of the image point to the following elements:

- Select mode of operation
- Temperature sampling period
- Frequency of transmission to network
- Select keep-alive frame frequency

Callouts from the right side of the image point to the following elements:

- Lower threshold
- Upper threshold
- Offset applied to each reading and to the displayed value
- Difference in °C (vs. last reading sent) If outside range, send an alert.

Callouts from the bottom of the image point to the following elements:

- ACW-TM1D firmware version
- Radio module firmware version
- Network ID
- Restore the ACW's default configuration
- Reload the ACW's current configuration
- Apply settings

#### d. Configuring periodic mode:

The screenshot shows the ACW Configurator window with the following settings:

- Mode of operation:** Periodical
- Sampling and statement period:** 2 H 0 Min
- Temperature configuration:**
  - Low threshold: 20.0°C
  - High threshold: 40.0°C
  - Offset: 0.0°C
  - Delta in comfort zone: +/- 2.0°C
- Keep alive and downlink request:** Once every day
- LoRaWan Pairing method:** OTAA (selected)

Buttons at the bottom: Restore, Reload, Apply.

Footer text: ACW-TMxD:7.0.0 | ARM-N8LW:2.3.3 | DevEUI:70B3D59BA000078E

Select mode of operation

Temperature sampling + statement period

Lower threshold

Upper threshold

Offset (applied to each reading and to the displayed value)



Once the configuration is complete, do not leave the module connected via USB. This mode of operation is very energy intensive. When you remove the USB connection without removing the battery, the module re-initializes itself and automatically returns to normal operation.

#### e. Factory settings

When it leaves the factory, the TM1D is configured as follows:

- Periodic mode selected by default

Parameters shared by Periodic and Energy Saver modes:

- LoRaWAN pairing: OTAA
- Keep-alive frame sent 1x / day
- Temperature offset: 0°C
- Lower threshold: 20°C
- Upper threshold: 40°C

Parameter for periodic mode:

- Sampling and statement period: 2 hours

Parameters for Energy Saver mode:

- Delta: +/- 2°C
- Sampling period in comfort zone: 2 hours (alert frame sent out if delta value is exceeded or if upper or lower threshold is crossed)
- Statement period when temperature is stable within comfort zone: 8 hours
- Sampling and statement period outside comfort zone: 2 hours

# Uplink frame formats

## a. Sigfox and LoRaWAN

The data are different depending on the type of frame sent out. The frames specific to the ACW-TM1D use the following format:

Description	Frame format					
	oct 0 (dec)	oct 0 (hex)	oct1	oct2	oct3	oct4
Keep-alive frame	1	0x01	Supply IDLE voltage		Supply Tx voltage	
Test frame	5	0x05	Test counter			
Period temperature reading frame	27	0x1B	Digital temperature 1w - sensor 1			
Lower threshold was crossed	42	0x2A	Digital temperature 1w - sensor 1			
Upper threshold was crossed	44	0x2C	Digital temperature 1w - sensor 1			

The temperature is calculated with the following formula: Digital temperature 1w \* 0.0625

**BEWARE:** A temperature value equals to « 0x8000 » indicates a measuring error. This is often due to a loose cable.

## b. Example

Example of frame received: (hex) 2C0348

'Frame type' = (hex) 2C = 44 => 'Higher threshold was crossed'

'Digital temperature 1w - sensor 1' = (hex) 0348 = 840 => 'Actual temperature' = 840\*0.0625 = 52.5°C

Example of frame received: (hex) 2AFDD0

'Frame type' = (hex) 2A = 42 => 'Lower threshold was crossed'

'Digital temperature 1w - sensor 1' = (hex) FDD0 = -560 => 'Actual temperature' = -560\*0.0625 = -35°C

## c. Startup sequence:

At startup, the TM1D transmits 5 frames spaced one minute apart, with a test counter 0x0501, 0x0502, up to 0x0505.

6th frame transmitted is a keep alive frame.

The 7th frame is an application frame containing a temperature and the header 0x1B. This contains the temperature, but no information on its relative position toward thresholds.

Then the application frames will have the headers 0x1B, 0x2A or 0x2C.

## Downlink

This feature is available on ACW-TM1D models that meet the following conditions:

	Application software:	Radio firmware:
SIGFOX version	V7.10 or higher	v5931 or higher
LoRaWAN version	V7.10 or higher	v2.3.3 or higher

The USB configuration of these products requires an ACW configuration tool of version **4.4.0** or higher. The document ATIM\_ACW-DLConfig explains how the downlink works and is available at the below link: <https://www.atim.com/download/8182/>

The parameters specific to ACW-TM1D-HP models are:

### a. Keep-alive frame frequency

Parameter code (Byte 1)	Parameter value (Byte 2)
<b>0x03,</b>	0x00 = Deactivated, 0x04 = every 10 min, 0x05 = every hour, 0x0A = every 2 hours, 0x0B = every 4 hours, 0x0C = every 8 hours, 0x06 = every day, 0x0D = every 2 days, 0x0E = every 3 days, 0x0F = every 4 days, 0x07 = every week (7 days), 0x08 = every month (30 days).

### b. Mode of operation

Parameter code (Byte 1)	Parameter value (Byte 2)
<b>0x0A</b>	0x00 = Periodic, 0x01 = Energy Saver.

### c. Lower threshold

Parameter code (Byte 1)	Parameter value (Byte 2)	Parameter value (Byte 3)
<b>0x0B</b>	0xYY	0xZZ

For a threshold in °C with a precision in sixteenths of a degree °C, 0xYY and 0xZZ are calculated as follows:

$$0xZZYY = \frac{threshold \times 10000}{625}$$

The threshold must fall between -55.0°C and +125.0°C.

### d. Upper threshold

Parameter code (Byte 1)	Parameter value (Byte 2)	Parameter value (Byte 3)
<b>0x0C</b>	0xYY	0xZZ

For a threshold in °C with a precision in sixteenths of a degree °C, 0xYY and 0xZZ are calculated as follows:

$$0xZZYY = \frac{threshold \times 10000}{625}$$

The threshold must fall between -55.0°C and +125.0°C.

e. Temperature sampling period

Parameter code (Byte 1)	Parameter value (Byte 2)	Parameter value (Byte 3)
0x0D	0xYY	0xZZ

The sampling period will be every 0xZZYY minutes.

The minimum value is 10 minutes (0x0A00).

The maximum is 23 hr 59 min (0x9F50)

Example:

If 0xZZYY = 0x8200, the product will take a sample every 2 hours and 10 minutes.

f. Temperature offset

Parameter code (Byte 1)	Parameter value (Byte 2)
0x0E	0xYY (signed integer)

For an offset in °C with a precision in tenths of a degree °C, 0xYY is calculated as follows:

$$0xYY = offset \times 10$$

The offset must fall between -10.0°C and +10.0°C.

g. Pairing with LoRaWAN network

Parameter code (Byte 1)	Parameter value (Byte 2)
0x0F	0x00 = ABP 0x01 = OTAA

ABP: Activation By Personalization

OTAA: Over The Air Activation

h. Delta for comfort zone

Parameter code (Byte 1)	Parameter value (Byte 2)
0x10	0xYY

For a delta in °C with a precision in tenths of a degree °C, 0xYY is calculated as follows:

$$0xYY = delta \times 10$$

Delta must fall between +0.3°C and +10.0°C.

i. Statement period when outside the comfort zone

Parameter code (Byte 1)	Parameter value (Byte 2)	Parameter value (Byte 3)
0x11	0xYY	0xZZ

The statement period will be every 0xZZYY minutes.

The minimum value is 10 minutes (0x0A00).

The maximum is 23 hr 59 min (0x9F50)

Note that this period must be a multiple of the sampling period.

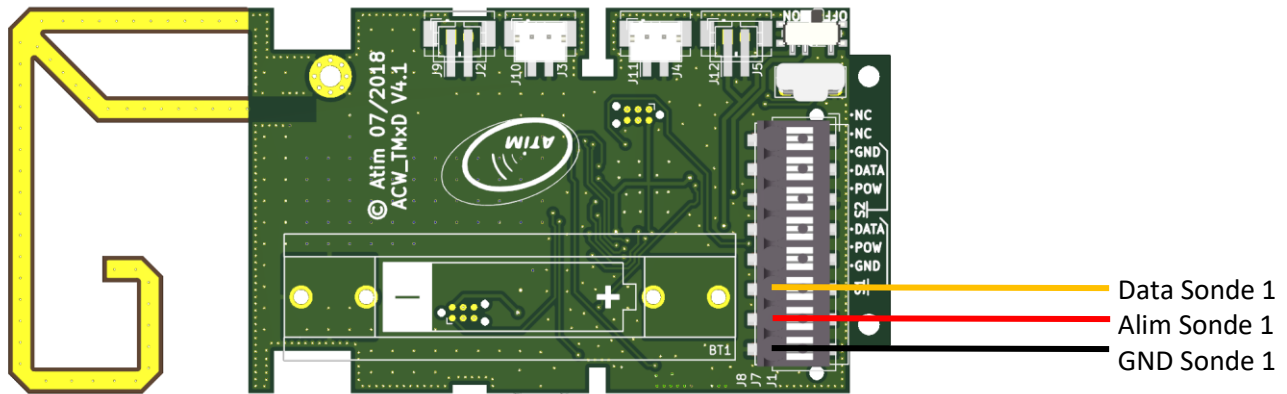
Example: If 0xZZYY = 0x8200, the product will send out a frame every 2 hours and 10 minutes, if it is in energy saver mode and it is outside the comfort zone.

j. Codes reserved for future developments:

Parameter code (Byte 1)	Parameter value (Byte 2)
0x12	0x08

**IMPORTANT: DO NOT CHANGE THESE VALUES**

## Connecting the modem



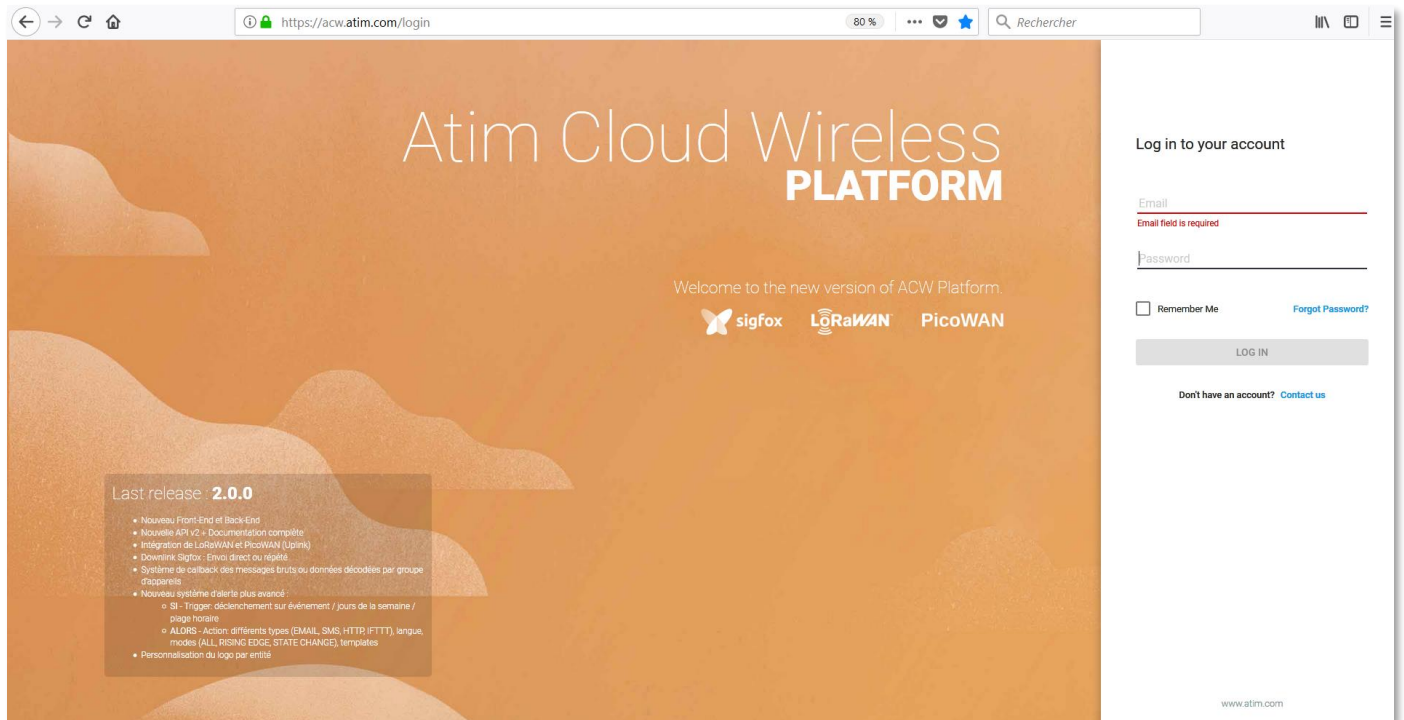
Number	Signals to be wired	Description
1	GND S1	Earth for probe 1
2	Power S1	Power for probe 1
3	Data S1	Data for probe 1
4	Nc	nc
5	nc	nc
6	nc	nc
7	nc	nc
8	nc	nc

The ACW-TM1D-HP modem is equipped with an external digital temperature probe.

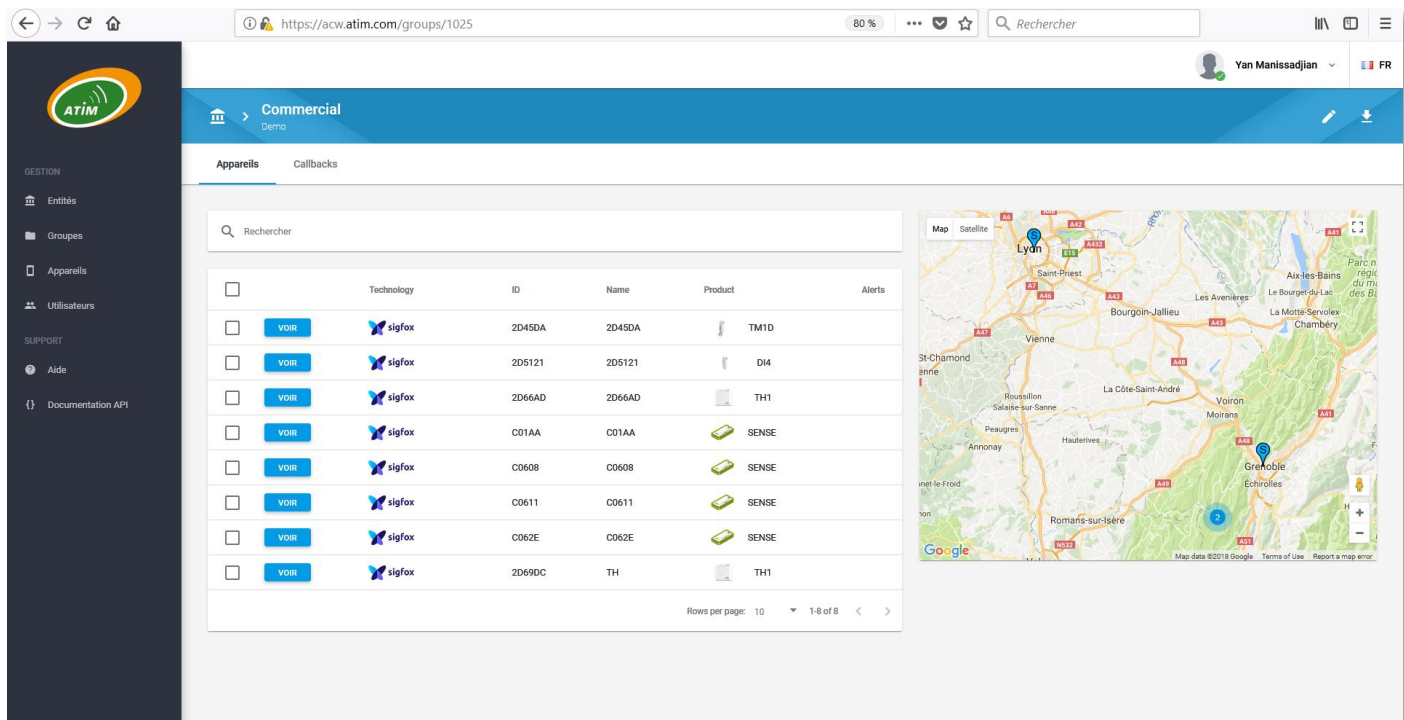
# Accessing data on the web (Sigfox and LoRa solutions)

## a. Viewing probes on the ACW platform

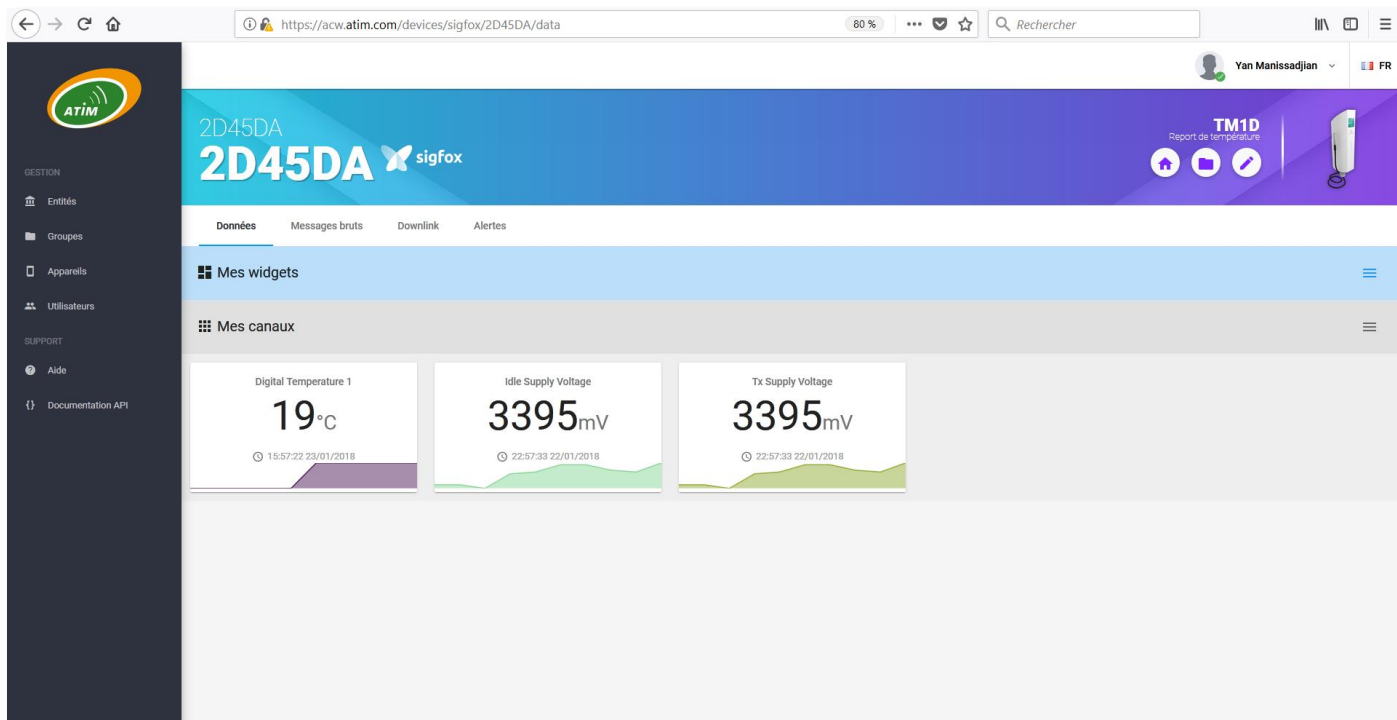
Connect to the Web platform at <http://acw.atim.com> to access all your devices and view your data. Your login credentials will be emailed to you when we send out your order.



The 'My Groups' page shows location data for all your devices after installation.



You will find all your temperature readings, as well as battery voltages on standby and when transmitting (if you requested that these information channels be displayed):



#### b. Registering the modem on the Sigfox network

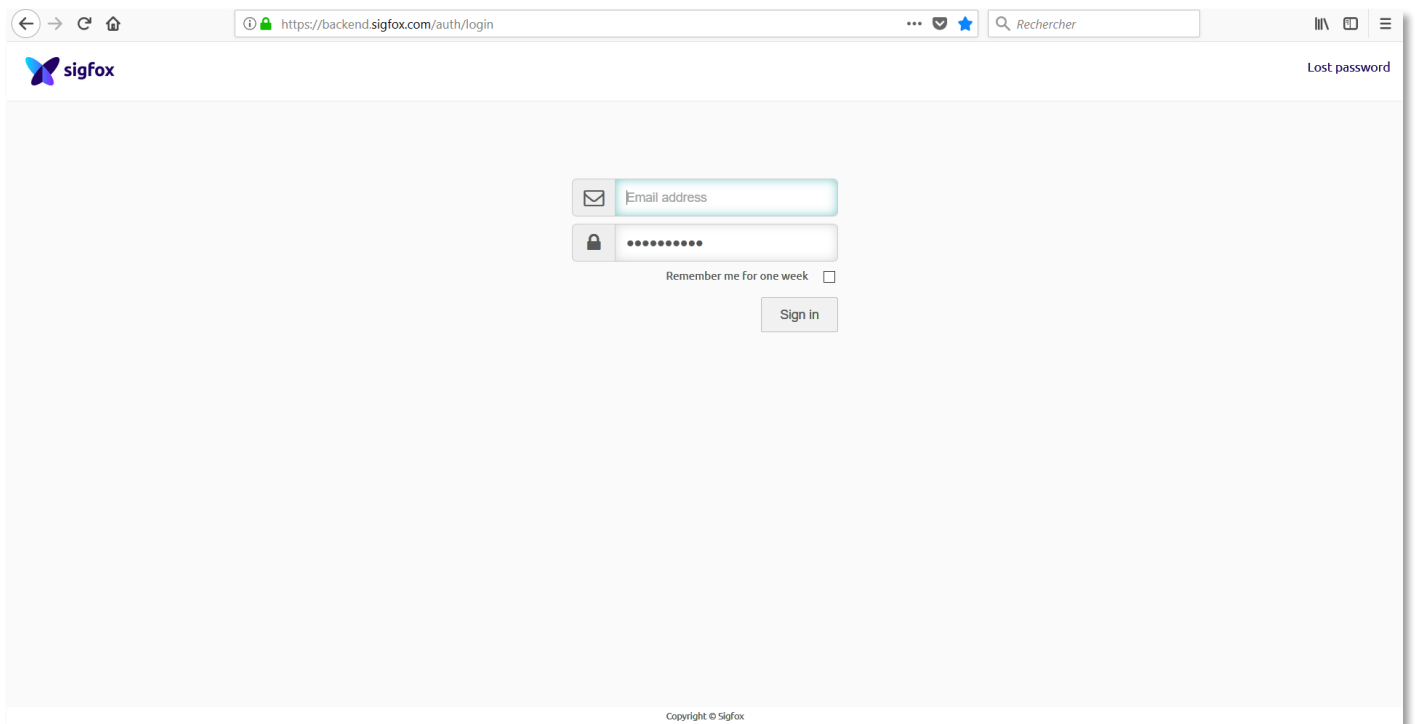
If you have signed up with ATIM for a subscription to the Sigfox network, we will take care of registering your modem/probe/sensor on the Sigfox network. However, if you have set up your subscription through Sigfox, you will need to register your device yourself through the Sigfox online portal.

Here is a fast procedure to register your product on the Sigfox network.

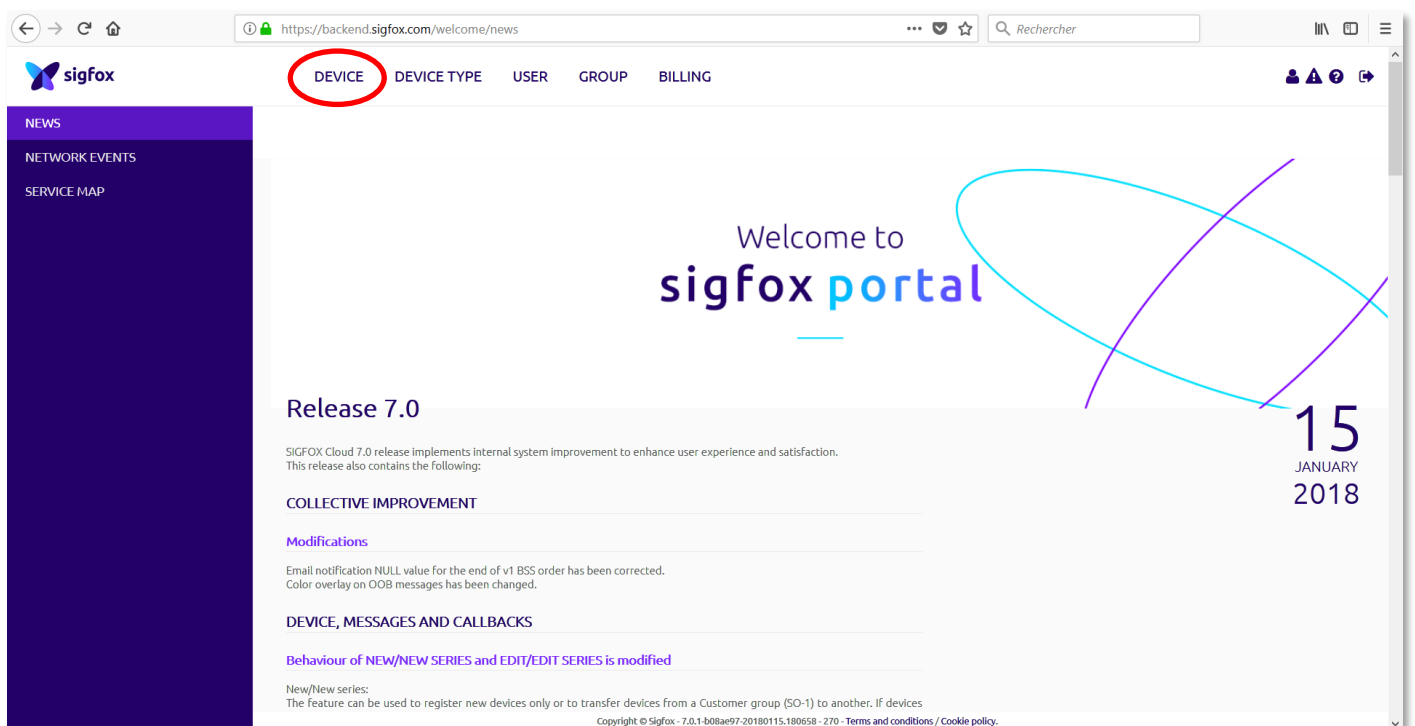
**For more details, contact Sigfox customer support directly.**



**Step 1:** Open a Web browser and go to <https://backend.sigfox.com>.  
Enter the login name and password you selected when you created your Sigfox customer account:



**Step 2:** Click 'Device' at the top left:



**Step 3:** On the screen with your list of devices, click 'New':

Device - List

Count: 16112 / 16112

Id	Name	Average Rssi	Average SNR	Device type	Last seen	Communication status
79B7A8	ACW0079B7A8	98.99	52.07	V2_ACW	2018-01-19 13:43:09	●
79B7A6	ACW0079B7A6	-134.24	18.83	V2_ACW	2018-01-19 13:54:16	●
79B7A5	ACW0079B7A5	120.33	30.68	V2_ACW	2018-01-19 13:50:47	●
79B7A4	ACW0079B7A4	105.50	45.52	V2_ACW	2018-01-19 07:52:08	●
79B7A2	ACW0079B7A2	-122.36	28.87	V2_ACW	2018-01-19 13:23:30	●
79B79B	ACW0079B79B	-120.81	30.25	V2_ACW	2018-01-19 13:31:51	●
79B79A	ACW0079B79A	-136.33	14.78	V2_ACW	2018-01-19 13:28:20	●
79B799	ACW0079B799	-113.61	37.37	V2_ACW	2018-01-19 10:56:10	●
79B798	ACW0079B798	-132.43	18.65	V2_ACW	2018-01-15 15:31:10	●

**Step 4:** Enter the required information about the new device that you want to register in your Sigfox account:

Device - New

Device information

Identifier (hexd) 0000

Name

PAC

End product certificate

Where can I find the end product certificate?

Type ACW - Demo

Lat (-90° to +90°) 0.0

Lng (-180° to +180°) 0.0

Map Locate on map

Ok Cancel

Sigfox identifier

Sigfox PAC code

Sigfox certificate number for your product (provided by ATIM)

Select the device type under which you want to register the device

Confirm the information by clicking "OK"

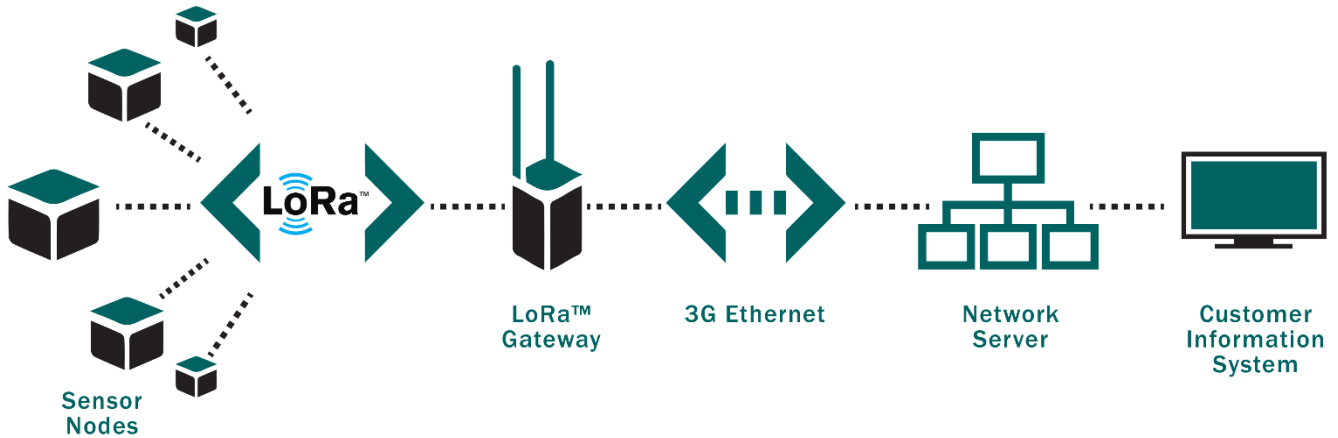
Your product is now being imported to your Sigfox account. The import may take several hours.

### c. Registering the modem on the LoRaWAN network

**IMPORTANT:** By default, ACW/LW8-TM1D uses the OTAA mode (Over-The-Air Activation) for network pairing. You can choose between ABP (Activation By Personalization) and OTAA from a dropdown menu in the configuration tool interface. We recommend that you use the simpler OTAA mode.

When configured in OTAA mode, the device sends out a join request for a LoRa network when it is switched on. The device must first be provisioned on the required network, with one of the national operators (such as Orange or Objenious in France) or on an existing private gateway.

A new join request may be sent by switching the device on again.



## Troubleshooting

The modem cannot be configured via USB or the configuration tool page does not refresh

- Check whether the power supply is correctly connected to the modem
- Check whether the blue light is flashing
- Make sure that Windows Update is activated, the PC is connected to the Internet and driver installation has completed. Also make sure that you have an up-to-date version of the configuration tool (File menu -> Update).
- Replace the USB cable
- If you receive an 'Error writing configuration', unplug the USB cable and plug it back in

Radio data not received

- Check whether the power supply is correctly connected to the modem
- Check whether the modem has been registered on the network
- Check whether radio network coverage is available
- Check whether the blue and green lights flash during transmission

Meter index does not increase

- Confirm that the wires to the meter are not inverted and that they are fully inserted into the terminal block
- Confirm that the sensor head uses the right dimensions for your use (litres, m<sup>3</sup>)
- Confirm that the meter's output does not exceed 5 V if using a push-pull output

Modem LED is not flashing

- Check whether the power supply is correctly connected to the modem
- Configure the modem using the USB configuration tool

## Technical support

For any information or technical problems, you can contact our technical support by e-mail and phone:

<https://www.atim.com/en/support-2/technical-support/>