Telit Charlie Evaluation Kit Application Example

Application Note

80xxxNT1yyyyA Rev. 0 – 2021-07-26

Telit Technical Documentation

APPLICABILITY TABLE

PRODUCTS
TELIT CHARLIE EVALUATION KIT

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1. INTRODUCTION

1.1. Scope

This document describes an application's example for the Telit Charlie board, which is used to detect a freefall. All the features and solutions described in this document are applicable to Telit Charlie Evaluation Kit.

1.2. Audience

This document is intended for Telit customers, especially system integrators, about to implement their applications using the Telit Charlie Evaluation kit.

1.3. Contact Information, Support

For general contact, technical support services, technical questions and report of documentation errors contact Telit Technical Support at:

- *TS-EMEA@telit.com*
- *TS-AMERICAS@telit.com*
- *TS-APAC@telit.com*
- *TS-SRD@telit.com*
- *TS-ONEEDGE@telit.com*

Alternatively, use:

https://www.telit.com/contact-us/

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

https://www.telit.com

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates the user feedback on our information.

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1.4. Symbol Conventions

	Danger: This information MUST be followed or catastrophic equipment failure or personal injury may occur.
	Warning: Alerts the user on important steps about the module integration.
	Note/Tip: Provides advice and suggestions that may be useful when integrating the module.
	Electro-static Discharge: Notifies the user to take proper grounding precautions before handling the product.

Table 1: Symbol Conventions

All dates are in ISO 8601 format, that is YYYY-MM-DD.

1.5. Related Documents

- ME310G1/ME910G1/ML865G1 AT commands Reference Guide, 80617ST10991A Rev.9
- Charlie EVK HW User Guide, 1VV0301670 Rev. 5
- LwM2M AT Commands Reference Guide, 80529ST10974A Rev. 4
- How to generate freefall interrupt using BMA400, Bosch Sensortec

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2. PREREQUISITES

2.1. Hardware

You need a Telit Charlie board, a cellular antenna and a micro-USB cable. The Telit Charlie Evaluation kit can be found at https://www.telit.com/developer-zone/charlie/.

The Charlie Board Evaluation Kit comes with the Hardware User Guide.

Please read carefully the Charlie's HW User Guide first.

2.2. Software

The software used are Arduino IDE version 1.8.15 and a serial terminal tool (i.e. Tera Term). Telit AT Controller (TATC) is recommended, please download it from

https://telit.com/developer-zone/charlie/

You also need a browser to connect the board with OneEdge.

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3. SETUP SOFTWARE

Dowload the Arduino IDE and the Arduino library for Telit module ME310G1 at

https://github.com/telit/arduino-me310-library.

Download the Grove_3Axis_Digital_Accelerometer_BMA400 library from

https://github.com/Seeed-Studio/Grove_3Axis_Digital_Accelerometer_BMA400.

To add the Charlie Board on Arduino IDE, click on *File->Preference.* Enter the release link into *Additional Board Manager URLs* field:

https://raw.githubusercontent.com/telit/arduino-charlie/main/Arduino/package_Telit-board_index.json.

Click on *Tools->Boards...->Boards manager* and install Charlie platform. Select your Charlie board from *Tools->Board* after installation.

To add the library for the accelerometer, go on *Sketch->Include library->Add .ZIP Library* and select the folder or ZIP file which would you import.

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4. SETUP IOT PORTAL ONEEDGE

To manage the module through the IoT portal it is necessary to have an account on OneEdge IoT platform.

4.1. Register your account

Go to https://portal-dev.telit.com/app/login .

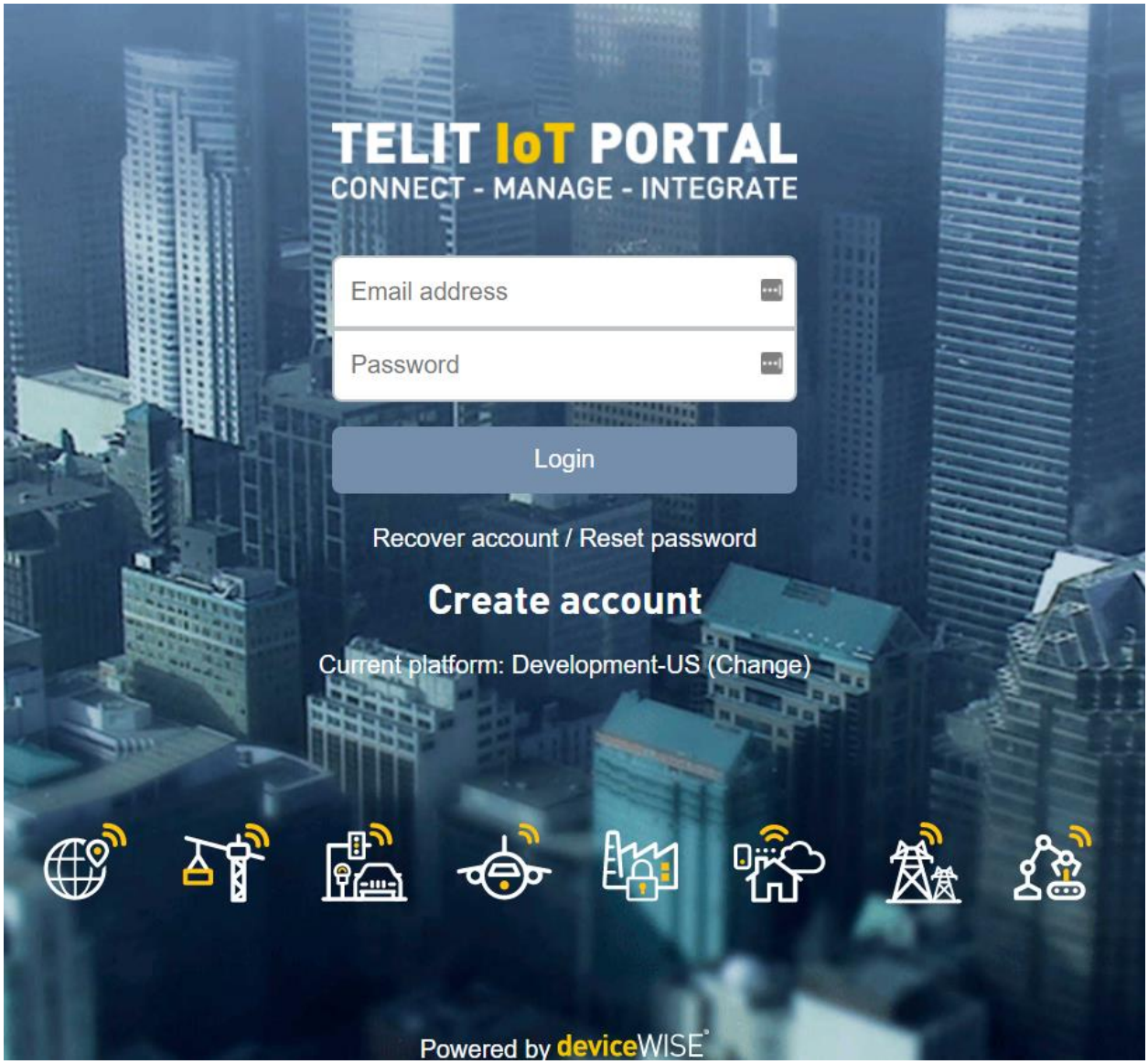

Figure 1: Log in page

If you have an account, skip this and continue to read from *4.2 Setup the thing definition and device profile*.

Click on "Create account", enter your email and then look for an activaction link in your email folder.

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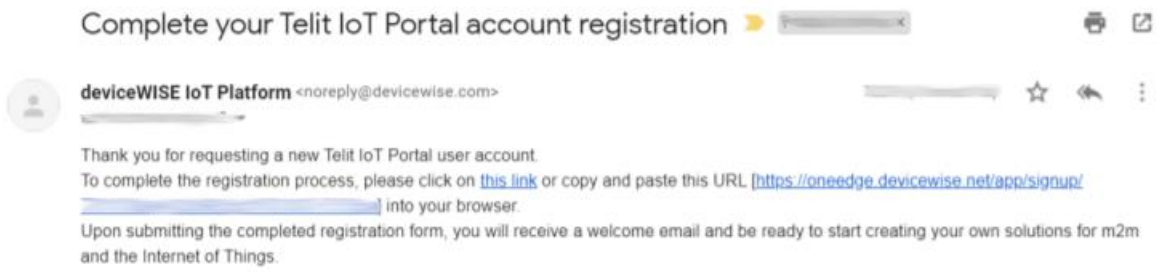

Figure 2: Activation link

Click on link or copy and paste the link to your browser. The following form will appear

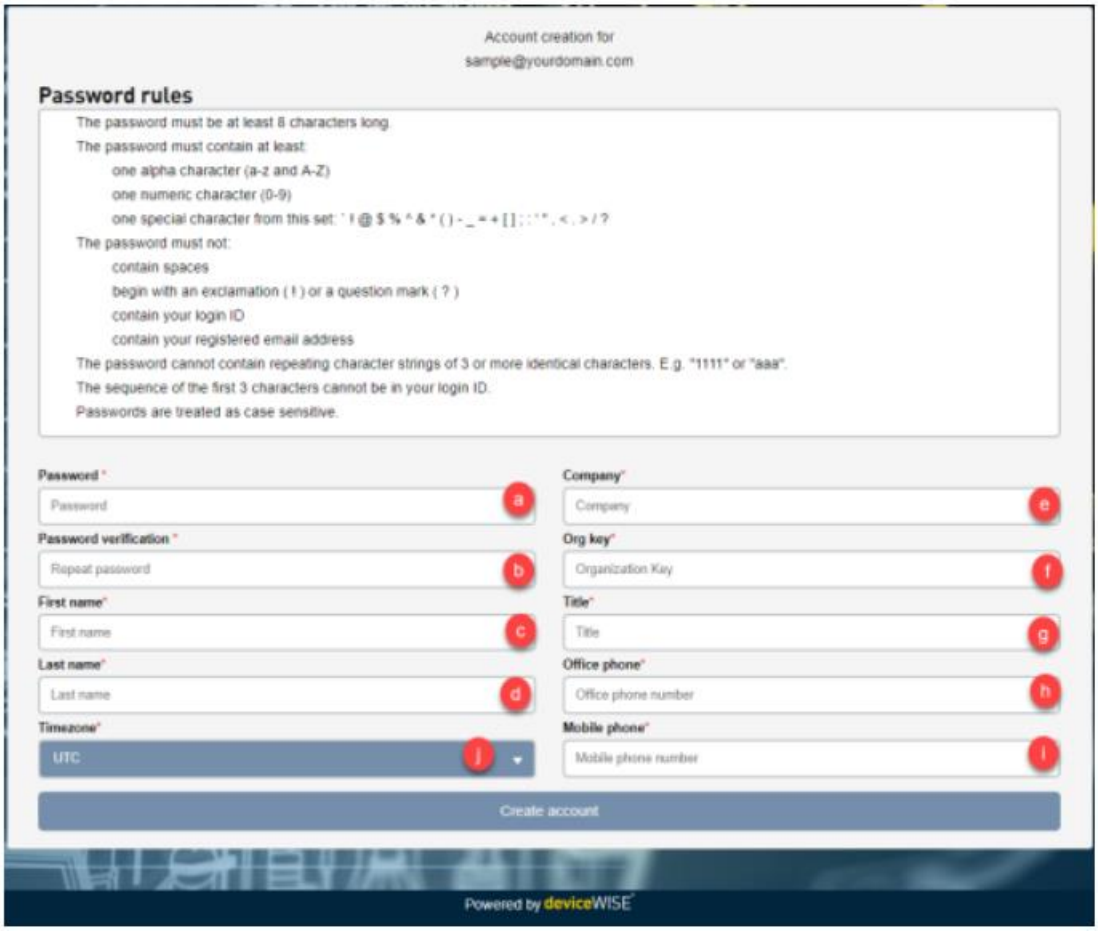

Figure 3: Account creation

The fields marked with * are mandatory. Please make sure all fields are correctly filled.

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Organization names may be duplicated.

Organizaton keys are unique, please choose a different key value

Then accept privacy policy and Terms and Conditions.

4.2. Setup the thing definition and device profile

Thing definition and device profiles define which capabilities are provided by the device.

Specifically, the device profile provides all the information to bind the LwM2M object to the real properties, events and commands- the device data model.

4.2.1. Import the Thing definition

Click on tab Developer.

Figure 4: Menu tabs IoT portal

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Click on Thing definition on the left menu.

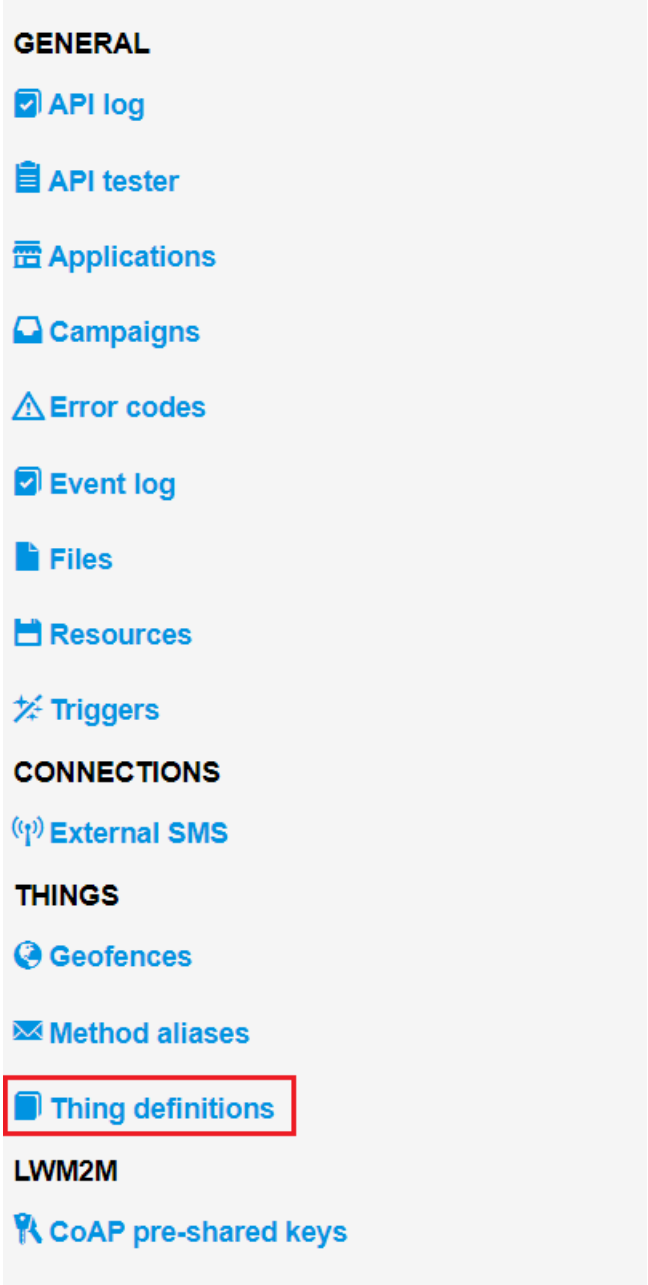

Figure 5: Left menu Thing definition

Click on tab Import.

Figure 6: Import Thing definition

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In the next page, click on Attach file and select the file *thing_defs.json.* Then click on Import button.

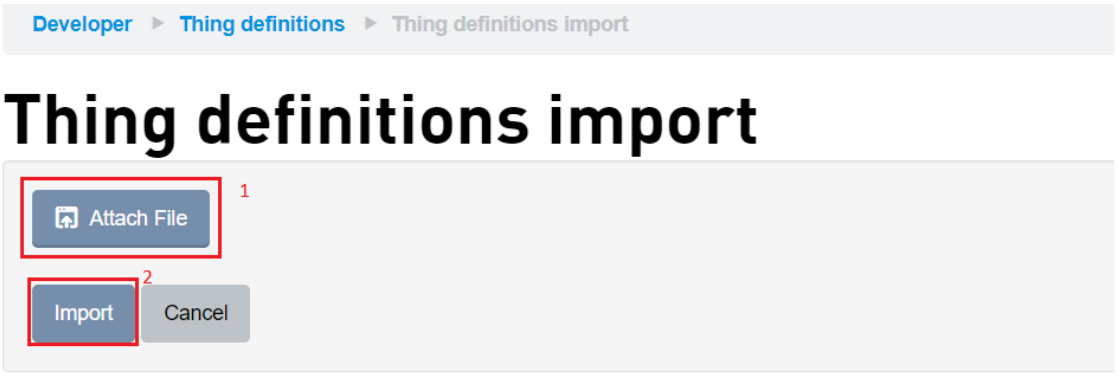

Figure 7: Attach file and Import buttons

Note- Please make sure that the JSON file imported on the thing definition is reporting "thing definition" and not "device profile" in the name.

4.2.2. Import Device profiles

Go back on Developer section and select Device profiles from the left menu. In the next page click on Import.

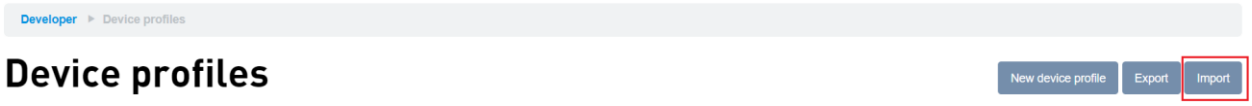

Figure 8: Import Device profile

Like in the step about Thing definition, click on Attach files and select the file *LwM2M_profiles.json.* Then click on Import button.

Now in the list of Device profiles will appear the Charlie_profile. Click on Edit button (marked in green in Figure 9) and check that the device profile objects are properly registered.

Figure 9: Device profile imported

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4.2.3. Import Trigger

On Developer page, click on Trigger from left menu. From this page, click on Actions and from the drop down menu choose Import. Click on Attach files button, upload the file *triggers.json* and after that, click on Import.

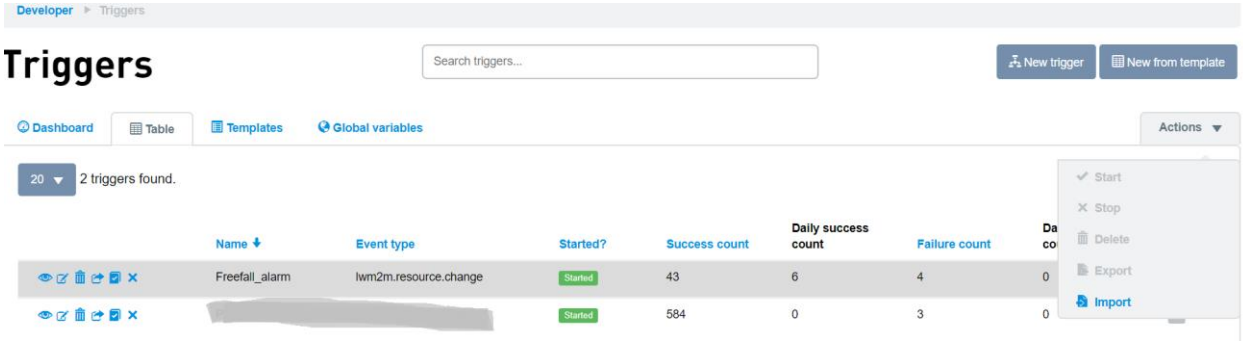

Figure 10: Trigger import

In the Triggers Table, the new Trigger is not running: click on the last symbol (tick symbol) to make it run. The tick symbol will be replace by the cross symbol.

Then click on second symbol Edit. In the next page click on 2.email.send button and then on pencil symbol

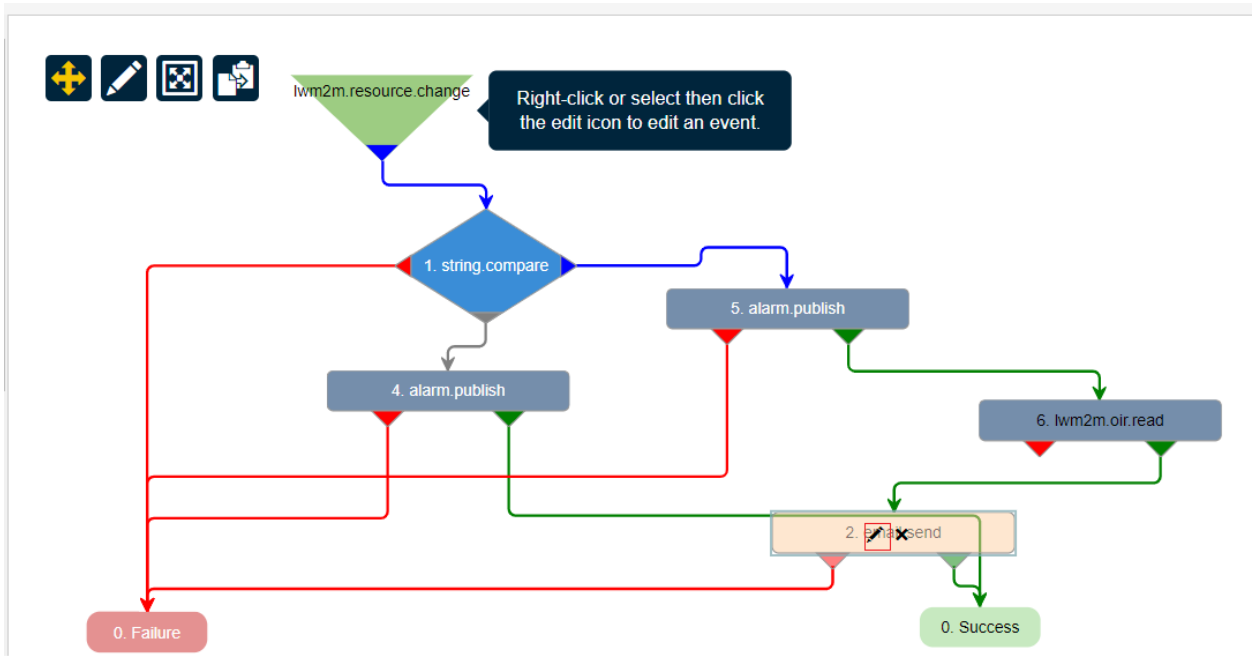

Figure 11: email.send editing

In the next window, replace the field To with your email and then click on Add button. After that, click on Update button.

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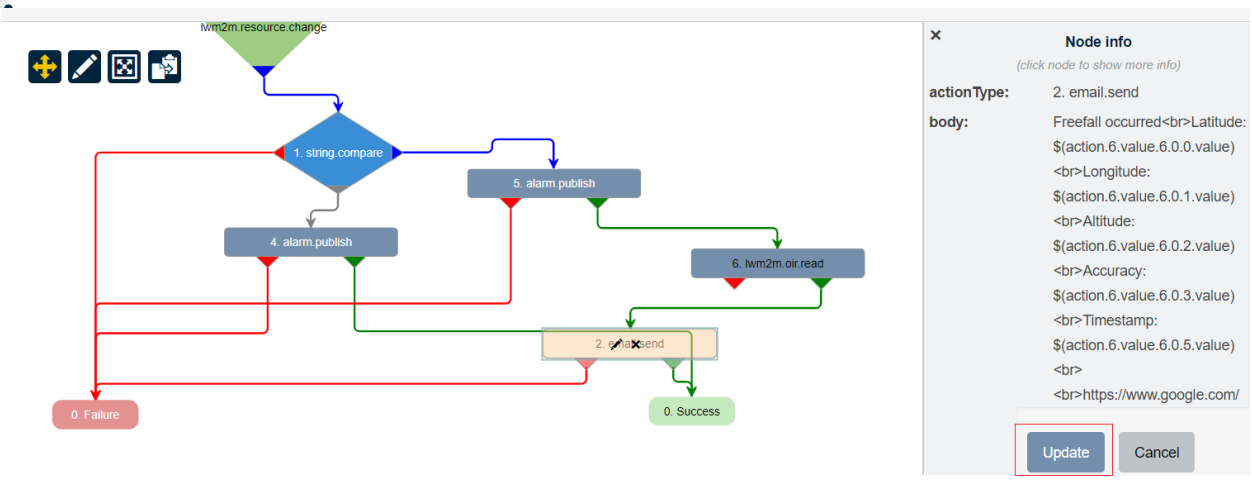

Figure 12: Update button

4.2.4. Create a new Thing

Before operating with the IoT portal, it is necessary to create a new Thing on the portal. The procedure is available at:

https://docs.devicewise.com/Content/Products/Management_Portal/Things/Creating-a-thing-for-a-Telit-module.htm

In point 4 of the guide reported in the link above, in field Thing definitions choose ME310G1-WW, which has the alarm interruptStatus.

In point 8 select the Device profile Charlie_profile.

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5. CONNECT CHARLIE BOARD TO IOT PORTAL

5.1. Disable WWAN connection in Windows

Windows 10 users: by default, the OS is detecting and taking control of ME310 cellular connection. Please ensure this option is disabled as described in the following paragraph.

Whenever the Charlie Board is set up with a valid APN, Windows 10 network manager is able to detect this valid configuration and can automatically start a Dial-up connection as soon as the module is connected to the PC.

In this scenario the context is already enabled by Windows, the agents inside the module will get an error when trying to perform any connection using the same PDP context.

To avoid this scenario, it's necessary to disable the network adapter at runtime or change the default setting in the Windows registry.

5.1.1. Disable network adapter at runtime

- Open the Device Manager windows tool
- Open "Network adapters" section
- Search for "Telit USB WWAN Adapter" element
- Right-click and disable the device

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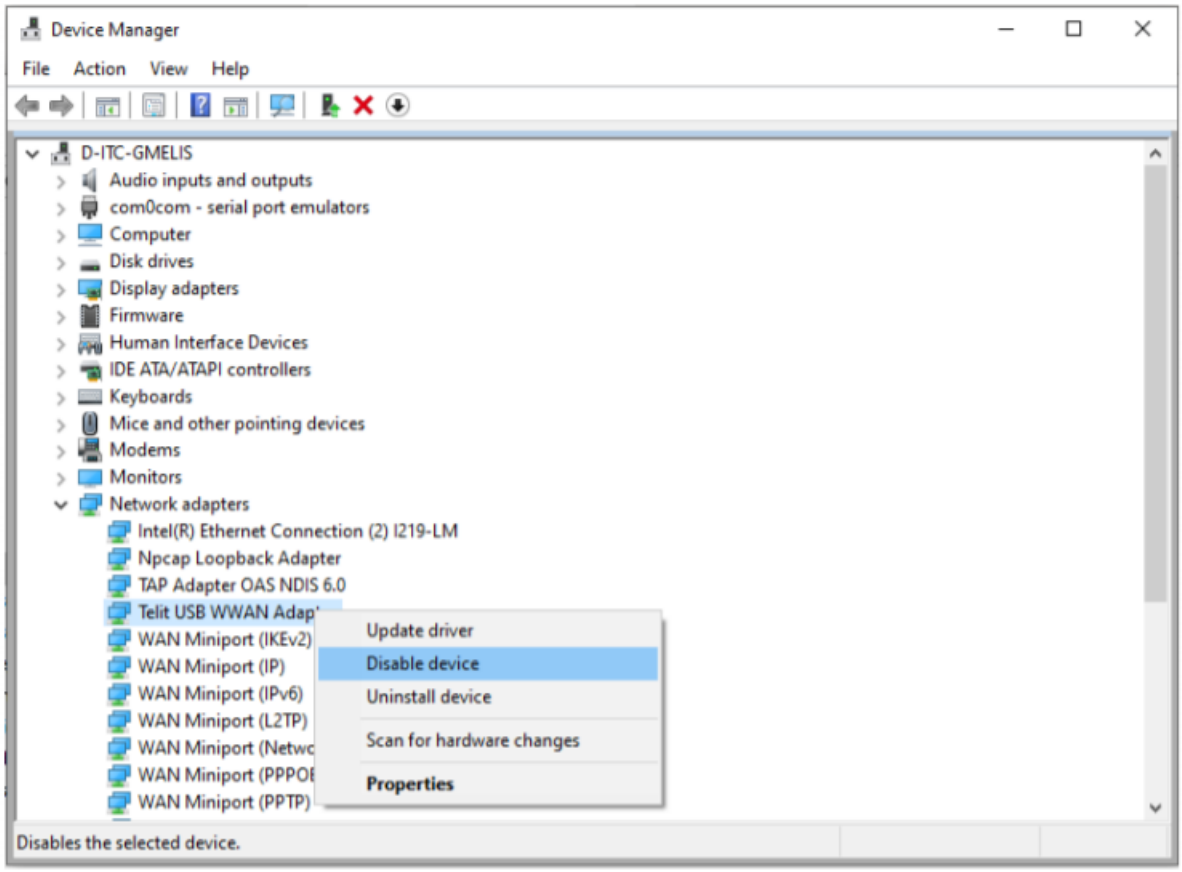

Figure 13: Network adapter disable

This setting is applied only to the device currently connected to the computer, so the user should repeat this procedure for all new devices connected to the computer.

5.2. Telit AT Controller

After the installation, double click on **Telit AT Controller** icon to open the application.

Figure 14: Telit AT controller icon

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Click on the icon marked in red.

Figure 15: Setting icon

In the next window, set the parameters like in Figure 14. Then click on OK button

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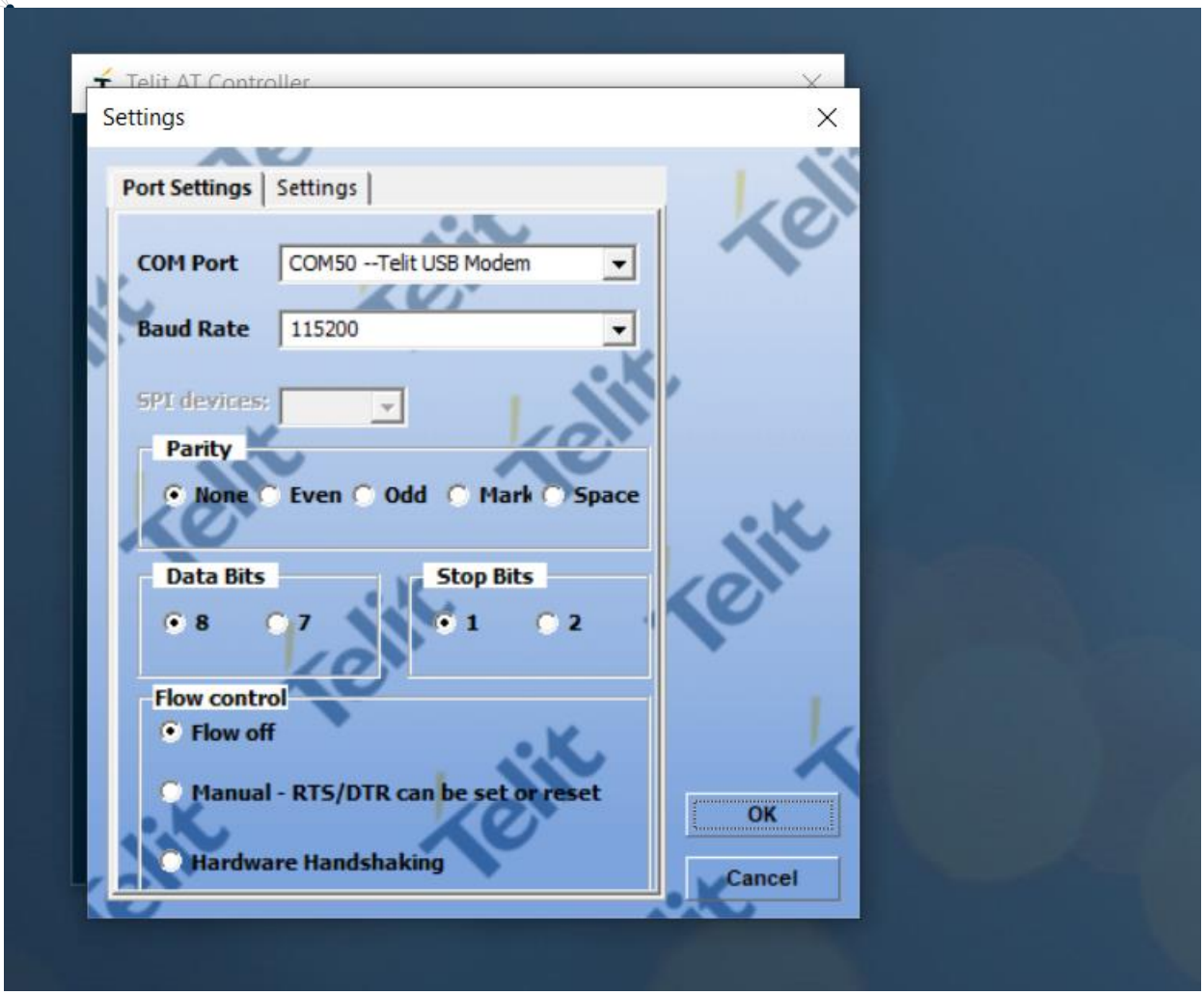

Figure 16: Setting window

Upon configuration, click on Connect button

Module information such as IMEI, Manufacter name, Model name an FW release will be displayed

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Figure 17: Setup completed

Then click on AT Terminal button

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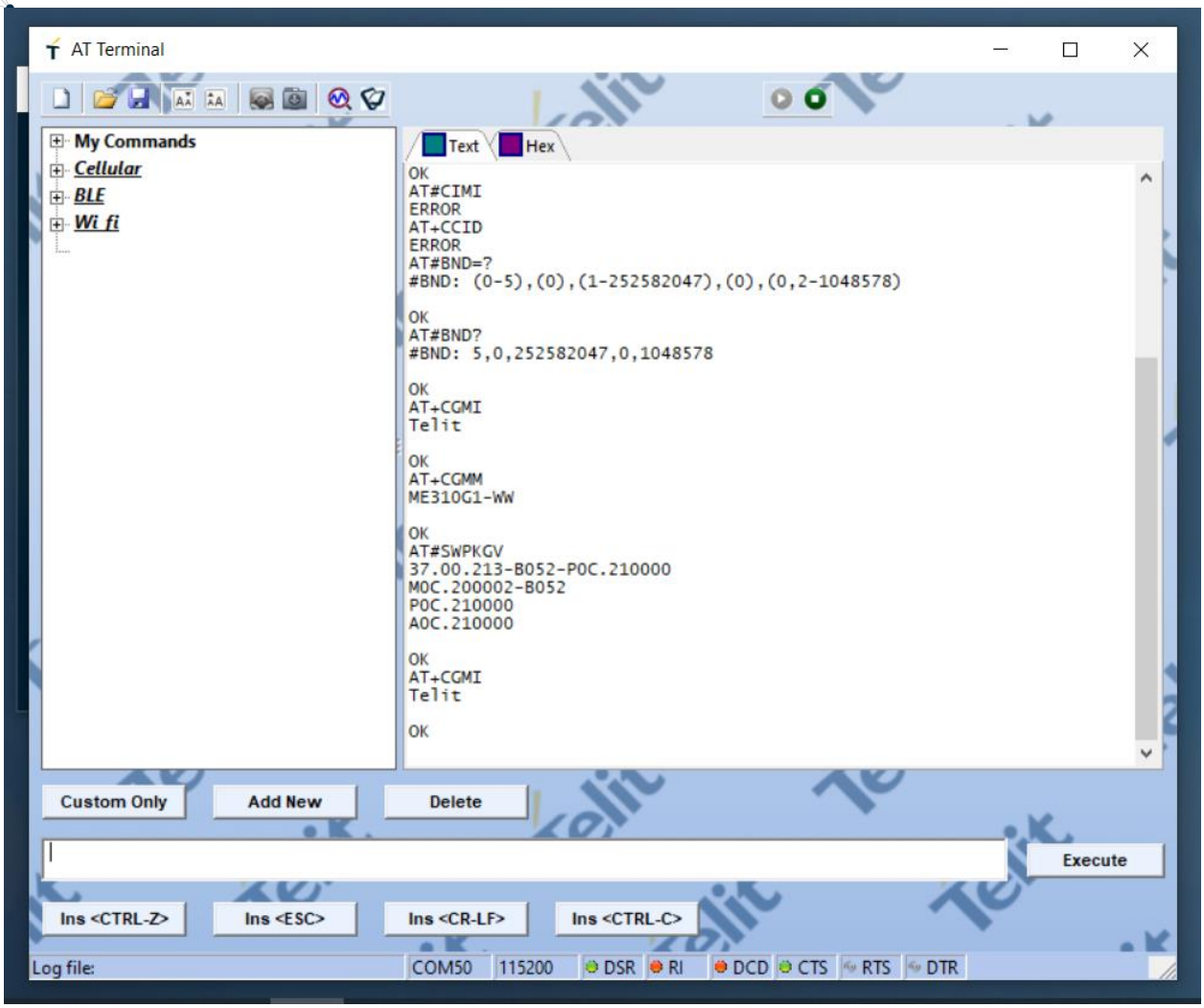

Figure 18: AT Terminal console

5.3. Connection to the IoT portal

The LwM2M client requires an active connection in order to be able to start the LwM2M handshake with the server and perform following interactions.

In case the LwM2M client is enabled before having an active connection, it will stay on hold until data connection is active.

From a serial terminal, send the following AT commands:

- AT+CGDCONT=1,"IP","YOUR_APN", to set the PDP context to be used by the LWM2M client
- AT#SGACT=1,0, to let the LWM2M client handle the connection and the PDP context startup
- AT#LWM2MENA=1 (refer to AT#LWM2MENA=<en> on the AT commands reference guide.)

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The LwM2M client will perform the Bootstrap (only the first time or when forced) and the terminal will receive the following URC:

```
LWM2M-TLT: "BOOTSTRAPPING",SSID=0,"coaps://bs.telit.io"
LWM2M-TLT: "BOOTSTRAPPED",SSID=0,"coaps://bs.telit.io"
```

After the Bootstrap, the LwM2M client will perform the registration on the DM server, and if the service is enabling through AT#LWM2MW=0,33211,0,0,1,1 command, the following URC are received:

```
LWM2M-TLT:"REGISTERING",SSID=99,"coaps://api-dev.devicewise.com"
LWM2M-TLT:"REGISTERED",SSID=99,"coaps://api-dev.devicewise.com"
```

5.4. Add the object 3200

Next step is to add the object 3200 to the client. It corresponds to a digital pin which was used to detect the interrupt generated by the freefall and for schedule the procedure to send the email. In the folder you will find the file *object_3200.xml.*

On module ME310G1 add the object 3200 with the followings AT commands:

1. AT#M2MWRITE="/XML/object_3200.xml", size

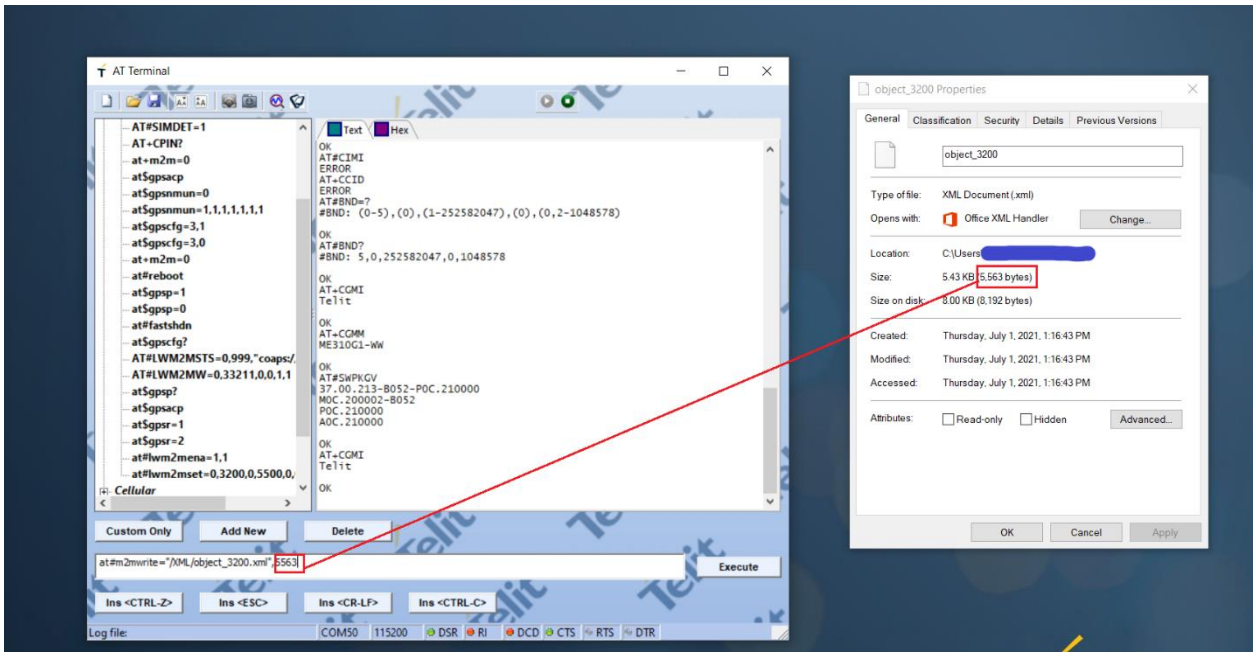

Figure 19: Parameters for AT#M2MWRITE

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2. After the command AT#M2MWRITE, there will be the symbol >>>. It indicates that the module is waiting for the upload of the file .xml. Click on the button marked in red in Figure 15 and select the file object_3200.xml

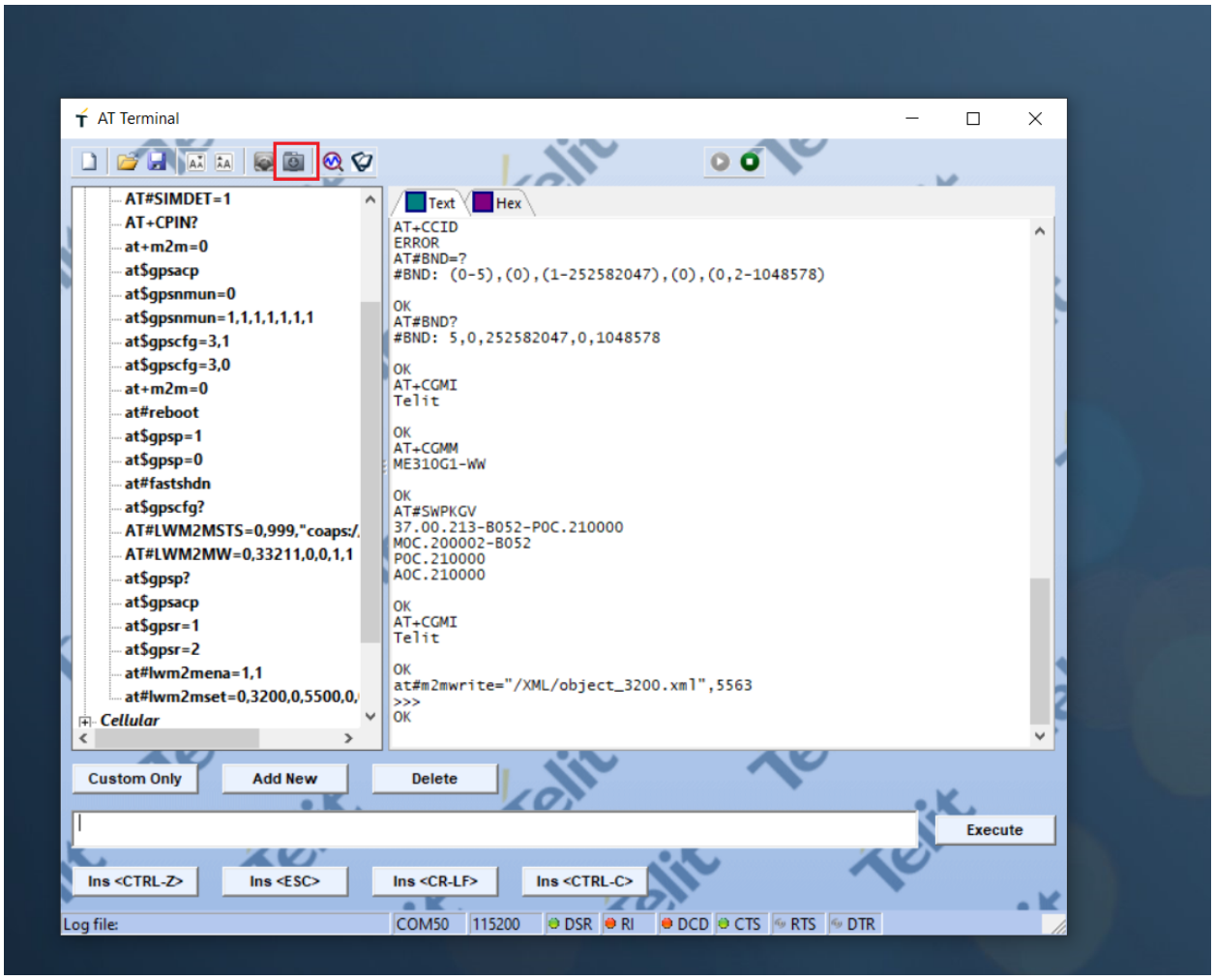

Figure 20: Uploading the file objct_3200.xml

3. AT#REBOOT
4. AT#M2MLIST=/XML/ to verify if the file is uploaded

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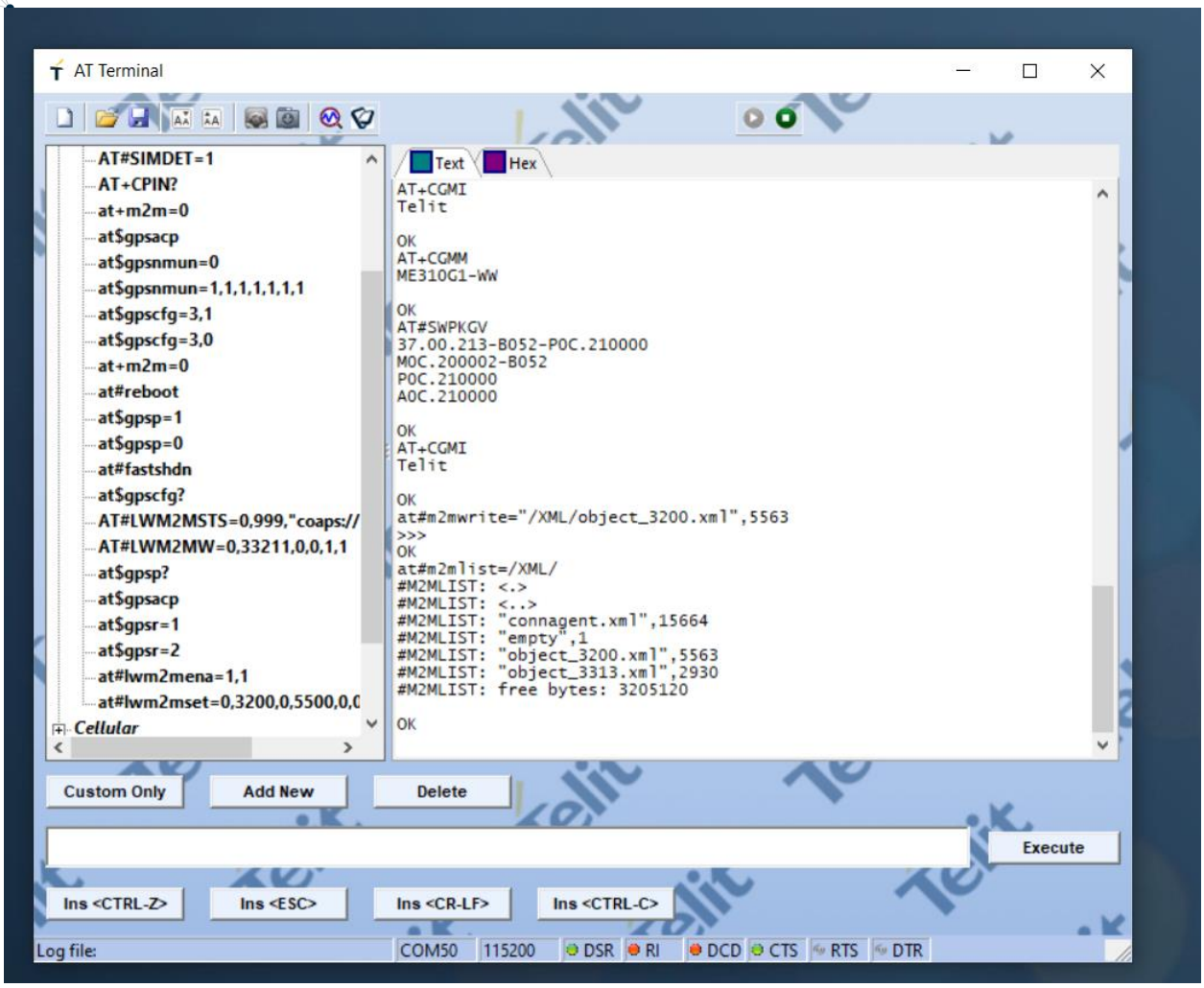

Figure 21: List of the files in the directory XML

5. AT#LWM2MENA=1
6. On the portal there will be the object 3200
7. Create an object instance through AT#LWM2MNEWINST=0,3200,0
8. Reload the object browser page (click on tab LWM2M from main page and then on Object browser)

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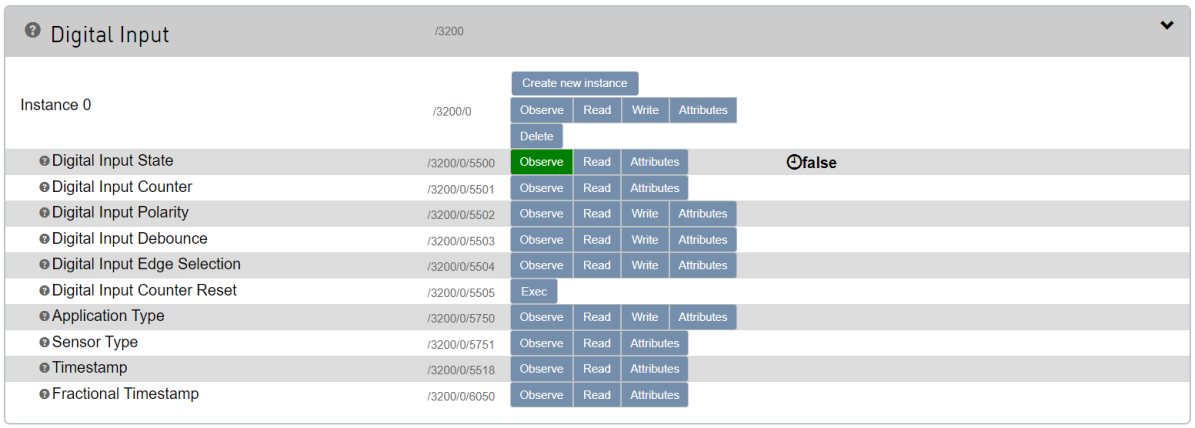

Figure 22: Object 3200 on the IoT portal

Then you have to change the value of the Lifetime parameter from 60 to 120. To do that, from module main page, click on tab LwM2M and then on Object browser.

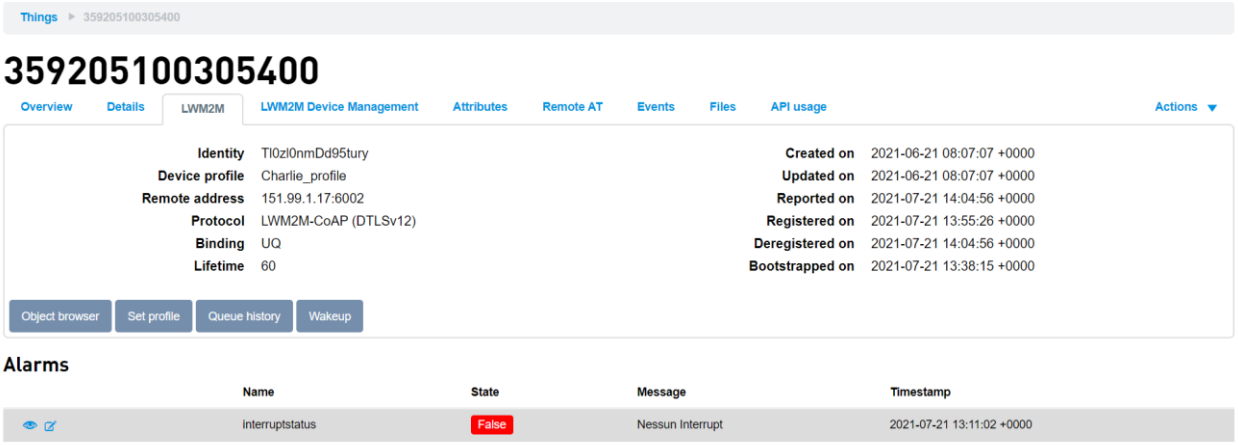

Figure 23: LWM2M page

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On Object browser page, click on LwM2M Server and then on Write button in field Lifetime.

Figure 24: LwM2M Server object

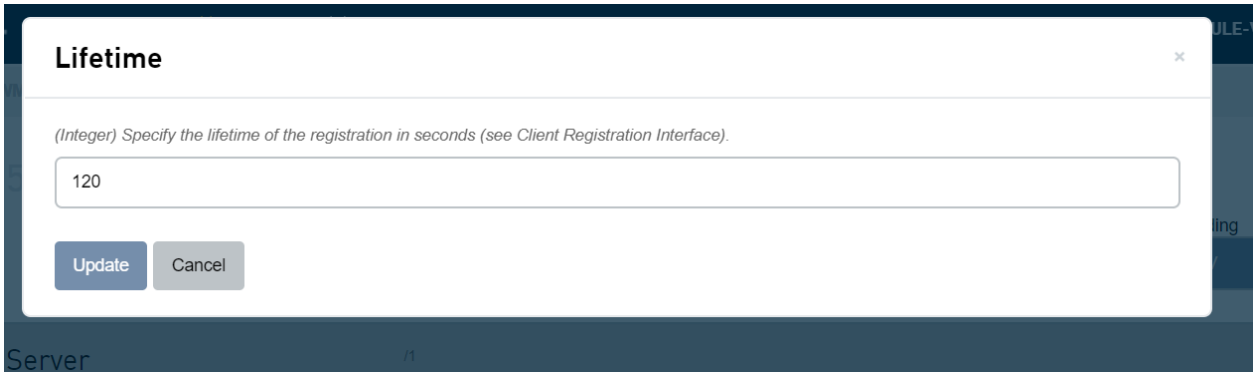

Figure 25: Lifetime field

Click on Update button to update the value.

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6. DETECTING A FREEFALL WITH CHARLIE BOARD

For the example described in this chapter, there are two variants: one for product 2G and one for product 4G.

It is necessary to select the wireless technology that will be used.

Please read the AT commands reference guide regarding the command AT+WS46.

6.1. Select the wireless technology

To select the wireless technology, from a serial terminal send to the module the following command

- AT+WS46= 12 if you want to use 2G technology
- AT+WS46= 28 if you want to use 4G technology

After you send the command, the module needs a reboot to store in the memory the select wireless technology. To do that, send the AT command AT#REBOOT.

6.2. Detecting freefall with Charlie Board

On Arduino IDE, go to *File->Examples->ME310G1* and select which sketch would you use.

Warning: if your SIM needs the PIN code, you need to change the *char pin[]* variable value XXXX with your PIN code in both Arduino sketches.

Upload the sketch on Telit Charlie. After done uploading, open the serial monitor to trace the application's flow.

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Figure 26: Serial monitor Arduino IDE

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COM53

```
Telit Test AT LWM2M accelerometer
ME310 ON
Network status
+CEREG: 0,1
BMA400 Raw Data
BMA400 is connected

Device InitializationBuffer LEN=80
0x0     0x90
0x1     0xA9
0x2     0x0
0x3     0x94
0x4     0x20
0x5     0x0
0x6     0x7D
0x7     0xF
0x8     0xFB
0x9     0xD
0xA     0x8
0xB     0x53
0xC     0x5D
0xD     0x0
0xE     0x0
0xF     0x0
0x10    0x0
0x11    0x1F
0x12    0x0
0x13    0x0
0x14    0x80
0x15    0x0
0x16    0x0
0x17    0x0
0x18    0x0
0x19    0x2
0x1A    0x49
0x1B    0x0
0x1C    0x0
0x1D    0x0
```

Figure 27: Execution flow

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COM53

```
0x3D    0x0
0x3E    0x0
0x3F    0xF0
0x40    0x1
0x41    0x3F
0x42    0x0
0x43    0xA
0x44    0x0
0x45    0x0
0x46    0x0
0x47    0x0
0x48    0x0
0x49    0x0
0x4A    0x0
0x4B    0x0
0x4C    0x0
0x4D    0x0
0x4E    0x0
0x4F    0x0
Freefall not occurred
Freefall not occurred
Freefall not occurred
Freefall not occurred

***********
Freefall Occurred
*******
Enabling and registering LWM2M client
Registered on server DM
Writing 1 in resource 33211/0/0/0
VALID
$GPSCFG: 1,1,1,1,1
Switching to GNSS priority
Switched to GNSS
```

Figure 28: Execution flow (2)

Verify on IoT portal that client is registered to the server. In Figure 29, this is visible in field Last Seen, in which the green clip indicates the registration. If the client is not registered to the server, the clip will be red.

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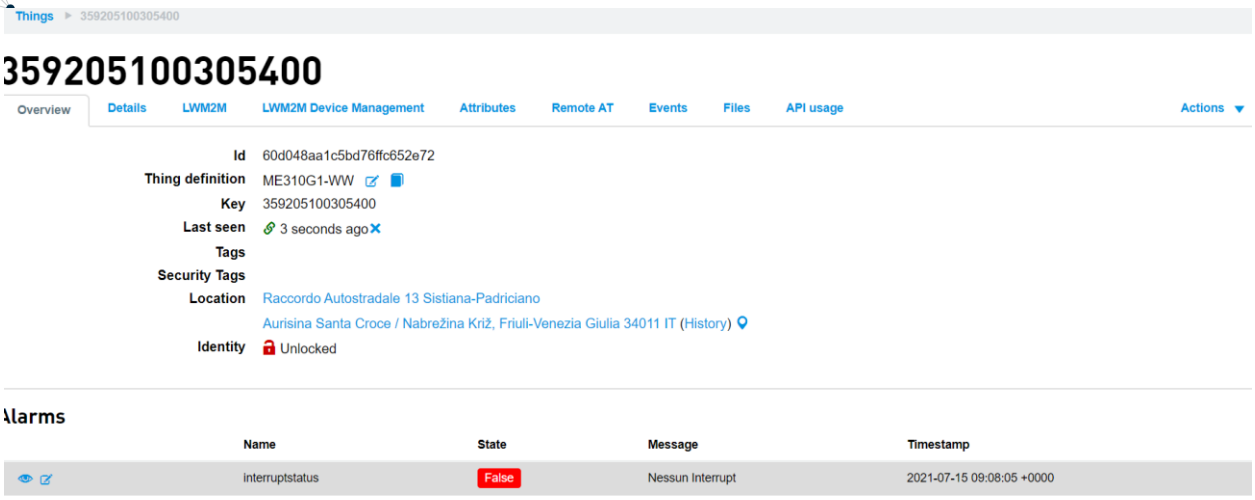

Figure 29: Registration on IoT portal

Note that in Figure 29 the alarm status is set to false.

When the freefall occurred (like in Figure 28), the MCU will send the command AT#LWM2MENA=1,1 to enable the client registration. Then on IoT portal there will be the situation illustrated in Figure 29.

In GPS priority, the client perform a LwM2M read operation every 10 seconds on resource 6/0/3, corresponding to GPS accuracy, until the reosurce value is below 20.0000.

When the value is below 20.0000, the pririty is switche to WWAN, licke in Figure 28.

```
Switched to WWAN
```

Figure 30: Priority switched to WWAN

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On portal side the situation is

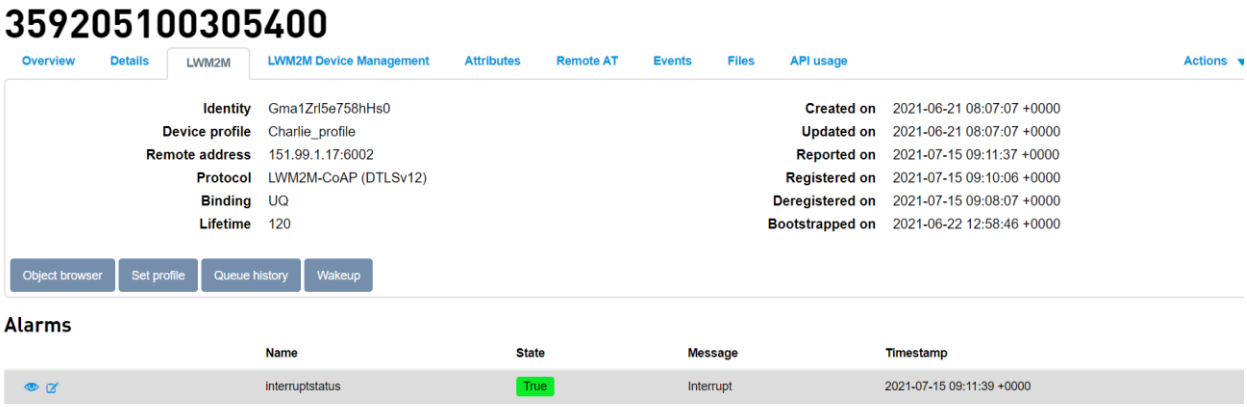

Figure 31: Alarm true

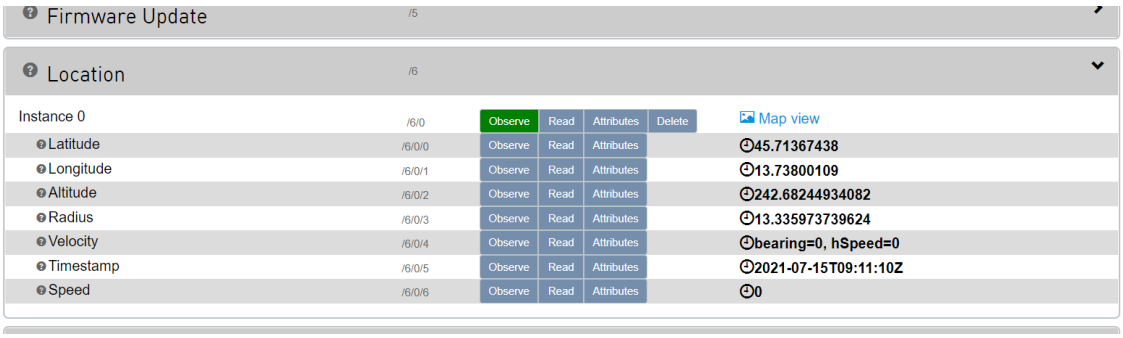

Figure 32: GPS fix

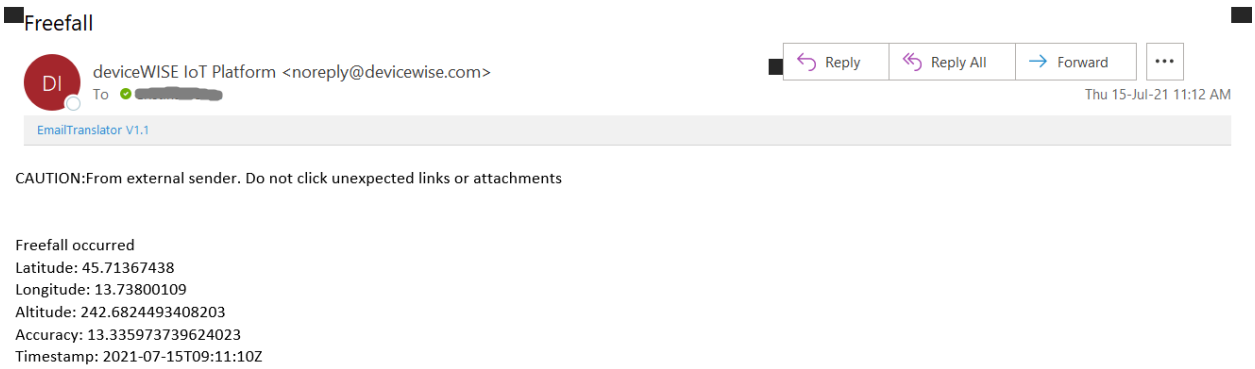

Figure 33: Email sent with the GPS coordinates

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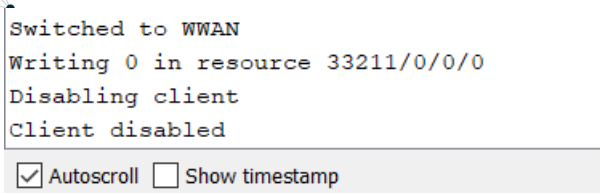

Figure 34: Execution flow (4)

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7.3. Safety Recommendations

Make sure the use of this product is allowed in your country and in the environment required. The use of this product may be dangerous and has to be avoided in areas where:

- it can interfere with other electronic devices, particularly in environments such as hospitals, airports, aircrafts, etc.
- there is a risk of explosion such as gasoline stations, oil refineries, etc. It is the responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conformed to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power saving mode.

The system integrator is responsible for the functioning of the final product. Therefore, the external components of the module, as well as any project or installation issue, have to be handled with care. Any interference may cause the risk of disturbing the GSM network or external devices or having an impact on the security system. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed carefully in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation.

The equipment is intended to be installed in a restricted area location.

The equipment must be supplied by an external specific limited power source in compliance with the standard EN 62368-1:2014.

The European Community provides some Directives for the electronic equipment introduced on the market. All of the relevant information is available on the European Community website:

https://ec.europa.eu/growth/sectors/electrical-engineering_en

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8. GLOSSARY

APN	Access Point Name – It's the gateway name between a GSM, GPRS, 3G or 4G mobile network and another computer network (usually the internet)
IMEI	International Mobile Equipment Identity- It's aunique number that is associated with all 2G-5G devices
IMSI	International Mobile Subscriber Identity- It's a unique number that is associated with all SIM cards
I/O	Input Output
JSON	JavaScript Object Notation- It's a text-based data interchange format designed for transmitting and storing structured data, both human readable and machine readable
LWM2M	LightWeight Machine to Machine- IoT application protocol designed for bidirectional communication between devices and a central server
PDP	Packet Data Protocol- It's a protocol that defines a specific data structure that allows the device to communicate using the Internet Protocol
RTC	Real Time Clock
SIM	Subscriber Identification Module
USB	Universal Serial Bus
URC	Unsolecited Result Code- It's the message returned by the mobile equipment (the modem) that is not a direct result of an AT command. It could be a soft interrupt or the response of an AT asynchronous command
XML	eXtendible Markup File- It's a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable
WWAN	Wireless Wide Area Network, is a form of wireless network usually associated to mobile bradband connection.

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9. DOCUMENT HISTORY

Revision	Date	Changes
1	2020-07-26	Initial revision

From Mod.0809 rev.3

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