

**LoRaMoteConfig
User Guide**

Revision History

Version	Date	Changes and/or Modifications
Rev 1.2	December 2016	Update with the Mote II requirements
Rev 1.1	Novmber 2015	Modifications to reflect Release 1.1 of the utility
Rev 1.0	July 2015	New document

Contents

Revision History	2
1. Scope.....	4
2. Installation.....	5
2.1 Prerequisite	5
2.2 Step 1: Install LoRaMoteConfig	6
2.3 Step 2: Install STM VCP Drivers	6
2.4 Step 3: Upgrade the Firmware	7
2.4.1 LoraMote Firmware Upgrade.....	7
2.4.2 Mote II Firmware Upgrade	8
2.5 Step 4: Connect to the Utility	8
3. LoRaMoteConfig Functionality.....	9
3.1 Saving and Restoring Parameters	9
3.2 Activation Tab	9
3.3 MAC Layer Tab	10
3.4 Channel Tab	11
3.5 Application Tab	12
3.5.1 Sensors GPS Demo.....	12
3.5.2 GPS Tracking Demo.....	13
3.5.3 Radio Coverage Tester.....	13
3.5.4 Compliance Test	14

1. Scope

The goal of this document is to describe the use of the PC utility named “LoRaMoteConfig”.

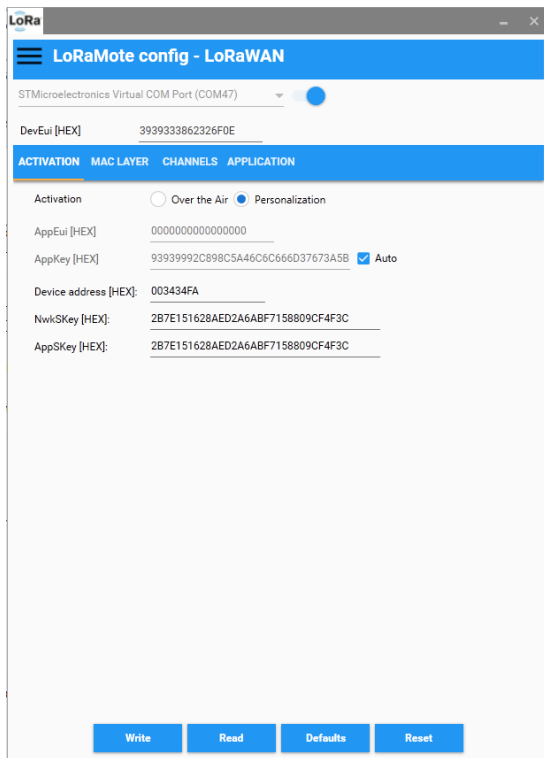


Figure 1-1: LoRaMote Config Welcome Screen

LoRaMoteConfig is useful to control PHY, MAC and application-related parameters of the firmware running in the LoRaMote. Examples:

- Change channels
- Change activation method (personalization or activation over the air)
- Change the application, for instance a GPS tracker demo or a coverage test demo

2. Installation

2.1 Prerequisite

Please download the latest LoRaMoteConfig installer file from the Semtech web repository.

The requirements are:

- a Personal Computer running Windows 7 (tested), Windows 8 (untested) or Windows 10 (untested)
- ST Microelectronics Virtual Com Port (VCP)
- DfuSe drivers for bootloader mode, this is only needed for the LoRa Mote
- Microsoft .NET Framework 4.5 installation is automated and described below.

As far as hardware is concerned, Semtech's (or IMST's) LoRaMote and Mote II are supported:



Figure 2-1: LoRaMote



Figure 2-2: Mote II

2.2 Step 1: Install LoRaMoteConfig

Double click the installer “LoRaMoteConfigSetup.exe” and follow the on-screen instructions. The .NET Framework will be installed automatically if not already present on the machine. The required material is available in the installation directory:

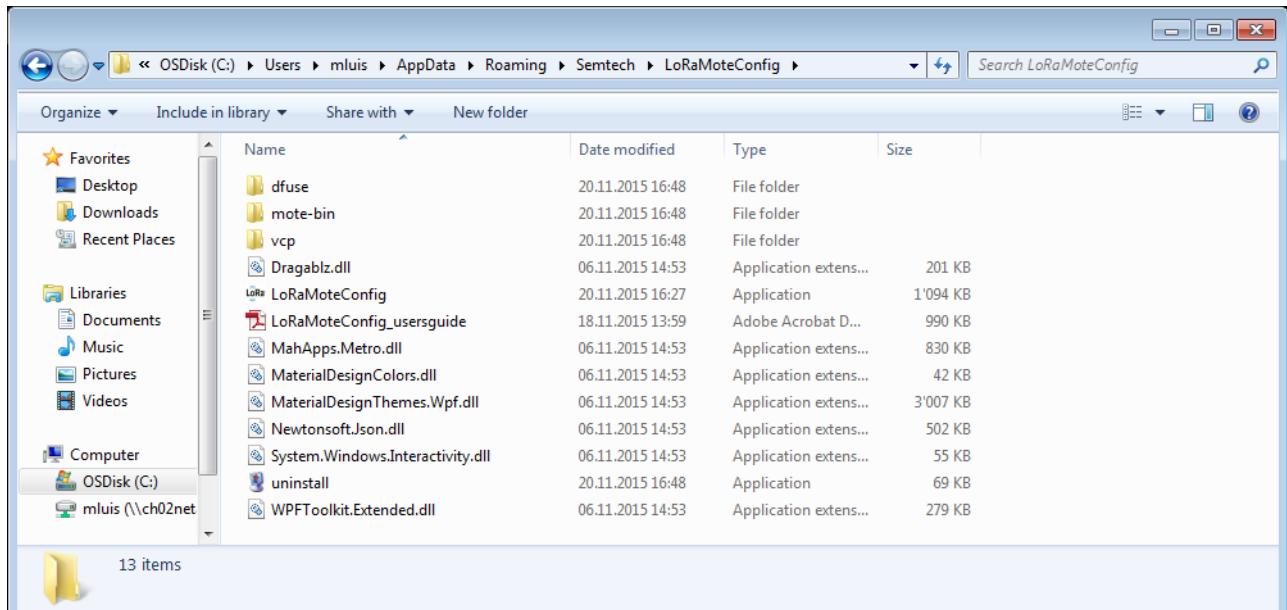


Figure 2-3: Installation Directory

2.3 Step 2: Install STM VCP Drivers

In order to establish connection between the LoRaMote and LoRaMoteConfig, a serial communication must be established. Simply navigate to “vcp” in the installation sub-folder, and launch “VCP_V1.4.0_Setup.exe”

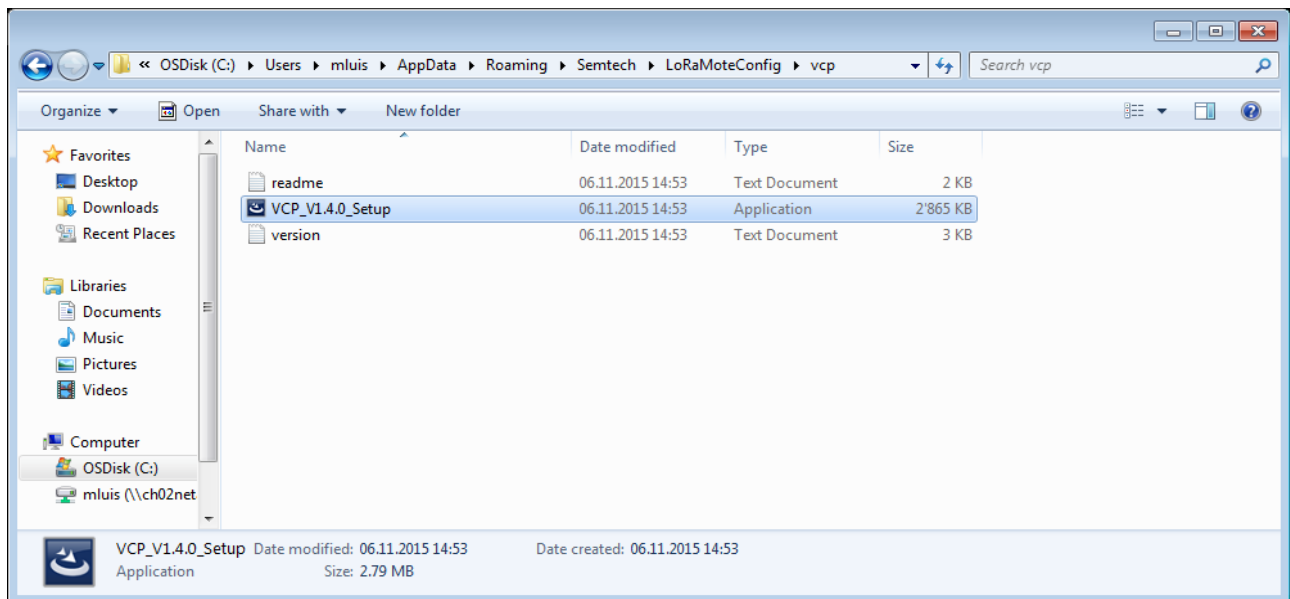


Figure 2-4: VCP Installation

2.4 Step 3: Upgrade the Firmware

2.4.1 LoraMote Firmware Upgrade

2.4.1.1 Install the DfuSe 3.0.5 Utility in the LoRaMote

- This utility is required to re-flash the LoRaMote without the use of a JTAG programmer. Simply navigate to the /dfuse subdirectory, double-click “DfuSe_Demo_V3.0.5_Setup.exe” and follow the on-screen instructions.
- Launch “DfuSeDemo.exe”
- The device will appear in the “Available DFU and compatible HID Devices” drop-down list, select it
- Select both offered options, as below:

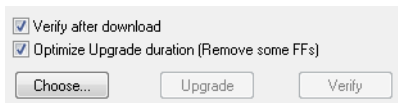


Figure 2-5: DfuSe Programming Options

- With the “Choose” button, navigate to the “mote-bin” sub-folder and select the binary file, “LoRaMoteConfig-eu868.dfu”

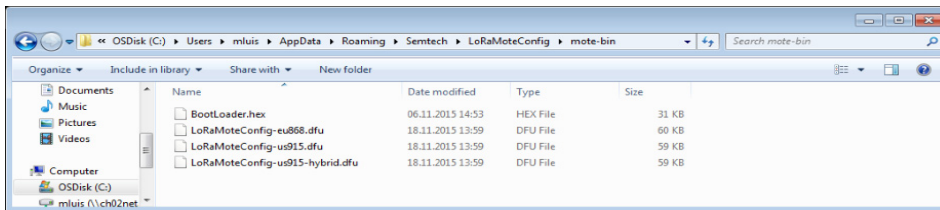


Figure 2-6: Firmware DFU File Location

- A warning message will be displayed when the “Upgrade” button is hit, select “OK”

The firmware of the LoRaMote is now up-to-date, and compatible with the installed version of LoRaMoteConfig PC utility.

2.4.1.2 Upgrade the Firmware in the LoRaMote

The LoRaMote needs to be set in bootloader mode:

- Remove its USB cable (or turn it off with the slide switch, ensuring there is no battery inside)
- Pinch the PCB-etched RF antenna



Figure 2-7: Press the Antenna to Enter Bootloader Mode

- Power-up the mote by connecting back the USB cable
- Observe the three LEDs flashing at a one second interval which indicate the platform is now in bootloader mode. If the three LEDs are not flashing, then the process must be done again as there was an issue with the detection of the finger on the sensor antenna

Note: if the LEDs do not flash, it is certainly because the Bootlader is not installed on the device. A binary file "Bootloader.hex"; provided in the same directory, should be flashed onto the device. To this end, the enclosure should be opened, and a JTAG programmer such as ST's STLink can be used

2.4.2 Mote II Firmware Upgrade

- Select the file "MotellConfig-eu868.bin", copy and paste it into the disk created "Mote_II"
- The LED will blink red and green alternatively, and when the upgrade is finished it will stay green
- Press the reset button
- The unit will display "Mote II"

2.5 Step 4: Connect to the Utility

The LoRaMote shall now be connected to the PC, and a Virtual Com Port will be assigned when the driver is installed.

Note: the COM port number can be looked-up from Windows Device Manager

From the Windows start menu, launch LoRaMoteConfig.exe, and select the appropriate COM port number from the List:

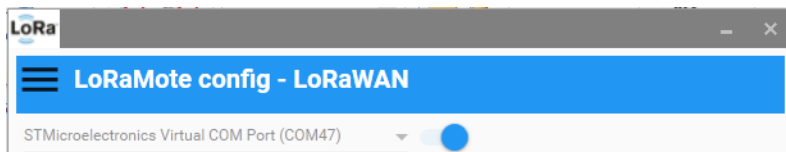


Figure 2-8: Connect the LoRaMote to LoRaMoteConfig

Once this is done, hit the blue button, and the node is now connected to the application.

3. LoRaMoteConfig Functionality

Most parameters related to the implementation of a sensor connected to a LPWAN network following the LoRaWAN R1.0 specification, can be modified by the PC application for later use in a stand-alone fashion. They are stored in the E2PROM of the host microcontroller.

3.1 Saving and Restoring Parameters



Figure 3-1: Control buttons

- Write: Writes the current configuration to the EEPROM
- Read: Reads the current configuration from the EEPROM
- Defaults: Resets the configuration to its default values
- Reset: Resets the LoRaMote. The new configuration is only applied once the LoRaMote has been reset.

3.2 Activation Tab

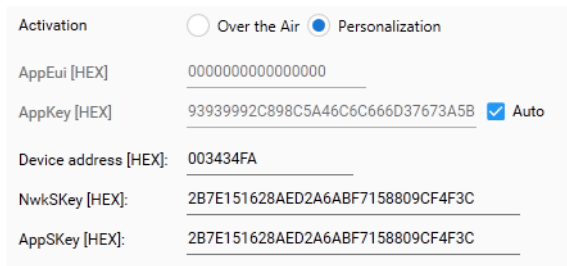
A screenshot of a web-based configuration interface for the 'Activation' tab. At the top, there are two radio buttons: 'Over the Air' (unselected) and 'Personalization' (selected). Below this are several input fields for hexadecimal values: 'AppEui [HEX]' with value '0000000000000000', 'AppKey [HEX]' with value '93939992C898C5A46C6C666D37673A5B' and a checked 'Auto' checkbox, 'Device address [HEX]:' with value '003434FA', 'NwkSKey [HEX]:' with value '2B7E151628AED2A6ABF7158809CF4F3C', and 'AppSKey [HEX]:' with value '2B7E151628AED2A6ABF7158809CF4F3C'.

Figure 3-2: Activation Tab

Activation method (OTAA or Personalization) can be selected here. Depending on the chosen method, parameters can be modified:

- OTAA: AppEUI and AppKey. An automatically-calculated AppKey is proposed to simplify the process, and will be unique to each DevEUI
- Personalization: AppSKey and NwkSKey can be programmed here

3.3 MAC Layer Tab

ACTIVATION	MAC LAYER	CHANNELS	APPLICATION
Tx power:	14		dBm
ADR:	<input type="radio"/> ON <input checked="" type="radio"/> OFF		
Datarate:	DR_SF12		
Channel mask [HEX]:	01FF		
Transmission redundancy:	1		
EU868 PHY duty cycle:	<input checked="" type="radio"/> ON <input type="radio"/> OFF		
Network type:	<input checked="" type="radio"/> Public <input type="radio"/> Private		
RX2 CHANNEL			
Frequency:	869.525		MHz
Datarate:	DR_SF9		
Receive delay 1:	1.0		s
Receive delay 2:	2.0		s
Join accept delay 1:	5.0		s
Join accept delay 2:	6.0		s

Figure 3-3: MAC Layer Tab

All parameters related to the MAC Layer are controlled here. Remarks:

- ADR should be turned off for the testing of mobile sensors
- Transmission redundancy indicates how many times the same unconfirmed packet should be repeated (same FCnt)
- EU868 PHY Duty Cycle enforcement can be temporarily turned off, in instances where a large number of packets must be send over a short period of time
- Network Type selects the type of SyncWord used for the LoRa packets, i.e. 0x12 for “Private Networks” and 0x34 for “Public networks”

3.4 Channel Tab

Up to 16 channels can be defined, edited, enabled or disabled. The “Load” and “Save” buttons can be used to save and duplicate a channel line-up into multiple LoRaMotes. The channel definition is stored in an JSON ASCII file which can be easily transported and edited with any text editor.

ACTIVATION MAC LAYER CHANNELS APPLICATION							
ID	FREQUENCY [MHZ]	DR MIN	DR MAX	BAND			
0	868.1	DR_SF12	DR_SF7	868-868.6 MHz DC-1%	Edit	Disable	
1	868.3	DR_SF12	DR_SF7	868-868.6 MHz DC-1%	Edit	Disable	
2	868.5	DR_SF12	DR_SF7	868-868.6 MHz DC-1%	Edit	Disable	
3	868.85	DR_SF12	DR_SF7	868.7-869.2 MHz DC-0.1%	Edit	Disable	
4	869.05	DR_SF12	DR_SF7	868.7-869.2 MHz DC-0.1%	Edit	Disable	
5	869.525	DR_SF12	DR_SF7	868.4-869.65 MHz DC-10%	Edit	Disable	
6	0.0	DR_SF12	DR_SF12	865-868 MHz DC-1%	Edit	Disable	
7	0.0	DR_SF12	DR_SF12	865-868 MHz DC-1%	Edit	Disable	
8	0.0	DR_SF12	DR_SF12	865-868 MHz DC-1%	Edit	Disable	
9	0.0	DR_SF12	DR_SF12	865-868 MHz DC-1%	Edit	Disable	
10	0.0	DR_SF12	DR_SF12	865-868 MHz DC-1%	Edit	Disable	
11	0.0	DR_SF12	DR_SF12	865-868 MHz DC-1%	Edit	Disable	
12	0.0	DR_SF12	DR_SF12	865-868 MHz DC-1%	Edit	Disable	
13	0.0	DR_SF12	DR_SF12	865-868 MHz DC-1%	Edit	Disable	
14	0.0	DR_SF12	DR_SF12	865-868 MHz DC-1%	Edit	Disable	
15	0.0	DR_SF12	DR_SF12	865-868 MHz DC-1%	Edit	Disable	

Load Save

Figure 3-4: Channel Tab

3.5 Application Tab

Four applications are currently implemented:

- Sensor GPS demo: the Mote reports back, at pre-defined intervals, information from the set of sensors, along with its GPS coordinates
- GPS Tracking demo is a slight variation, where the FRMPayload size is reduced by removing most of the sensor information, except compressed GPS coordinates
- Radio Coverage Tester allows to systematically test Packet Success Rate over a pre-defined number of packets
- Compliance Test incorporate a basic "Echo" application which can be used to test the protocol (Semtech tool)

3.5.1 Sensors GPS Demo

When this application is selected the LoRaMote sends the frames to port 2 and they are formatted as follows:

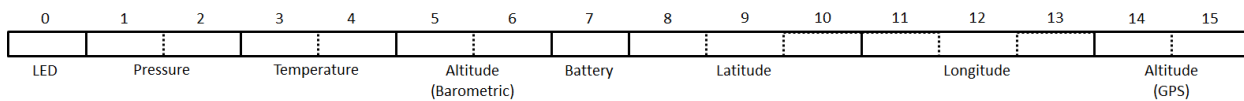


Figure 3-5: Sensors GPS Demo Frame

Table 3-1: Frame fields description

Frame field	Conversion	Variable type
LED	0: OFF 1: ON	unsigned 8 bits
Pressure	hPa/10	unsigned 16 bits
Temperature	°C * 100	signed 16 bits
Altitude (Barometric)	m * 10	signed 16 bits
Battery	0 The end-device is connected to an external power source. 1..254 The battery level, 1 being at minimum and 254 being at maximum 255 The end-device was not able to measure the battery level	unsigned 8 bits
GPS Latitude & Longitude	The GPS latitude and longitude fields encode the geographical location as follows: <ul style="list-style-type: none"> • The north-south latitude is encoded using a signed 24 bit word where -2^{23} corresponds to 90° south (the South Pole) and 2^{23} corresponds to 90° north (the North Pole). The equator corresponds to 0. • The east-west longitude is encoded using a signed 24 bit word where -2^{23} corresponds to 180° west and 2^{23} corresponds to 180° east. The Greenwich meridian corresponds to 0. 	signed 32 bits
GPS Altitude	meters	signed 16 bits

3.5.2 GPS Tracking Demo

When this application is selected the LoRaMote sends the frames to port 4 and they are formatted as follows:

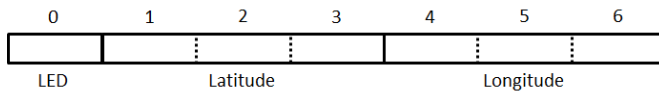


Figure 3-6: GPS Tracking Demo Frame

3.5.3 Radio Coverage Tester

This application enables the Packet Error Rate measurement on all available channels at 3 different data rates for each of the selected site. All participating gateways log every incoming packets into a CSV file which can be later analysed by Semtech in order to generate the report.

Note: This test doesn't rely on GPS

The LoRaMote sends the frames to port 15 and they are formatted as follows:

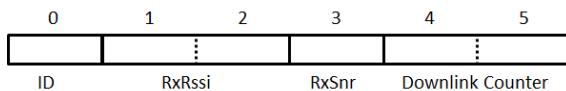


Figure 3-7: Radio Coverage Tester Frame

Table 3-2: Frame fields description

Frame field	Conversion	Variable type
ID	Represents the test site identification	unsigned 8 bits
RxRssi	Uplink only always 0 Downlink activated represents the received RSSI in dBm	signed 16 bits
RxSnr	Uplink only always 0 Downlink activated represents the received SNR in dB	signed 16 bits
DownlinkCounter	Uplink only always 0 Value incremented each time a downlink happens	unsigned 16 bits

Before doing the tests one must define the test sites. From experience each test site takes in average 10 minutes. So, do not plan more than 30 sites for a day else it becomes unmanageable.

Test procedure:

- Go to first site
- Set the "ID" field to 0 and "Number of packets" field to 15
- Reset the LoRaMote
- The end device led starts to blink fast at first then slower, each blink corresponds to one frame transmitted
- Take a picture of the site and write down in the log book the site position and characteristics. This is compulsory to be able to repeat accurately the test later on at exactly the same location and also to generate the report.

-
- When the LED stops blinking the test is over.
 - Go to second site and set the "ID" field to 0
Note: Changing the "ID" field number with each site is capital. It enables the script later on to separate which data comes from which site.
 - Repeat the procedure as much as necessary to cover all selected sites.
 - At the end of the test, log onto each gateway and recover all the packet-logger files. All those files can be placed in the same directory on the PC. There might be several log files because the packet-logger closes the log file every 30 minutes and opens a new one each time to avoid losing all data in case of crash.
 - Zip the log directory and send it to *support_rf@semtech.com* for report generation.

3.5.4 Compliance Test

The compliance tests are part of the Sensors GPS Demo and GPS Traking Demo applications. These can be accessed using the port 224 as specified by the LoRaAlliance.

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