

Atim Cloud Wireless

LTE-M analog sensor

User guide



Models concerned : ACW/LTEM-AN



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Version history for this document

Version	Date	Description	Author
1.0	23/02/2023	Creating the document	JA

Disclaimer

The information contained in this document is subject to change without notice and does not represent a commitment on the part of ATIM.

Trademarks and copyrights

ATIM, ACW ATIM Cloud Wireless®, ARM Advanced Radio Modem® are registered trademarks of ATIM Sarl en France. Other trademarks mentioned herein are the property of their respective owners.

Declaration of conformity

All ACW Atim Cloud Wireless® products comply with the regulatory requirements of R&TT Directive 1999/5/EC Article 3:



1 SECURITY (Article 3.1a of Directive 1999/5/EC)

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 Directive 1999/5/EC)

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

3 Efficient use of the radio-frequency spectrum (Article 3.2 of Directive 1999/5/EC)

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

Environmental recommendations

a) Explosive atmosphere

With the exception of the ACW-ATEX range intended for this purpose, do not use ACW radio modems in the presence of flammable gases and fumes. The use of equipment in this environment is a hazard

b) Environment

Respect the storage and operating temperature ranges of the products. Failure to follow these instructions could disrupt operation and even damage equipment.

Follow the precautions and instructions below to ensure your safety and that of your environment and to prevent any damage to your device.



General danger – If instructions are not followed, there is a risk of damage to equipment.



Electrical hazard – If instructions are not followed, there is a risk of electrocution and bodily harm.



WARNING : Do not install equipment near a heat source or near a moisture source.



WARNING : for your safety, it is imperative that before any technical intervention on the equipment it is turned off and not connected to the mains.



WARNING : Do not install equipment near a heat source or near a moisture source.



This symbol on the product or its packaging indicates that this product should not be disposed of with your other household waste. Instead, it is your responsibility to dispose of your waste by bringing it to a designated collection point for the recycling of electrical and electronic devices. Separate collection and recycling of your waste at disposal will help conserve natural resources and ensure recycling that respects the environment and human health. For more information about the nearest recycling centre to your home, contact the nearest town hall, the household waste disposal service or the shop where you bought the product.

Specifications

The LTE-M analog sensor is used to record the value of an analog probe.

The format of the measurement can be either 0-10V, 0-5V or 4-20mA (To be specified at the order).

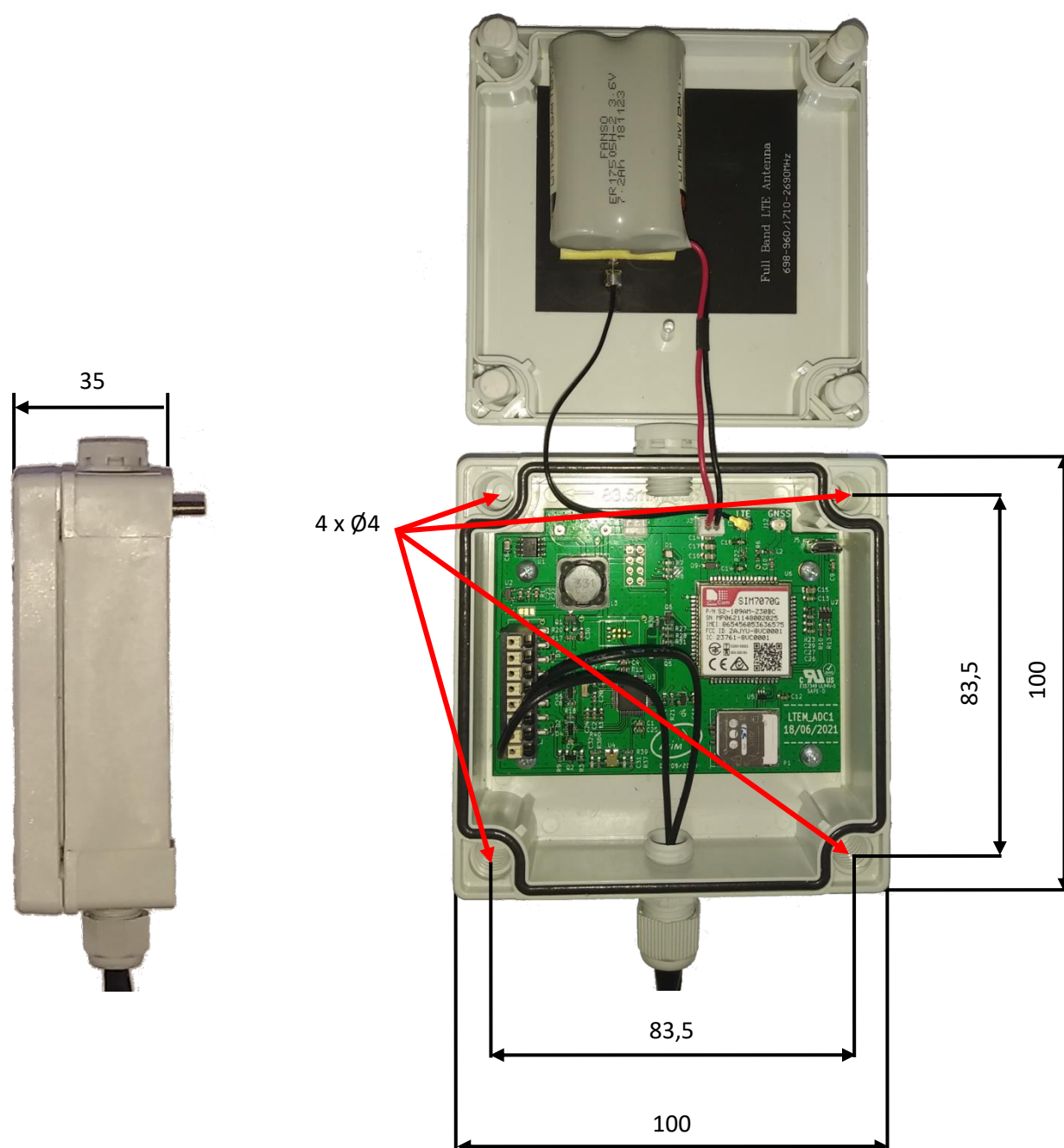
The power supply of the analog probe can be provided by the sensor up to 12V (To be specified at the control).

The sensor is energy autonomous (a battery is included) and sends level readings via the LTE-M network.

Size	100 x 100 x 35 mm
Antenna	Integrated (patch type)
Temperature	0°C to +50°C (Operating)
	0°C to +30°C (storage)
Fixation	Wall
Package	IP 66**
Feeding	2 x Lithium A batteries [ER18505M]
Weight	220 g
Frequency	800 – 1800 MHz
Power	21 dBm (Type Class 5)
Debit	LTE-M: 1Mbit bps
Transmission current	LTE-M: 400 mA max – 200 mA continuous
Sleep mode	Depending on the connected probe

* Standby power may vary depending on measurement period and sensor type

Dimensions and mounting



4 holes of diameter 4mm allow to fix the case of the sensor in wall lamp.

The orientation shown above (Anti-condensation filter upwards) must be respected when installing the sensor in order for optimal radio performance.

Product commissioning

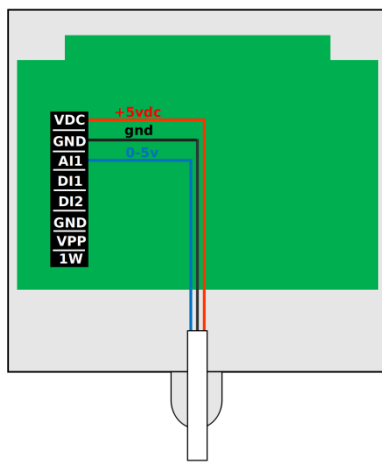
a) Connecting the analog probe

The analogue probe must be connected to the J2 terminal block of the electronic board.

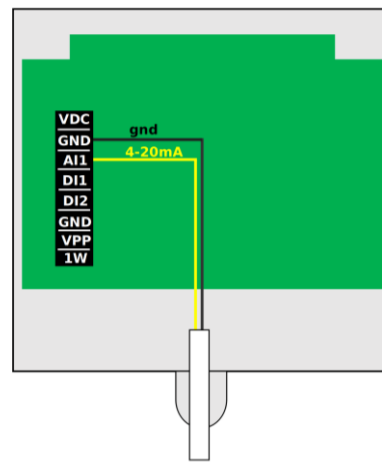
The probe cable must first be inserted into the box via the gland. Make sure that the cable passes to the left of the terminal block so as not to obstruct the passage of the battery when closing the case.

The gland is limited to a cable diameter between 3 and 7mm.

To maintain the IP rating of the product, care must be taken not to open and close the box several times. In addition, the 4 closing screws should be screwed with sufficient torque.



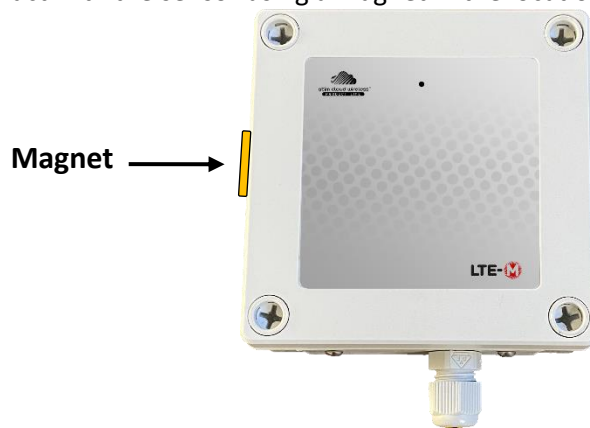
0-5V analog sensor - Powered



4-20mA analog sensor - Non-powered

a. Operating modes

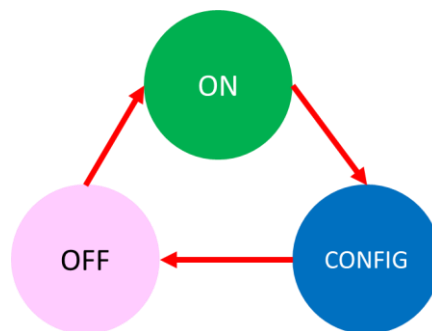
It is possible to interact with the sensor using a magnet in the location indicated by the product QR code:



To **find out the current mode** pass a magnet briefly (<2 sec):

- **OFF** mode: The sensor is off (default mode)
- **ON mode**: The sensor is activated and sends survey frames in MQTT
- **SETUP mode**: The sensor can be reconfigured to USB

To **change the mode** to hold a magnet (>2s), the mode then alternates according to the order defined below:



Once the mode has been changed, the sensor processes an associated function. The LED then remains on continuously while this function is processed, for example:

1. In **ON** mode the sensor starts sending a life frame followed by three survey frames
2. In **SETUP mode** the sensor is waiting for a USB connection (flashing blue LED)

When the sensor handles one of these functions, the LED remains lit and it is impossible to change modes.

b. Démarrage du produit

If the product is delivered without connectivity (no SIM card) or without access to the ACW wireless platform, it must be configured via USB before start-up (see **ACW LTE-M Configurator** section).

Once correctly configured, the product switches to **OFF** mode.

To switch it on, move the magnet until you see the **GREEN** LED (**ON** mode).

The sensor then attempts to connect to the LTE-M network and to the remote MQTT broker, to retrieve any configuration (MQTT subscribe) and to send a life frame (MQTT publish).

If the sensor manages to connect, the LED flashes and gives an indication of the strength of the signal received :

4 times **GREEN** if RSSI > -50dBm

4 times in **YELLOW** if RSSI is between -60dBm and -80dBm

4 times **ORANGE** if RSSI < -60dBm

Three frames of data are then sent every two minutes, and the sensor goes into standby mode until the next frame is sent.

If the sensor fails to connect, the LED flashes **RED** :

5 times if battery voltage is too low (below 3V)

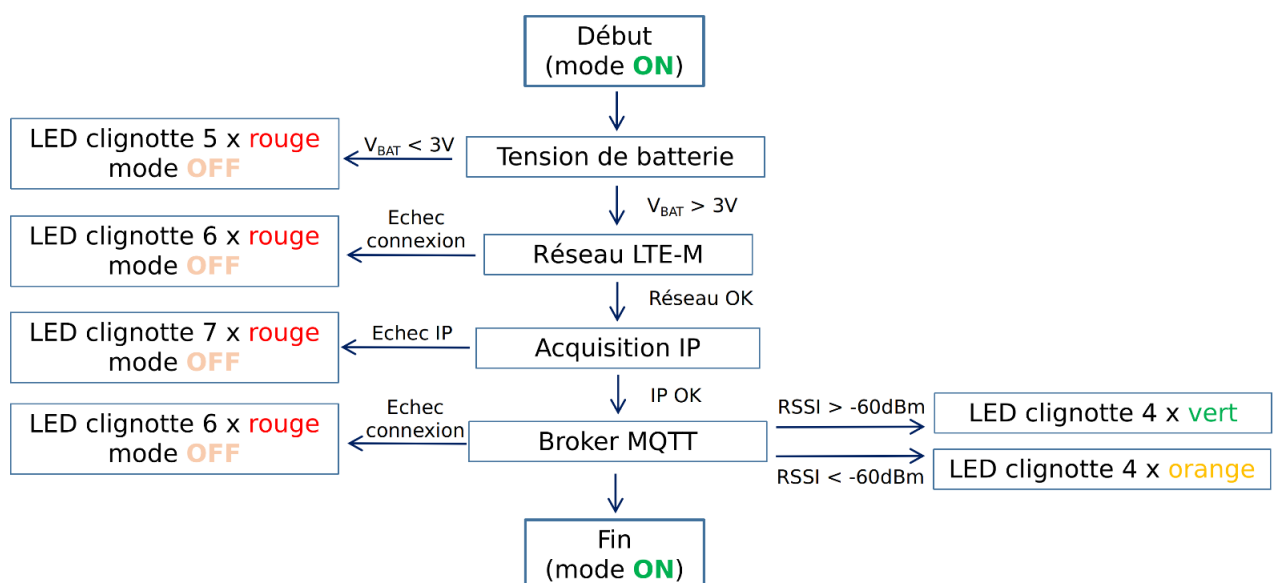
6 times if network connection is impossible

7 times if the sensor cannot obtain an IP address

8 times if the MQTT broker cannot be reached

In the event of an error, the start-up phase is considered incomplete, and the sensor automatically returns to **OFF** mode.

Start-up algorithm



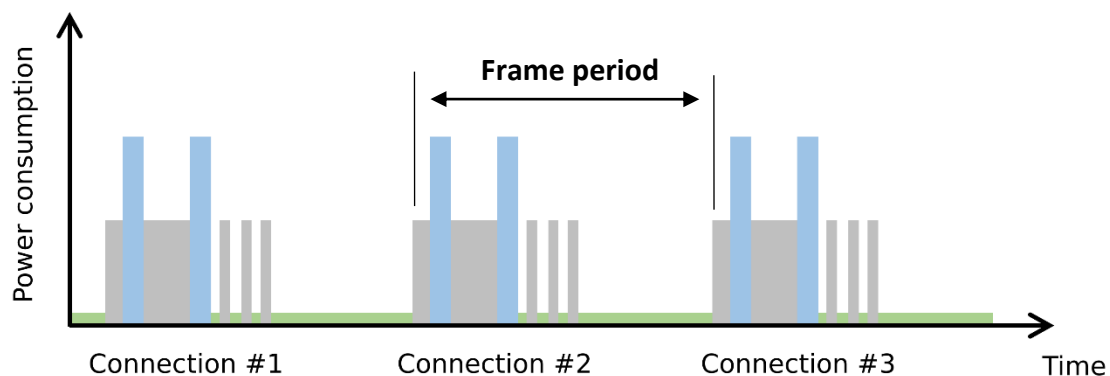
c. Normal operation and consumption

When the sensor is in **ON** transmission mode and the commissioning phase is complete, the sensor enters standby mode, to reduce power consumption until the next frame transmission.

Between two transmissions, the sensor takes level readings at regular intervals.

The period between two MQTT transmissions (**Frame period**) is adjustable, as is the period between two level readings (**Measure period**).

The graph below shows the consumption curve for three transmissions or network connections:



Blue areas represent data transmission periods, the most power-hungry periods (150mA average).

Gray zones represent data reception periods (40mA average).

The green areas represent standby periods, which consume the least power (around 50uA).

A data frame transmission phase lasts around 20 seconds and represents 0.6 mA.h on average.

Level readings are not shown in the figure above; a level measurement lasts about 300ms and represents 7uW.h.

d. Frame format

Each level reading is stored in a table, which is then sent in a **reading frame**.

The JSON format of the report frame is given below :

```
{
  "CNT":2,
  "FPERIOD":120,
  "MPERIOD":10,
  "TAB":
    [
      1227,1225,1213,1217,1237,1213,1209,1231,1221,1231,1237,1231,1229,1229,1231,1257,1253,
      1223,1231,1237,1217,1229,1217,1205,1205,1227,1231,1199,1197,1221,1193,1199,1237,1205,
      1217,1231,1221,1199,1231,1225,1221,1199,1197,1213,1231,1225,1205,1199,1213,1217,1217,
      1221,1205,1231,1249,1225,1205,1231,1221,1205,1231,1223,1197,1217,1199,1221,1199,1197,
      1209,1221,1205,1213,1209,1197,1217,1197,1221,1197,1229,1231,1225,1245,1241,1217,1253,
      1197,1199,1245,1239,1219,1229,1225,1229,1245,1231, 1237,1 221,1229,1225,1249
    ]
}
```

The **CNT** field is an indicator that is incremented each time a reading or life frame is sent.

The time period (minutes) between two readings is given by the **FPERIOD** field.

The period (minutes) between two readings is given by the **MPERIOD** field.

The **TAB** table contains the last 100 level readings in raw values [0-4095].

Once a week, the sensor measures its battery level and the quality of the network and sends this information in a **life frame** :

```
{  
    "IMEI": "861340040029330",  
    "RSRP": -115,  
    "RSRQ": -16,  
    "RSSI": -66,  
    "SINR": 11,  
    "VOLTAGE": 3437,  
    "FPERIOD": 4,  
    "MPERIOD": 10,  
    "CNT": 1  
}
```

The **IMEI** number identifies the sensor.

RSSI (received signal strength indicator) is an indicator of signal strength.

SINR (signal noise ratio) is the signal-to-noise ratio.

VOLTAGE is the last battery voltage measured in mV.

FPERIOD is the period between two frames in minutes.

MPERIOD the period between two measurements in minutes.

CNT is a counter incremented with each life or reading frame.

Integration

When the sensor is connected to the network, it publishes MQTT requests to an external broker.

To enable connection to the broker, all MQTT identifiers and, if required, TLS security certificates must be entered in the sensor.

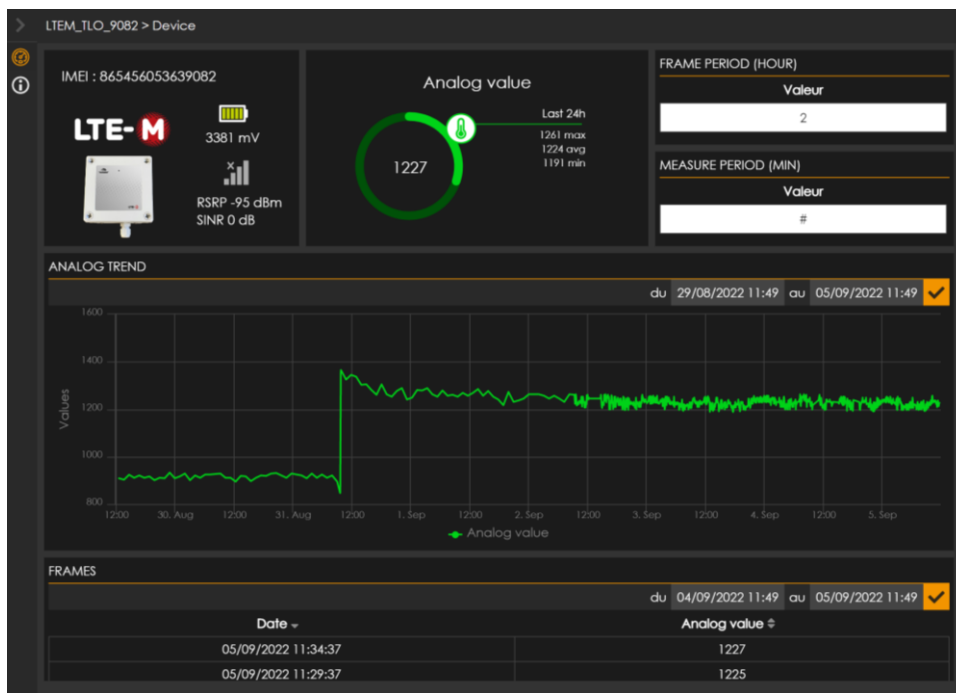
Two integrations are currently available:

1. ATIM Cloud Wireless platform
2. Live Objects platform.

a. ATIM Cloud Wireless platform

The platform interface proposed by ATIM has two pages.

The first page **Device**  of the ACW platform presents all the information processed:



The top left bezel shows the latest RSRP, SINR, and battery voltage values.

The frame at the top middle shows the last level value as well as the minimum, maximum and average values over the last 24 hours.

The frame at the top right allows you to edit the period parameters of frames and measurements.

A configuration change becomes effective the next time the sensor life frame is sent.

The middle frame is a curve of the evolution of the level.

The bottom frame shows the history of level values, exportable in .pdf or .xls

The second **Frames** page  allows you to view raw frames in JSON format :

LTEM_TLO_9082 > Frames	
FRAMES	
du 04/09/2022 11:51 au 05/09/2022 11:51	
Date ▾	Raw JSON payload ⚙
05/09/2022 11:34:37	[{"CNT":120,"FPERIOD":60,"MPERIOD":5,"TAB": [1227,1225,1213,1217,1237,1213,1209,1231,1221,1231,1237,1231,1229,1229,1231,1257,1253,1223,1231,1237,1217,1229,1217,1205,1205,1227,12 31,1199,1197,1221,1193,1199,1237,1205,1217,1231,1221,1199,1231,1225,1221,1199,1197,1213,1231,1225,1205,1199,1213,1217,1217,1221,1205,1 231,1249,1225,1205,1231,1221,1205,1231,1223,1197,1217,1199,1221,1199,1197,1209,1221,1205,1213,1209,1197,1217,1197,1221,1197,1229,1231, 1225,1245,1241,1217,1253,1197,1199,1245,1239,1219,1229,1225,1229,1245,1231,1237,1221,1229,1225,1249]}]
05/09/2022 10:32:34	[{"CNT":119,"FPERIOD":60,"MPERIOD":5,"TAB": [1237,1231,1229,1229,1231,1257,1253,1223,1231,1237,1217,1229,1217,1205,1205,1227,1231,1199,1197,1221,1193,1199,1237,1205,1217,1231,12 21,1199,1231,1225,1221,1199,1197,1213,1231,1225,1205,1199,1213,1217,1217,1221,1205,1231,1249,1225,1205,1231,1221,1205,1231,1223,1197,1 217,1199,1221,1199,1197,1209,1221,1205,1213,1209,1197,1217,1197,1221,1197,1229,1231,1225,1245,1241,1217,1253,1197,1199,1245,1239,1219, 1229,1225,1229,1245,1231,1237,1221,1229,1225,1249,1253,1229,1229,1249,1249,1245,1253,1229,1249,1229]}]
05/09/2022 09:30:37	[{"CNT":118,"FPERIOD":60,"MPERIOD":5,"TAB": [1217,1229,1217,1205,1205,1227,1231,1199,1197,1221,1193,1199,1237,1205,1217,1231,1221,1199,1231,1225,1221,1199,1197,1213,1231,1225,12 05,1199,1213,1217,1217,1221,1205,1231,1249,1225,1205,1231,1221,1205,1231,1223,1197,1217,1199,1221,1199,1197,1209,1221,1205,1213,1209,1 197,1217,1197,1221,1197,1229,1231,1225,1245,1241,1217,1253,1197,1199,1245,1239,1219,1229,1225,1229,1245,1231,1237,1221,1229,1225,1249, 1253,1229,1229,1249,1249,1245,1253,1229,1249,1229,1231,1237,1241,1229,1231,1231,1239,1231,1223,1221]}]
05/09/2022 08:28:35	[{"CNT":117,"FPERIOD":60,"MPERIOD":5,"TAB": [1193,1199,1237,1205,1217,1231,1221,1199,1231,1225,1221,1199,1197,1213,1231,1225,1205,1199,1213,1217,1217,1221,1205,1231,1249,1225,12 05,1231,1221,1205,1231,1223,1197,1217,1199,1221,1199,1197,1209,1221,1205,1213,1209,1197,1217,1197,1221,1197,1229,1231,1225,1245,1241,1 217,1253,1197,1199,1245,1239,1219,1229,1225,1229,1245,1231,1237,1221,1229,1225,1249,1253,1229,1229,1249,1249,1245,1253,1229,1249,1229, 1231,1237,1241,1229,1231,1231,1239,1231,1223,1221,1221,1237,1217,1245,1209,1245,1249,1205,1229,1221]}]
05/09/2022 07:26:35	[{"CNT":116,"FPERIOD":60,"MPERIOD":5,"TAB": [1221,1199,1197,1213,1231,1225,1205,1199,1213,1217,1217,1221,1205,1231,1249,1225,1205,1231,1249,1225,1205,1231,1249,1225,1205,1231,1249, 99,1197,1209,1221,1205,1213,1209,1197,1217,1197,1221,1197,1229,1231,1225,1245,1241,1217,1253,1197,1199,1245,1239,1219,1229,1225,1229,1 245,1231,1237,1221,1229,1225,1249,1253,1229,1229,1249,1249,1245,1253,1229,1249,1229,1231,1237,1241,1229,1231,1231,1239,1231,1223,1221, 1221,1237,1217,1245,1209,1245,1249,1205,1229,1221,1213,1199,1229,1191,1193,1199,1213,1221,1197,1205]}]
05/09/2022 06:24:35	[{"CNT":115,"FPERIOD":60,"MPERIOD":5,"TAB": [1217,1221,1205,1231,1249,1225,1205,1231,1221,1205,1231,1223,1197,1217,1199,1221,1199,1197,1209,1221,1205,1213,1209,1197,1217,1197,12 21,1197,1229,1231,1225,1245,1241,1217,1253,1197,1199,1245,1239,1219,1229,1225,1229,1245,1231,1237,1221,1229,1225,1249,1253,1229,1229,1 249,1249,1245,1253,1229,1249,1229,1231,1237,1241,1229,1231,1231,1239,1231,1223,1221,1221,1237,1217,1245,1209,1245,1249,1205,1229,1229,1 1213,1199,1229,1191,1193,1199,1213,1221,1197,1205,1245,1231,1209,1225,1221,1223,1223,1221,1249,1231]}]

b. Live Objects platform (Orange)

With this configuration an additional **model** parameter is available to identify sensors under Live Objects.

Under the platform it is possible to view the MQTT frames published in the **Data messages menu (Uplink)** which correspond to the content of the "value" field of the frame above.

Orange Business Services Orange Developer Hardware Couverture LoRa Couverture LTE-M Blog FR

Datavenu Live Objects Tableau de bord Parc Données Alarmes Administration Centre d'aide ATIM_001

Parc > urn:lsid:mqtt:myDevice > Data messages (Uplink)

<< ↑ Auto-created device (mqtt / urn:lsid:mqtt:... - urn:lsid:mqtt:myDevice)

Supervision
Identité
Data messages (Uplink)
Commandes (Downlink)
Firmwares
Configurations
Journal

StreamId: urn:lsid:mqtt:myDevice Nb max d'uplinks : 100

Seuls les 41 derniers uplinks sont affichés.

Date	Payload	État de décodage	Tags
12/01/2022 09:32:46	{ "IMEI": "861340040029330", "RSSI": -74, "SINR": 0, "VOLTAGE": 3533, "T3412": 8640, "T3412EXT": 0, "T3324": 16, "ITR": 0, "CNT": 1 ...	-	-
12/01/2022 09:21:17	{ "IMEI": "861340040029330", "RSSI": -75, "SINR": 11, "VOLTAGE": 3501, "T3412": 9720, "T3412EXT": 0, "T3324": 16, "ITR": 0, "CNT": ...	-	-
12/01/2022 08:48:16	{ "IMEI": "861340040029330", "RSSI": -73, "SINR": 10, "VOLTAGE": 3541, "T3412": 8280, "T3412EXT": 0, "T3324": 16, "ITR": 0, "CNT": ...	-	-
12/01/2022 05:54:36	{ "IMEI": "861340040029330", "RSSI": -73, "SINR": 12, "VOLTAGE": 3544, "T3412": 8280, "T3412EXT": 0, "T3324": 16, "ITR": 0, "CNT": ...	-	-
12/01/2022 03:12:36	{ "IMEI": "861340040029330", "RSSI": -75, "SINR": 11, "VOLTAGE": 3551, "T3412": 8280, "T3412EXT": 0, "T3324": 16, "ITR": 0, "CNT": ...	-	-
12/01/2022 00:24:46	{ "IMEI": "861340040029330", "RSSI": -78, "SINR": 12, "VOLTAGE": 3550, "T3412": 8280, "T3412EXT": 0, "T3324": 16, "ITR": 0, "CNT": ...	-	-

On the Live Objects platform it is also possible to edit the period of measurement and sending of frames via the Commands menu (Downlink). For this it is necessary to fill in the fields as on the example below or the requested sending period is 5 hours:

Orange Business Services Orange Developer Hardware Couverture LoRa Couverture LTE-M Blog FR

Datavenu Live Objects Tableau de bord Parc Données Alarmes Administration Centre d'aide ATIM_001

Parc > urn:lsid:mqtt:myDevice > Commandes (Downlink) > Enregistrer une nouvelle co...

<< ↑ Auto-created device (mqtt / urn:lsid:mqtt:... - urn:lsid:mqtt:myDevice)

Supervision
Identité
Data messages (Uplink)
Commandes (Downlink)
Firmwares
Configurations
Journal

Enregistrer une nouvelle commande * champ obligatoire

MQTT

Requête * configuration

Argument

tag "configuration_t3412" (1)

data "5h" (1)

(1) : Une valeur décrivant une chaîne de caractères au format JSON sera fournie comme telle en argument de la commande. Si les guillemets de début et de fin font partie de la chaîne de caractères à envoyer, il faut échapper ceux-ci par \" et en ajouter d'autres autour.

Durée max de l'état PENDING * 5 Jours 0 Heures 0 Minutes ?

Niveau d'acquiescement * ☒ Aucun ☐ Applicatif (Equipement a répondu) ?

Annuler Valider

ACW LTE-M configurator

Before using the ACW LTE-M configurator on a Windows PC, make sure to :

- Install Python3
- Install SIMCOM drivers

The drivers must first be saved in a known directory on the PC.

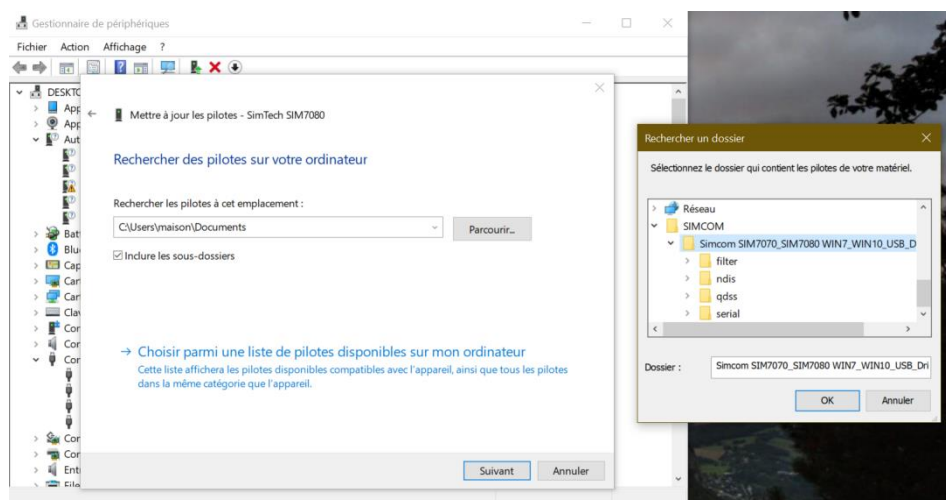
The sensor must then be placed in configuration mode. Deux techniques sont alors possibles :

- Disconnect and reconnect the J6 jumper
- If the sensor is already started use the magnet until the **SETUP mode is obtained**

Then connect the sensor to the PC via USB.

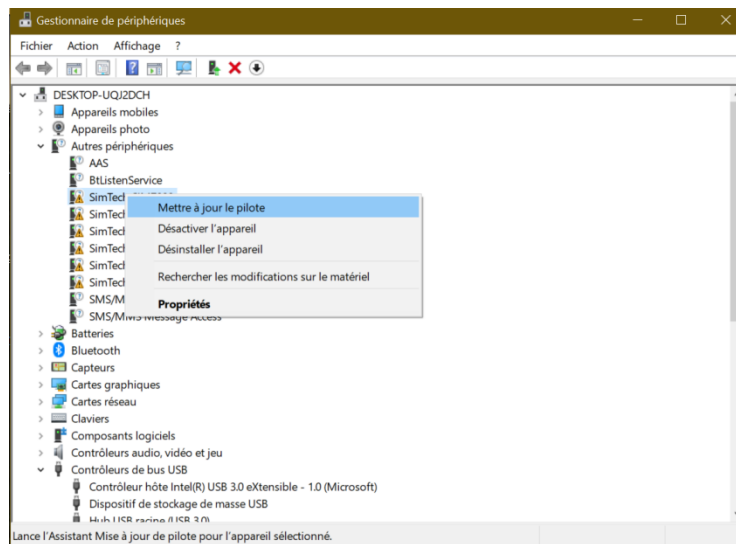
Only one SIMCOM device should first be located in Device **Manager**.

Right click on the SIMCOM device and then **update the driver** and search for the drivers folder.

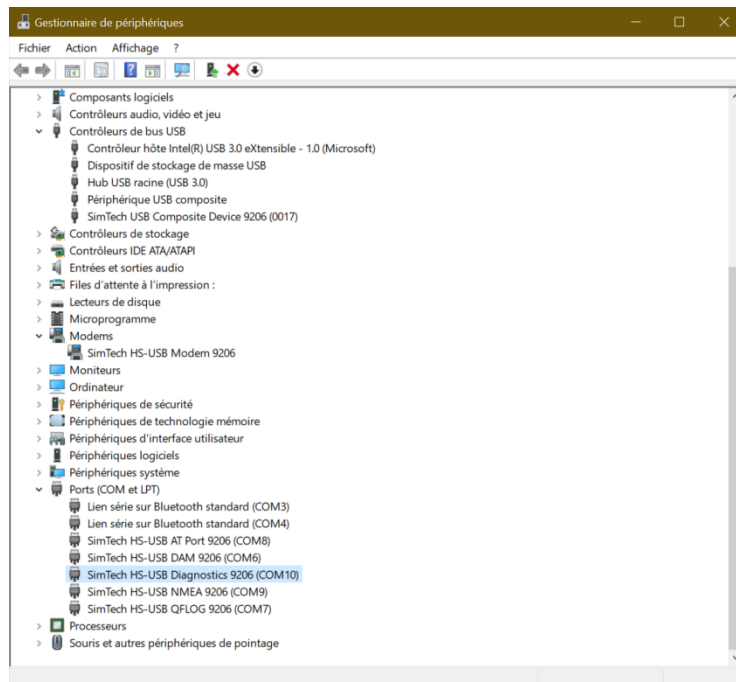


Following this first operation, several SimTech devices should then appear.

You must then repeat the update operation on all devices, until they are all in **Ports or Modems** and no longer in **Other Devices**.



Then locate the AT command port, for example **COM8** below.



Then launch the Configurateur_ACW_LTEM.exe executable program and enter the selected port.

Click on the download icon



If this is the first configuration, then the configurator should indicate that no configuration was found.

If the sensor has already been configured, the current settings are displayed.

The different fields can then be completed or modified before uploading the configuration via upload



The screenshot shows the 'LTE-M device configurator' window. At the top, there's a status bar with 'USB : COM4', download and upload buttons, and 'Connected in USB' text. The main area is divided into four sections:

- MQTT**: Includes a checked 'Secured connection (TLS)' option. Fields for URL, Username, Password, Port, Client ID, Pub. topic, and Sub. topic are filled with values like 'ksp-iot-hub.azure-devices.net' and 'ksp-415-350'. It also displays 'Server CA certificate' and 'Module certificate' in hex format.
- Device periods**: Fields for 'Frame period' (60) and 'Measure period' (5) with range indicators like '[5-1440 minutes]'.
- Device APN**: A 'Network APN' field containing 'iot.1nce.net'.
- Integration**: Fields for 'Device name' (LTEM_CNT_9066), 'Platform' (Atim cloud), and 'Sensor type' (Pulse).

Support technique

For any information or technical questions, we invite you to open a ticket on our [dedicated support web page](#).



Appendix

Live Objects CA Certificate

-----BEGIN CERTIFICATE-----

MIIE9DCCA9ygAwIBAgIQCF+UwC2Fe+jMFP9T7aI+KjANBgkqhkiG9w0BAQsFADBh
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