



Telit IoT AppZone m2mb Software and API

Developer Guide

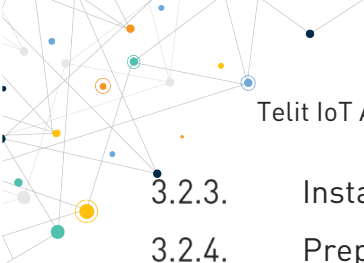
1VW0301746 Rev. 1 – 2021-11-04

APPLICABILITY TABLE

PRODUCTS
ME910C1 / ML865C1
ME910G1 / ME310G1 / ML865G1
LE910C1-EUX / LE910C1-SAX / LE910C1-SVX / LE910C1-WWX (ThreadX Environment)
LE910Cx (Linux Environment)
WE310F5

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1. INTRODUCTION

1.1. Scope

This document describes the AppZone IoT development environment for C and how to develop applications for Telit modules. It also provides an overview of commonly used architectures and how to leverage the computing resources of Telit Modules.

As a getting started guide, this document helps developers who are not familiar with the Telit software and hardware ecosystems in choosing the right development approach both in technical and technological terms. The m2mb API concept is introduced and a quick overview of the development lifecycle is presented with hands-on examples. Full references to Telit development resources and assets are provided along the document and listed in § 1.5.

1.2. Audience

This guide is intended for users who need to develop a custom application (M2M application) and run it on a Telit's module as an embedded application that uses the services provided by the module itself.

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.

1.4. Symbol Conventions

Table 1: 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.

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

1.5. Related Documents



Note/Tip: In the next pages the notation [x]/[y] is used to refer to documents of different modules. You have to see the document in accordance with the module you are using.

- [1] IoT AppZone Developer Resources <https://www.telit.com/developer-zone/iot-app-zone/>
- [2] Development and Evaluation kits <https://www.telit.com/developer-zone/>
- [3] Download Zone <https://www.telit.com/support-training/download-zone/>
- [4] IoT Connectivity Management solutions <https://www.telit.com/connectivity-solutions/>
- [5] LTE Cat. 1 Products contact page <https://contact.telit.com/Lte-cat1-4>
- [6] LTE Cat. M / NB-IOT Products contact page <https://contact.telit.com/nbiot>
- [7] Bravo Board Evaluation kit contact page <https://contact.telit.com/bravo>
- [8] Charlie Evaluation kit contact page <https://contact.telit.com/charlie-evaluation-kit>
- [9] 1V0301729 - Telit IoT AppZone IDE Software Developer User Guide
- [10] 80502ST10950A - LE910Cx AT Commands Reference Guide



2. PREREQUISITES

AppZone is software that allows to build and run applications on Telit cellular modules using a common set of Application Programming Interfaces and enabling for portability across the Telit Product Range.

IoT AppZone IDE is the integrated development environment for Telit products and is based on Eclipse IDE. Running on Windows and Linux, the IDE is bundled with a set of plugins based on the specific SDKs and environments to be used for software development.

You can start developing applications for Telit modules even if you do not own a Telit module yet.

Just install IoT AppZone 5 IDE and start developing. For further information please refer to AppZone developer Resources [1]

However for a full developer experience and to ensure everything works on the device, you need to acquire a development kit with updated firmware, a SIM with connectivity plan (for cellular modules), and hardware+software setup. Please check the following subsections for further details.

2.1. Telit Development Kit

Telit provides different development kits depending on the technology of choice and the module family.

Telit modems are equipped with a wide range of hardware interfaces and integrated components, depending on the variant and the family. Most of these resources are accessible through an Application Programming Interface (API). The following table represents an overview of the resources and the available applications.

Table 2: Resources.

Resources	Application
Operating System	Signals, Semaphores, Timers, Dynamic Memory Management, etc.
HW/SW	GPIO, I2C, UART, SPI, Keypad, Filesystem, RTC, etc.
GSM/GPRS	Communication services.
Networking	BSD socket support, SSL capabilities.

Please visit the [2] Development and Evaluation kits section to select the one that fits your need or contact Telit Technical support for advice (§1.3).

While Telit is constantly working to keep the software platforms aligned, meaning that the same code could work on different module families, it is recommended to develop your application software and run tests directly on the module of choice.

Also please consider that:

1. the same module may have country variants that differ in behavior, especially regarding cellular network attach lifecycle
2. the same module may perform differently when soldered on the final application device, please make sure you do the hardware design considering also the software requirements.



Note/Tip: C/C++ programming languages are used to develop the AppZone applications.

For further information on the actual capabilities of the module of choice please refer to the Getting started guide, Hardware user guide and Software user guide of the module of choice.

2.2. Latest Telit module firmware

Upon receiving the evaluation kit it is recommended to upgrade the modem to the latest firmware. Firmware is available under the Telit Download Zone[3] . Subscribe for free to get access to the latest documentation and resources.

Depending on the module family you can use:

1. a self-extracting-and-installing executable (Windows only), called TFI;
2. a firmware upgrade tool (Telit XFP), which is available also in bundle with Telit IoT AppZone IDE.

2.3. Cellular network connectivity

All Telit modules with modem functionality require a SIM card with an appropriate connectivity subscription to work. In several countries, for instance, an "IoT" plan is needed when connecting through a LTE Cat.M or NB-IoT modem.

Please make sure that on the local areas of your in-field deployment:

1. There is coverage for the specific technology
2. The SIMs are enabled to work with that specific technology either directly or in roaming



Tip: Telit provides a competitive connectivity offering that eases worldwide deployment, simplifies the management and reduces drastically the time to market of your IoT project. For further information please check Telit IoT Connectivity Management Solution [4] .

2.4. USB-Serial Terminal

All Telit development kits provide a USB port to control (and program) the module. Please make sure that you have the appropriate USB cable. On the USB, a serial connection (also mentioned as UART communication) is established.

Ensure you have the latest USB drivers: please download the *Telit_Modules_Linux_USB_Drivers_User_Guide* and the relevant drivers under Telit download zone [3]

2.5. Hardware setup

Please refer to the hardware of the specific evaluation kit you need.

2.5.1. ME910C1 / ML865C1

ME910C1 and ML865C1 are Cat.M/NB-IoT LTE modems, which feature different form factors with the same application processor. Depending on the variant and specific part number, various memory configurations are available. Please contact your sales representative to get an overview of the various possibilities and design your application accordingly.

The easiest way to start developing applications on ME910C1 / ML865C1 is to get a Bravo Evaluation board and, starting from the sample apps provided, kickstart your project on AppZone IDE with real use cases and deployment scenarios.

For further information check out Bravo board contact page featuring Telit ME910C1-WW Cat.M/NB-IoT module [7] or get one of the evaluation kits in the Cat.M / NB-IoT product range [6]

2.5.2. ME910G1 / ME310G1 / ML865G1

This device family features Cat.M / NB-IoT LTE modem technology with various form factors, while sharing the same application processor and different memory configurations based on the specific variant / part number.

Designed as a low power device with incredibly low footprint, memory resources are limited, and since GNSS and cellular share some blocks their utilization is mutually exclusive an arbitrator has been designed to ease the process of switching from cellular (WWAN) to GNSS and set the priorities according to the application use case. For further information please refer to Telit MEx10G1 / ML865G1 GNSS Application Note available in the Download Zone [3]

ME310G1 is the smallest Cat.M / NBIOT embedded module with customer application hosting in the market, now featuring also 450MHz band support.

The easiest way to start developing applications on ME310G1 is to acquire a Charlie evaluation board, equipped with Arduino and BMA400 motion sensor for rapid cellular IoT Prototyping. For further information check Charlie Evaluation kit contact page [8] . Alternatively please consider one of the evaluation kits in the Cat.M / NBIOT product range [6]

2.5.3. LE910Cx – Linux Environment (LE) and ThreadX)

If you are willing to develop on LE910Cx Cat.1 - Cat.4 evaluation board, please make sure you order both the Telit EVB Evaluation board plus the LE910Cx module interface (TLB) of your choice. Please make sure that you are ordering the correct family and regional variant.

LE910Cx devices come with two different operating systems:

- LE910C1-EUX -SAX -SVX and -WWX feature ThreadX OS and are mostly aligned, in terms of software capabilities and resources, with Cat.M/NBLoT families (e.g. ME310G1 and ME910C1);
- LE910Cx (LE) feature an optimized Linux embedded OS with User space access to development resources. Mostly suited for light routing applications and scenarios where a LTE gateway is needed, these devices feature also considerable amount of Flash memory for data logging and storage-demanding applications.

Contact our sales representative to get advice on the most suitable module, and to see if you qualify for a free kit, check the LTE Cat.1 Products contact page [5] .

2.6. Software setup

2.6.1. SimWISE - connectivity services

As a prerequisite for any LTE modem, a SIM with a valid subscription is needed to connect with Voice, SMS and data.

Based on industry standards for integrated SIM (iSIM) technology, Telit simWISE provides greater flexibility and functionality than a standard SIM card at a lower cost with added convenience.

For a practical example, please consider buying a Bravo evaluation kit with OneEdge and simWISE [7]



Warning: to develop *AppZone applications on ME310G1 / ME910G1 / ML865G1 with simWISE*, it is recommended to contact Technical support (see § 1.3) and receive guidance on how to optimize the resources.

2.6.2. OneEdge - IoT all-in-one platform suite

As IoT deployments grow in size and complexity, it becomes mandatory to manage the devices in the field, especially when equipped with cellular connectivity and spread on vast territories or worldwide.

As each device may require diagnostic checks, keepalive mechanism, troubleshooting tools, software updates and efficient data delivery, building a system that addresses all these concerns at once is a costly and risky business that may delay time-to-market.

Telit OneEdge is an award-winning, complete software suite with tools, device management and data orchestration platforms, agents, and drivers that provide ready-to-connect capabilities out of the box.

With the embedded Telit simWISE technology, OneEdge features five core components that provide an all-in-one solution to your mobile IoT challenges:

- Edge logic
- Connectivity service and management
- Enterprise Integration
- Centralized device management
- Embedded security

For a practical example, please consider buying a Bravo evaluation kit with OneEdge and simWISE [7] and check “Bravo Getting Started OneEdge”.

2.6.3. AppZone IDE

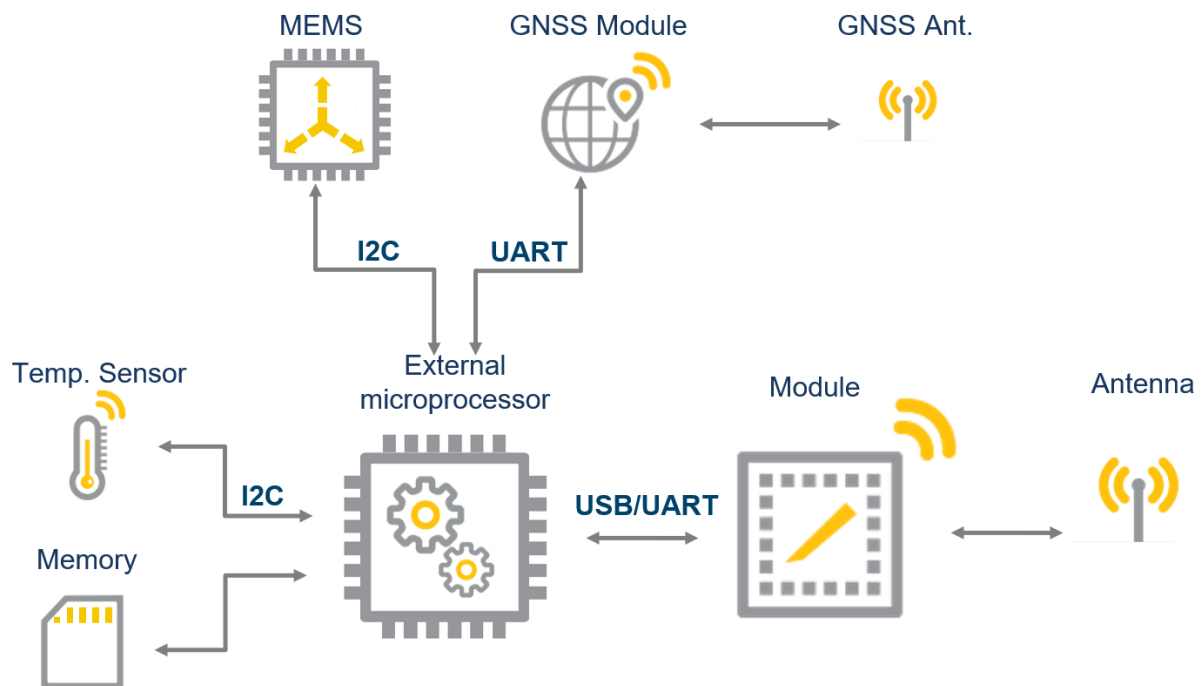
As part of the OneEdge software suite, you have the possibility to run Telit-m2mb based applications directly on-module and integrate your solution with the OneEdge Agent APIs. To achieve this, Telit provides IoT AppZone IDE - Integrated Development Environment that enables developers to perform in all stages of software development lifecycle.

Please check IoT AppZone Developer Resources [1] to download IoT AppZone IDE and browse the available software resources and assets.

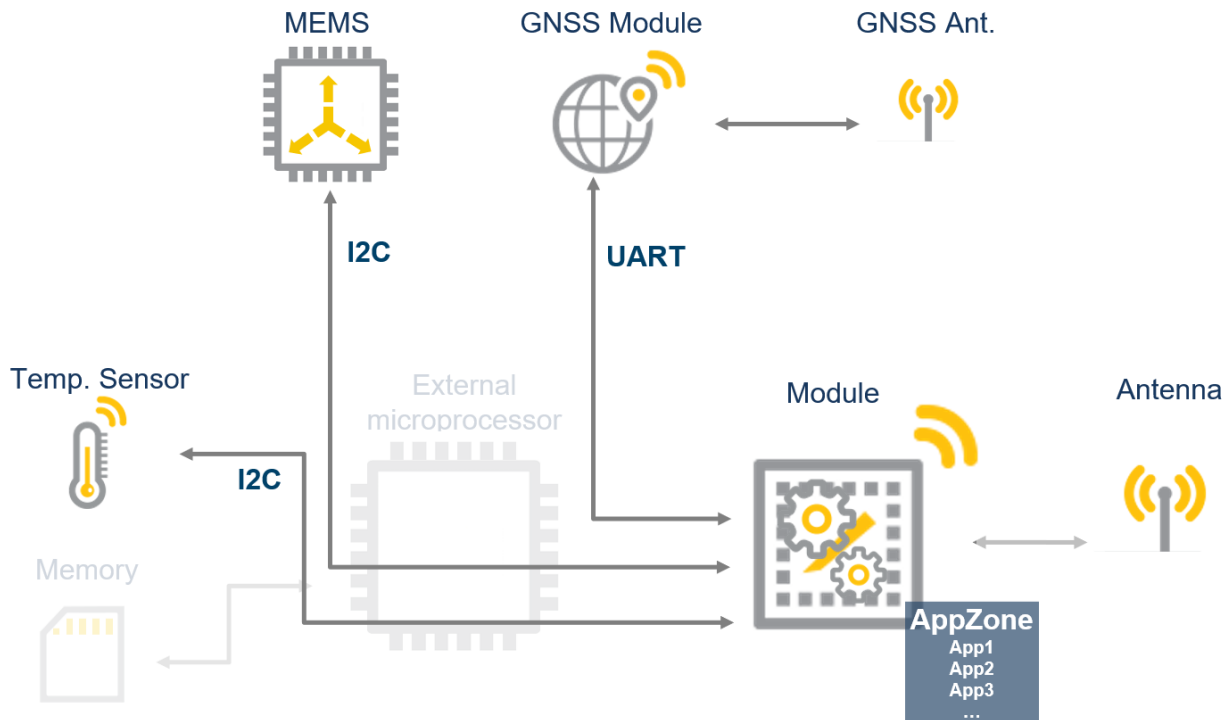
3. DEVELOP APPLICATIONS ON MODULES USING M2MB API

3.1. System architectures

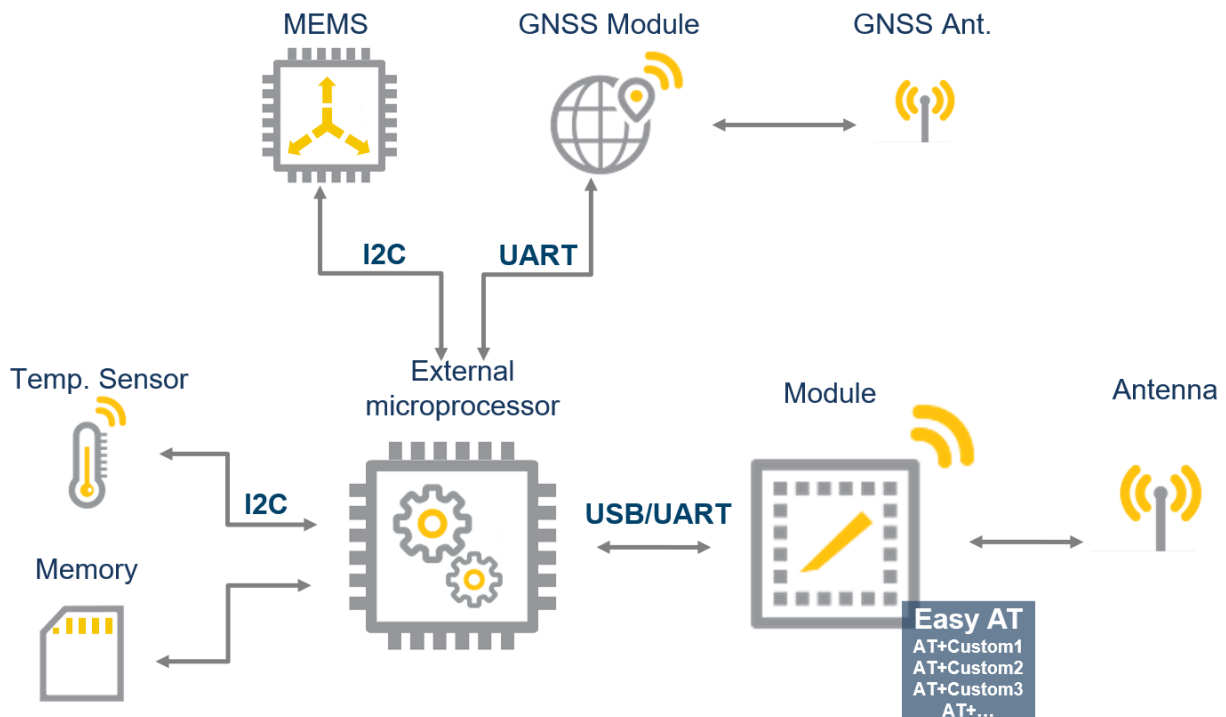
3.1.1. Dedicated MPU / MCU and Telit modem with AT interface



3.1.2. On-module application (hostless mode)



3.1.3. Mixed / distributed application (with Easy AT™ command interface builder)



3.2. Application Development with m2mb

You can develop and build applications for your Telit Module using m2mb API on Telit IoT AppZone IDE 5. Please check [1] AppZone developer resources to download and install AppZone IDE 5 and read the Telit IoT AppZone IDE Software Developer User Guide [9] before installing.

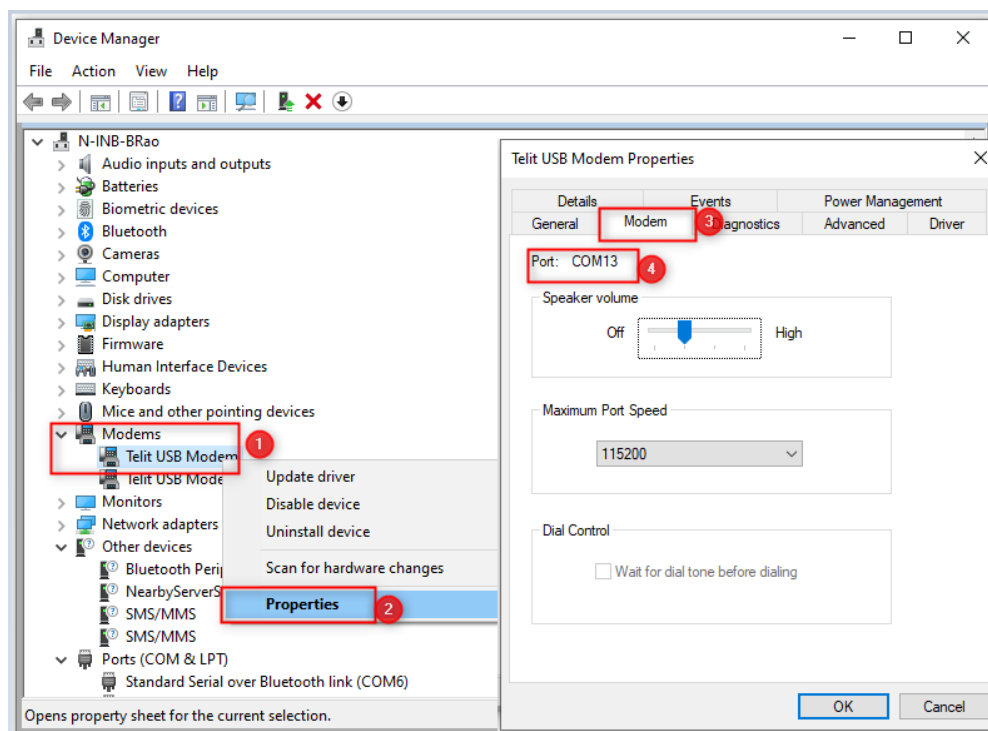
3.2.1. Build and run an AppZone application using AppZone IDE

Please refer to Telit IoT AppZone IDE Software Developer User Guide [9] and specifically to § 8.1 to perform the upload and run operation directly from the IDE.

Alternatively, you can use Telit AT Controller (TATC) or other terminal consoles to perform the deploy and configuration of your AppZone application: please see the following sections.

3.2.2. Set Up Telit AT Controller connection

Check the device manager for the port connection, as seen in the following figure:



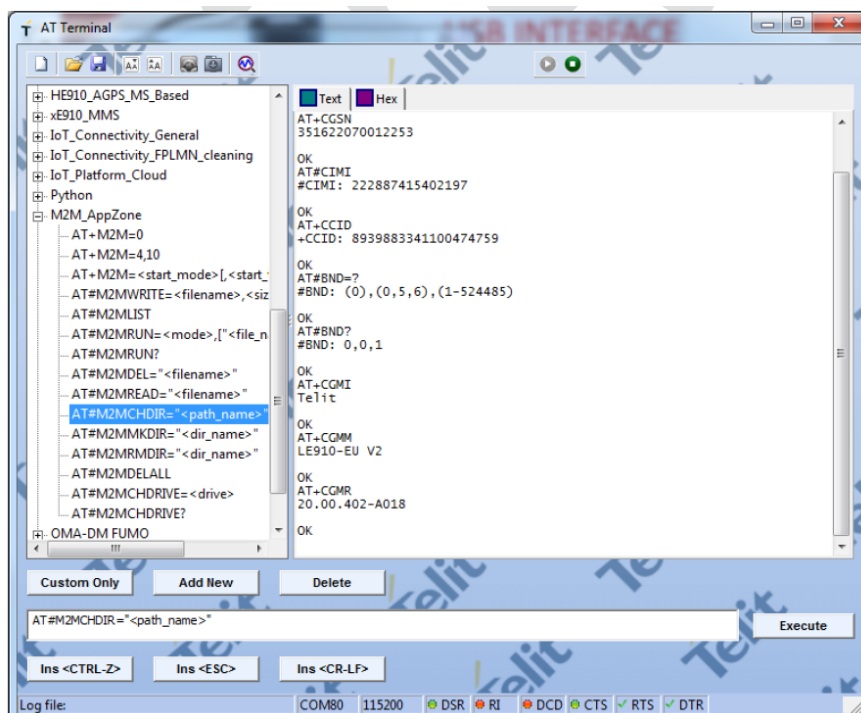
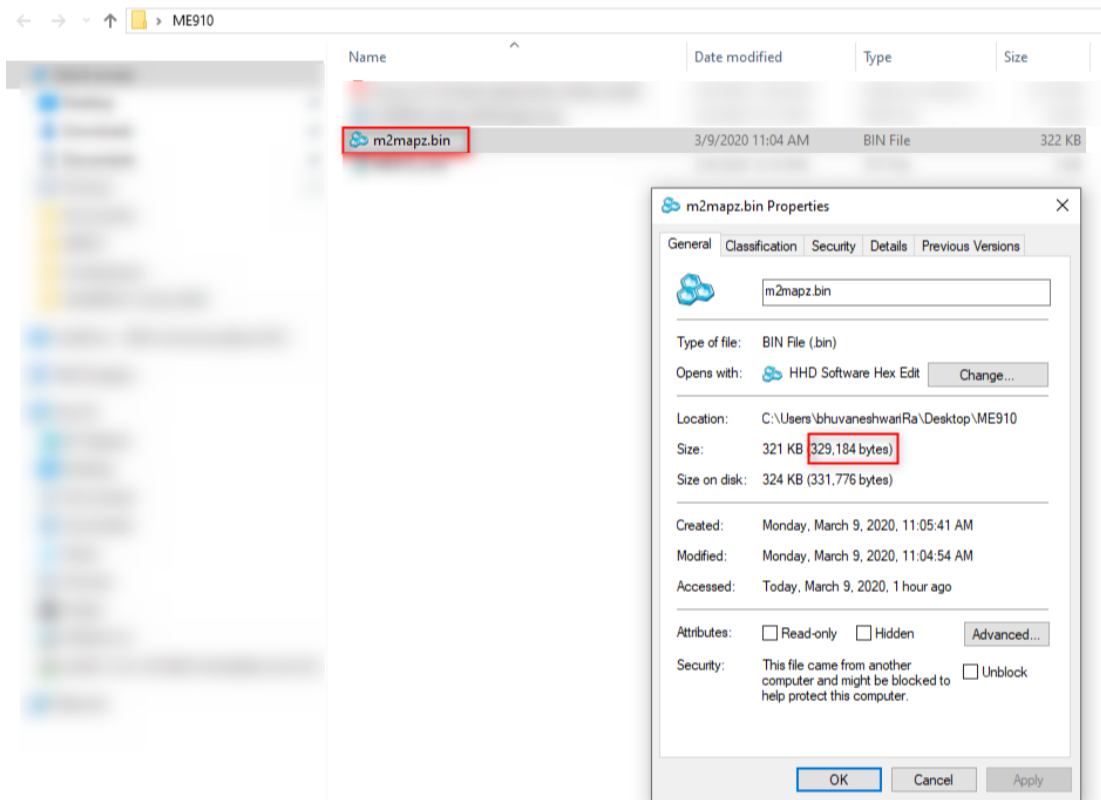
Open Telit AT Controller (TATC) tool (available in [1] or embedded in the IoT AppZone IDE), connect to the USB of the target module, and go to the tab M2M_AppZone as shown below:



Alternatively open a Tera Term session and connect to the COM port you identified

3.2.3. Install AppZone application

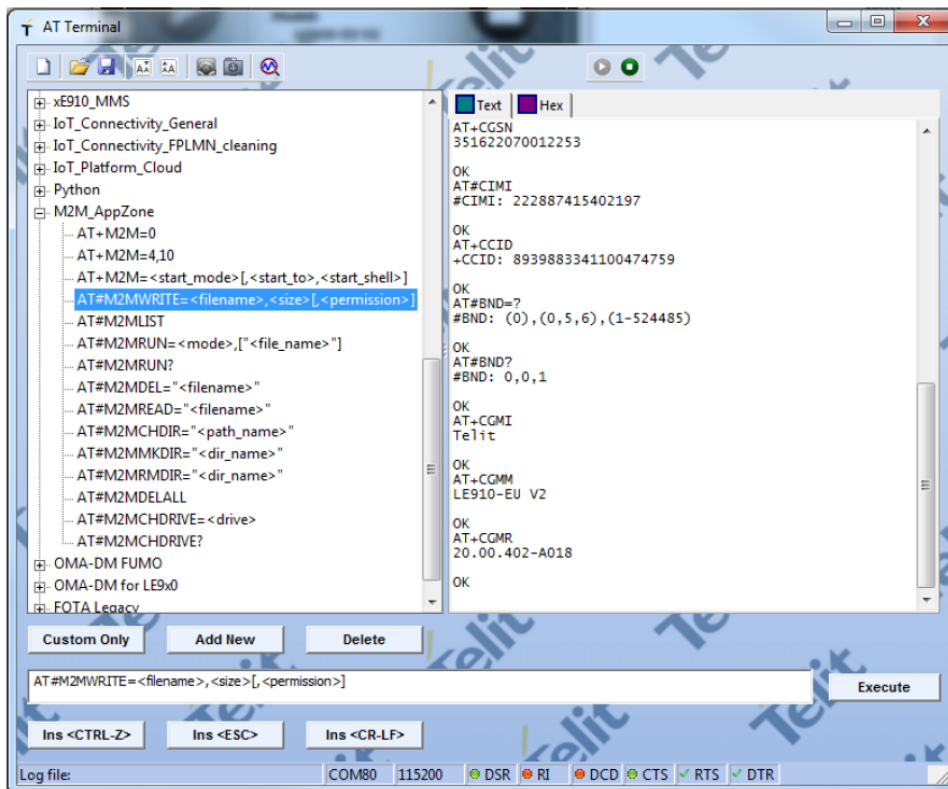
Use the file browser, go to the folder where the application file (e.g. `m2mapz.bin`) is located and right click on the bin file and take note of the file size in bytes, as seen in the following figure (Windows):



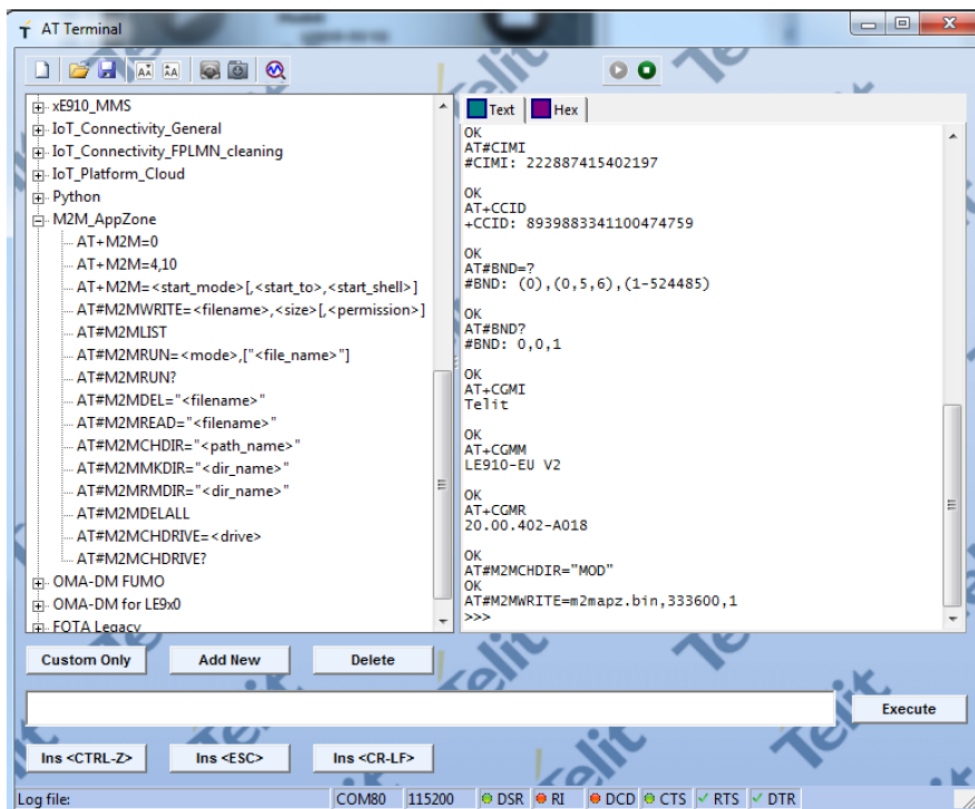
Issue the AT command `AT#M2MCHDIR="MOD"`. This will move to the MOD directory of the file system (like the DOS "chdir" command).

Issue `AT#M2MWRITE=<file name>, <size>, <permission>`

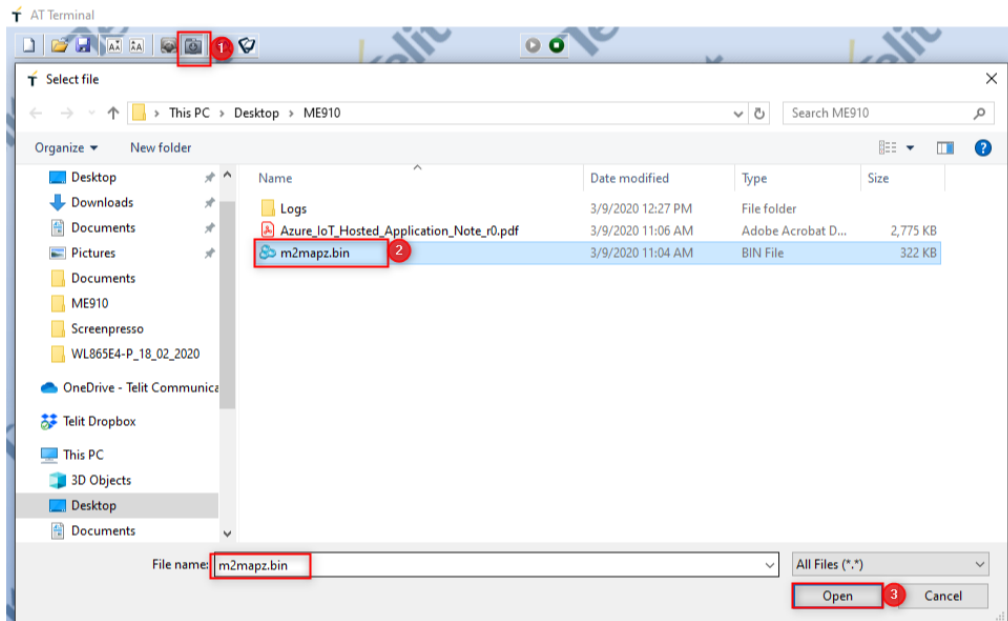
In this example `AT#M2MWRITE="m2mapz.bin", 329184, 1`



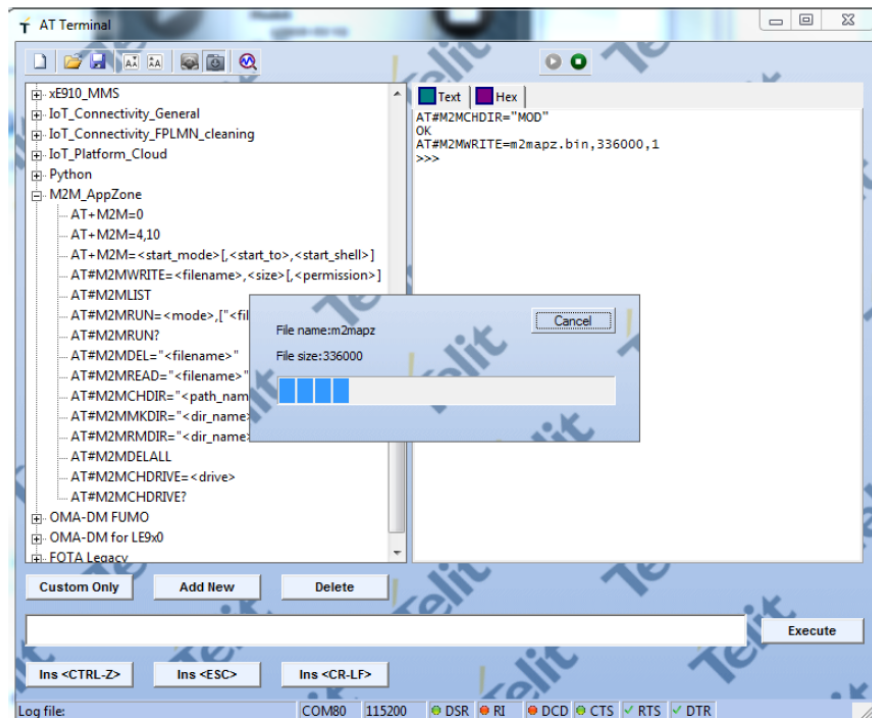
After executing `AT#M2MWRITE` command, a `>>>` prompt will be displayed:



Click the transfer button highlighted in red in the following figure and select the AppZone application to upload to the target module. Click Open button and the transfer will start.



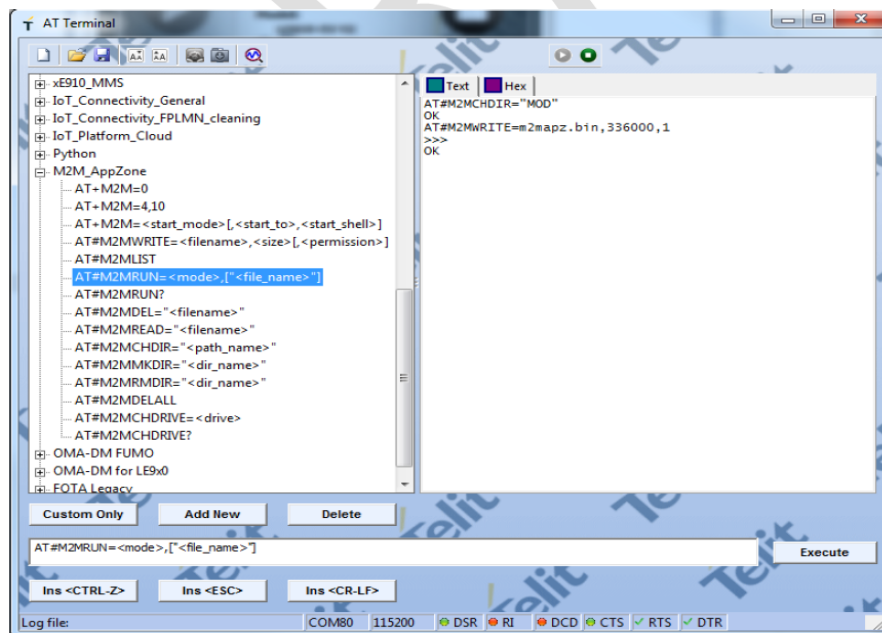
The transfer pop-up will appear



To check that the application binary has been correctly transferred, issue `AT#m2mlist` and check if the file size corresponds to the one read on the PC, in the current example it should be 329184

3.2.4. Prepare Application to run at next reboot

Now, AppZone application must be set to start at the next start-up: issue `AT#M2MRUN=2, <filename>`, in the example is `AT#M2MRUN=2,m2mapz.bin`:



On the open Terminal session and issue the command

AT#REBOOT

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4.1. Copyrights and Other Notices

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4.3. 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

5. GLOSSARY


Table 3: Acronym List.

ADC	Analog – Digital Converter
CLK	Clock
CMOS	Complementary Metal – Oxide Semiconductor
CS	Chip Select
DAC	Digital – Analog Converter
DTE	Data Terminal Equipment
ESR	Equivalent Series Resistance
GPIO	General Purpose Input Output
HS	High Speed
HSDPA	High Speed Downlink Packet Access
HSIC	High Speed Inter Chip
HSUPA	High Speed Uplink Packet Access
I/O	Input Output
MISO	Master Input – Slave Output
MOSI	Master Output – Slave Input
MRDY	Master Ready
PCB	Printed Circuit Board
RTC	Real Time Clock
SIM	Subscriber Identification Module
SPI	Serial Peripheral Interface
SRDY	Slave Ready
TTSC	Telit Technical Support Centre
UART	Universal Asynchronous Receiver Transmitter
UMTS	Universal Mobile Telecommunication System
USB	Universal Serial Bus
VNA	Vector Network Analyzer
VSWR	Voltage Standing Wave Ratio
WCDMA	Wideband Code Division Multiple Access

6. DOCUMENT HISTORY


Table 4: Document History.

Revision	Date	Changes
1	2021-11-04	First issue



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