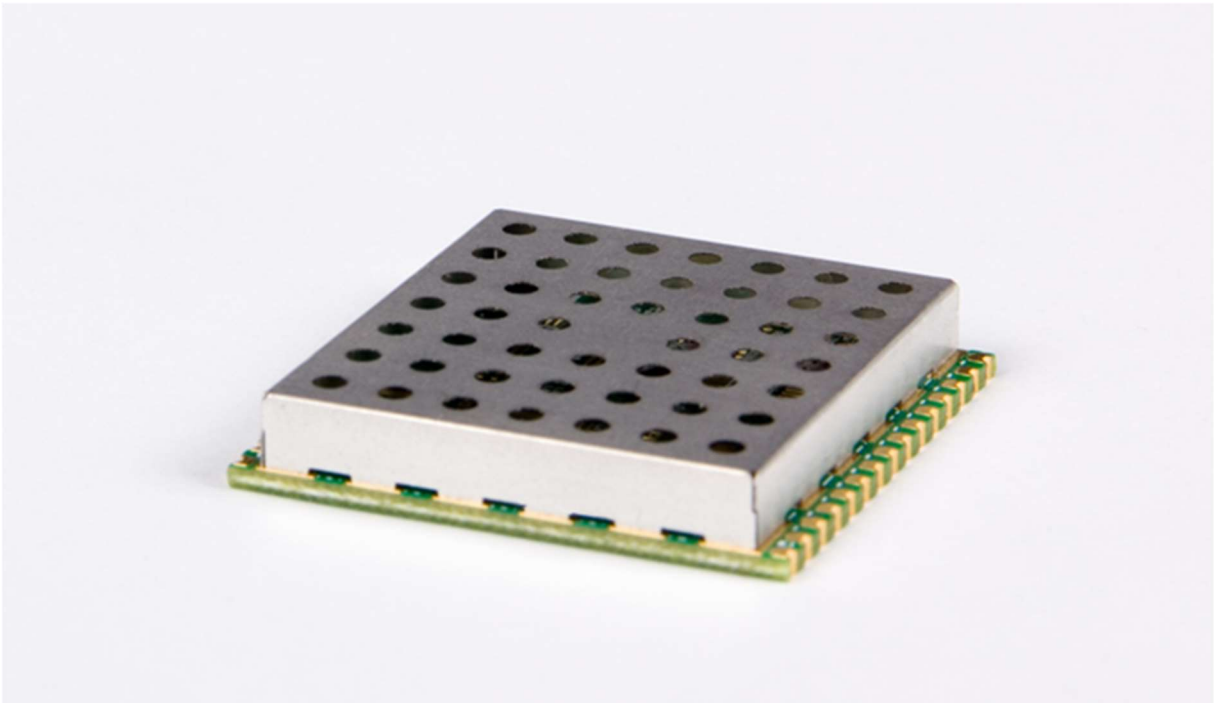

mURM ver. 2.0

UHF RFID Reader Module

Datasheet

Ver. 2.1

05/2018

TSS COMPANY s.r.o., Pod Rovnicami 41, 84104 Bratislava, Slovakia
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TSS COMPANY reserves the right to modify its products specifications without giving any notice. For up to date information please visit www.tsscompany.eu.

The information contained herein has been carefully checked and is believed to be accurate. However, no responsibility is assumed for inaccuracies.

Contents

1 Introduction

mURM module is an UHF RFID reader OEM module intended to be used in systems working with UHF RFID passive tags. The module supports all mandatory and some of the optional operations described in the EPCglobal UHF Class 1 Gen 2 specification. The module is characteristic of its small form factor, low power consumption and easy integration. These features make it ideal for embedded applications powered from a single USB port or from a battery.

The recommended way to start development with the mURM module is to use the mURM Evaluation Board. The mURM Evaluation Board has plenty of I/O pins, push buttons, LEDs, a buzzer and the possibility of communication via USB or RS232.

2 Regulatory statements

2.1 FCC:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/ TV technician for help

This device complies with Part 15 of the FCC. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This transmitter module is authorized to be used in other devices only by OEM integrators under the following conditions:

1. The antenna(s) must be installed such that a minimum separation distance of 3mm (in case of the antenna model DAE915R7865AGDZ1-T) or 15mm (in case of the antenna model DAE915R3540CGDD3-T) is maintained between the radiator (antenna) & user's/nearby people's body at all times.
2. The transmitter module must not be co-located with any other antenna or transmitter.

As long as the two conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

Note:

In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for reevaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user manual of the end product.

2.1.1 User Manual Requirement

The user manual for the end product must include the following information in a prominent location:

"To comply with FCC's RF radiation exposure requirements, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of <xx> mm is maintained between the radiator (antenna) & user's/nearby people's body at all times and must not be co-located or operating in conjunction with any other antenna or transmitter."

<xx> value can be found in the Table 11: Permitted antenna models based on the used antenna model.

AND

The transmitting portion of this device carries with it the following two warnings:

"This device complies with Part 15...."

AND

"Any changes or modifications to the transmitting module not expressly approved by TSS COMPANY s.r.o. could void the user's authority to operate this equipment" "

2.1.2 End Product Labelling

The final end product must be labelled in a visible area with the following:

"Contains Transmitter Module FCC ID: 2AK7JMURMV2"

or

"Contains FCC ID: 2AK7JMURMV2"

2.2 Industry Canada

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropic radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter [IC: 22603-MURMV2] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropic ally radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This device has been designed to operate with the antennas listed in Table 11: Permitted antenna models. Antennas not included in these lists are strictly prohibited for use with this device.

To comply with IC RF exposure limits for general population/uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 30mm (in case of the antenna model DAE915R7865AGDZ1-T) or 15mm (in case of the antenna model DAE915R3540CGDD3-T) from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

2.2.1 End Product labelling

The final end product must be labelled in a visible area with the following:

“Contains Transmitter Module IC: 22603-MURMV2”

or

“Contains IC: 22603-MURMV2”

2.3 Industrie Canada

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio [IC: 22603-MURMV2] a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur

Le fonctionnement de l' appareil est soumis aux deux conditions suivantes:

1. Cet appareil ne doit pas perturber les communications radio, et

2. cet appareil doit supporter toute perturbation, y compris les perturbations qui pourraient provoquer son dysfonctionnement.

Pour réduire le risque d'interférence aux autres utilisateurs, le type d'antenne et son gain doivent être choisis de façon que la puissance isotrope rayonnée équivalente (PIRE) ne dépasse pas celle nécessaire pour une communication réussie.

L' appareil a été conçu pour fonctionner avec les antennes énumérés dans les tables Table 11: Permitted antenna models. Il est strictement interdit de l' utiliser l' appareil avec des antennes qui ne sont pas inclus dans ces listes.

Au but de conformer aux limites d'exposition RF pour la population générale (exposition non-contrôlée), les antennes utilisés doivent être installés à une distance d'au moins 30 mm (DAE915R7865AGDZ1-T) ou 15mm (DAE915R3540CGDD3-T) de toute personne et ne doivent pas être installé en proximité ou utilisé en conjunction avec un autre antenne ou transmetteur.

2.4 Authorized Antennas

This device has been designed to operate with the antennas listed in Table 11: Permitted antenna models. Antennas not included in this list are strictly prohibited for use with this device.

3 Ordering Options

Table 1: Ordering options

EAN code	SKU	Description
8588005779029	mURM ver. 2.0 - E	mURM ver. 2.0 module compliant with ETSI standards
8588005779142	mURM ver. 2.0 - F	mURM ver. 2.0 module compliant with FCC standards

Warning: The module type must match the country/region of operating to comply with local laws and regulations. It is not allowed the use in different countries/regions from the one in which the device has been sold.

4 Technical specifications

Table 2: Technical specification

Frequency Band:	865 ÷ 868 MHz (ETSI EN 302 208 Ver. 3.1.1.) 902 ÷ 928 MHz (FCC part 15.247 / IC RSS-247)
Number Of Channels:	4 (compliant to ETSI EN 302 208 Ver. 3.1.1.) 50 (compliant to FCC part 15.247 / IC RSS-247)
RF Power Output:	max. 14 dBm
Antenna VSWR:	< 2:1
Antenna Impedance:	50 ohm
Air Interface Protocol:	EPCglobal UHF Class 1 Gen 2 Version 2.0.0 Supports tag vendor specific custom commands Supports NXP UCODE DNA
Modulation:	DSB-ASK
Tag Communication Rate:	40 kbps
Data Encoding Interrogator -> Tag:	PIE, Subcarrier Frequency 40kHz, Bit Rate 26.7 kbps (assuming equiprobable data)
Data Encoding Tag -> Interrogator:	FM0, Subcarrier Frequency 40kHz
Tag Read Rate:	Up to 50 tags/second
Tag Read Range:	Up to 1.5m, depending on antenna, tag and environment
Communication Interface:	UART (115200 b/s ,8,1,N,N)
Digital I/O:	9 configurable GPIOs (3.3V level)
Power Supply:	3.0 ÷ 3.5 V
Power Consumption:	max. 120mA (Continues TX)
Operating Temperature:	-20 °C do +55 °C
Package Type:	30 pin surface mount package SMT compatible
Dimensions:	38.1mm L x 38.1mm W x 6.68mm H

5 Pin Designation

Connections are made to the module using 30 edge connectors that allow the module to be surface mounted to a main board. Here is a top view of the module, showing the numerical interfaces of the module:

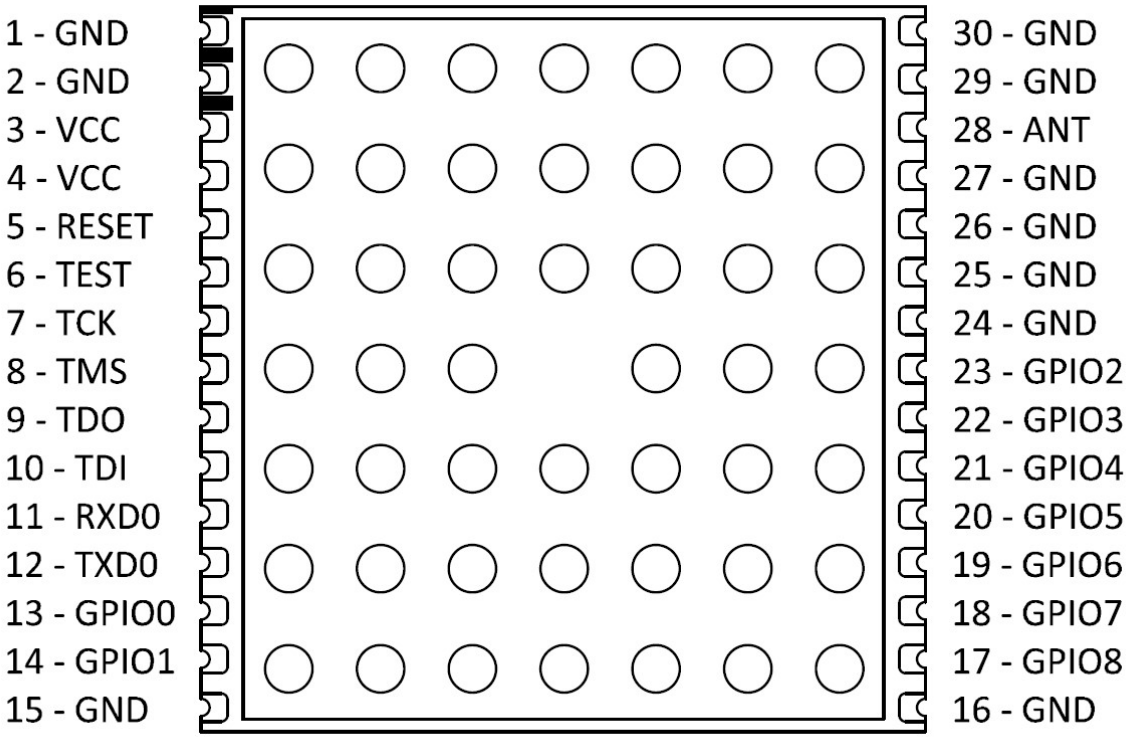


Figure 1: mURM ver. 2.0 module top view

Table 3: Pin descriptions

Pin Number	Pin Name	Description	Default Configuration
1	GND	Ground supply	-
2	GND	Ground supply	-
3	VCC	Power supply	-
4	VCC	Power supply	-
5	RESET	Reset input active low	-
6	TEST	JTAG signal (Test signal)	-
7	TCK	JTAG signal (Test signal)	-
8	TMS	JTAG signal (Test signal)	-
9	TDO	JTAG signal (Test signal)	-
10	TDI	JTAG signal (Test signal)	-
11	RXD0	UART signal RX (Input)	-
12	TXD0	UART signal TX (Output)	-
13	GPIO0	General-purpose digital I/O	Power LED
14	GPIO1	General-purpose digital I/O	Status LED
15	GND	Ground supply	-
16	GND	Ground supply	-
17	GPIO8	General-purpose digital I/O	Push Button
18	GPIO7	General-purpose digital I/O	Input
19	GPIO6	General-purpose digital I/O	Input
20	GPIO5	General-purpose digital I/O	Input
21	GPIO4	General-purpose digital I/O	Input
22	GPIO3	General-purpose digital I/O	Input
23	GPIO2	General-purpose digital I/O	Buzzer
24	GND	Ground supply	-
25	GND	Ground supply	-
26	GND	Ground supply	-
27	GND	Ground supply	-
28	ANT	RF antenna port (50 ohm)	-
29	GND	Ground supply	-
30	GND	Ground supply	-

6 Electrical Specifications

Table 4: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit	Conditions
Supply voltage VCC	2.7	3.7	V	
IO voltage	-	3.7	V	
RF input power	-	14	dBm	
Storage temperature	-55	150	ºC	

Table 5: Operating Conditions

Parameter	Min.	Typ.	Max.	Unit	Conditions
Supply	3.0	3.3	3.5	V	
Temperature	-20		55	ºC	

Table 6: Supply Current Specifications

Parameter	Typ.	Unit	Conditions
Active mode	120	mA	
Idle mode	7	mA	
Standby mode	0.8	mA	
Power Down mode	TBD	uA	No data retention

Table 7: Start-up and Wakeup Time

Parameter	Typ.	Unit	Conditions
Start-up Time	<500	ms	
Standby mode	<5	us	
Power Down mode	<500	ms	

Table 8: RF Receiver Specifications

Parameter	Min.	Typ.	Max.	Unit	Conditions
Frequency	865		868	Mhz	
Input impedance	-	50	-	Ω	
Antenna VSWR		< 2:1			
Rx sensitivity	-45	-50	-55	dBm	

Table 9: RF Transmitter Specifications

Parameter	Min.	Max.	Unit	Conditions
Tx Power	0	14	dBm	
Tx Power Error	-	1.5	dBm	
Frequency	865.7	867.5	MHz	ETSI version
	902.75	927.25	MHz	FCC version

Table 10: Digital Interface Specification

Parameter	Min.	Max.	Unit	Conditions
General Purpose I/O – Inputs and RESET Pin Parameters				
V_{IL}	0.75	1.65	V	
V_{IH}	1.5	2.1	V	
Hysteresis voltage	0.4	1	V	
Internal pull-up resistor	20	50	kΩ	If applied
Reset pulse width	5		us	
General Purpose I/O – Outputs Parameters				
V_{OH}	VCC-0.60	VCC	V	$I_{(OHmax)}$ = -15 mA
V_{OL}	VSS	VSS+0.60	V	$I_{(OLmax)}$ = 15 mA

Warning: The maximum total current, $I_{(OHmax)}$ and $I_{(OLmax)}$, for all outputs combined should not exceed ±100 mA to hold the maximum voltage drop specified.

7 Mechanical Specifications

In the drawings below the typical dimensions of the mURM module is shown. All dimensions are in millimetres (mm).

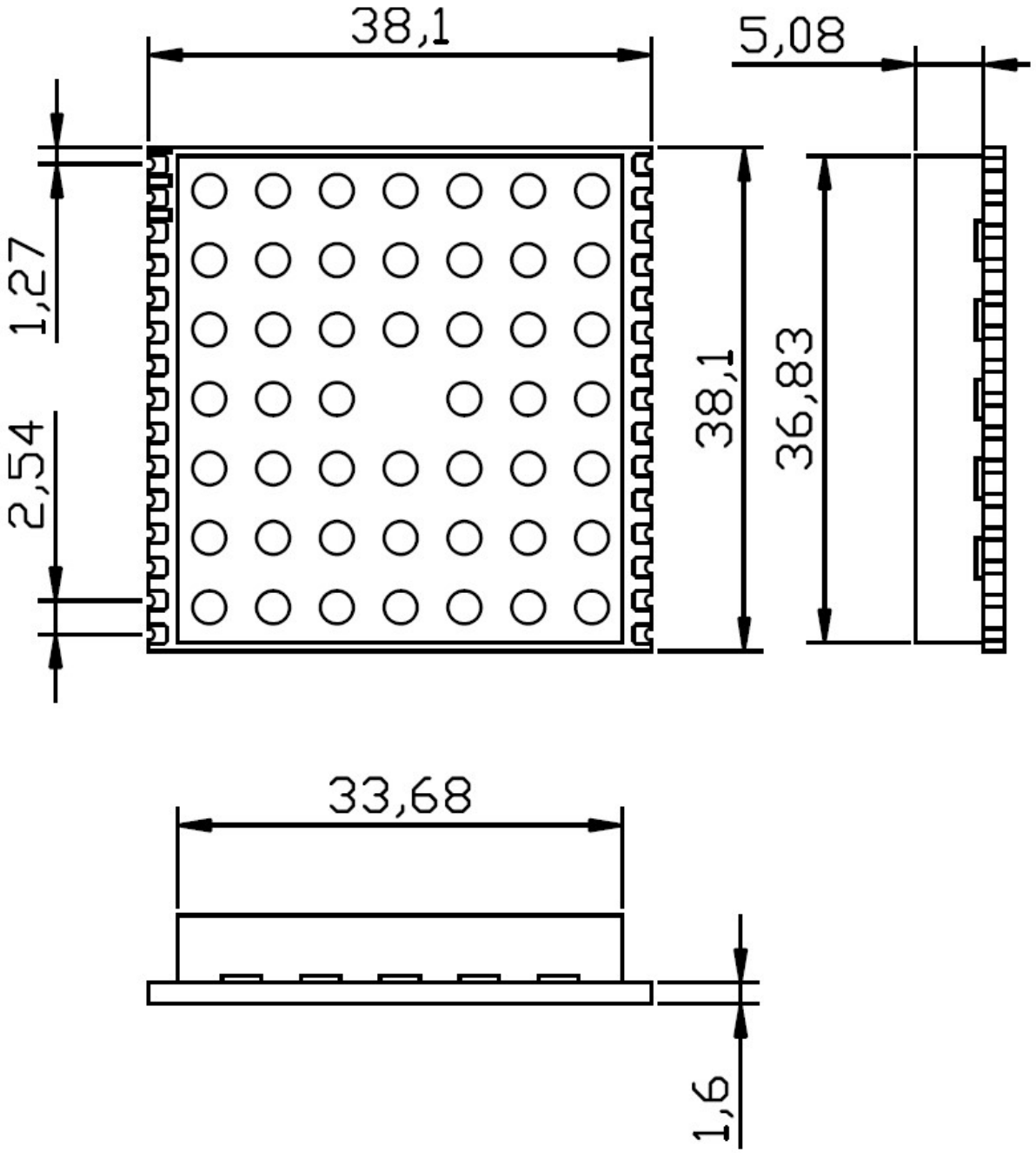


Figure 2: mURM ver. 2.0 dimensions (top and side views)

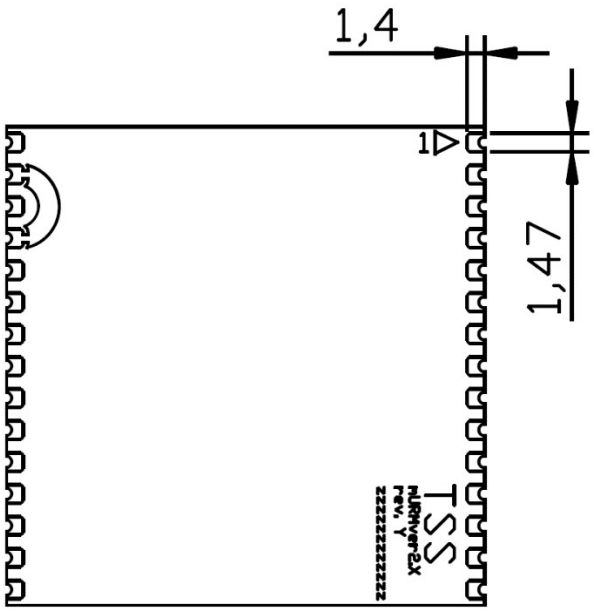


Figure 3: mURM ver. 2.0 dimensions (bottom view)

7.1 Recommended footprint

See the illustration below for the recommended footprint of the host board. All dimensions are in millimetres (mm).

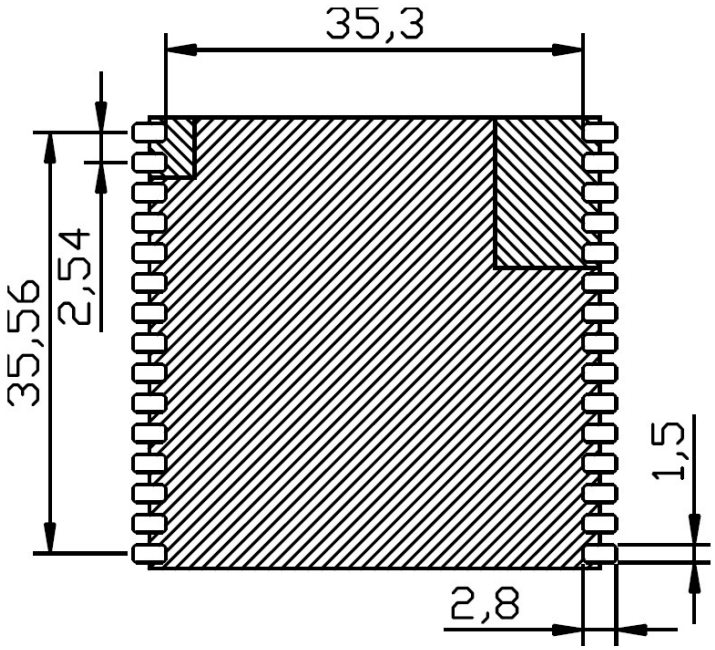


Figure 4: mURM ver. 2.0 recommended footprint

Warning: The area beneath the module should be kept clear of traces and copper.

8 Module connections

An example of a mURM ver. 2.0 connections for an embedded application is shown in Figure 5.

Required connections:

- VCC and GND are required to power the mURM ver. 2.0.
- ATN RF antenna port must be connected to the antenna.
- RXD0 and TXD0 provides an UART host communications to control the operation of the module.
- RESET pin resets the module when set low.

Recommended connections:

- TCK provides a failsafe backdoor to the built-in bootloader of the module microcontroller.
- GPIO0 indicates successful boot of the module. Connection to an LED provides a visual indication of whether or not an error condition exists.
- GPIO1 provides an indication when the module is performing an inventory round. Connection to an LED provides a visual indication.
- GPIO2 provides an indication when the module is inventorying tags. Connection to a buzzer provides an audio indication.
- GPIO8 can be used for a push button connection to allow the user to trigger an inventory rounds.

Optional connections:

- GPIO3 to GPIO7 or provide general purpose user-controlled digital I/O

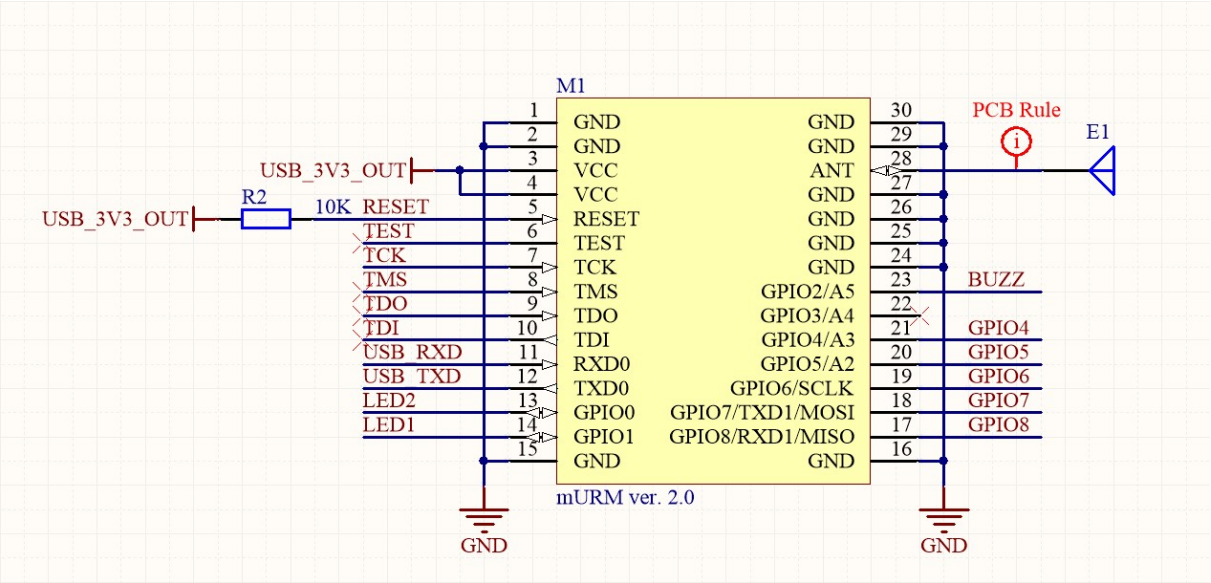


Figure 5: Default mURM ver. 2.0 connections

9 Antenna connection

mURM ver. 2.0 module has the surface mounted connection for the antenna (edge connector). This connector is used to interface to the RFID antenna system. The characteristic impedance of the RF antenna interface connector is 50 ohms nominal.

The following Table contains the permitted antenna models to be used with the mURM ver. 2.0 module:

Table 11: Permitted antenna models

Model	Type of antenna	Gain	Manufacturer	Minimum distance from human body
DAE915R7865AGDZ1-T	Patch antenna	4.5 dBi	TSS	30mm
DAE915R3540CGDD3-T	Patch antenna	1.5 dBi	TSS	15mm

The circuitry feeding the RF antenna port (ANT) of the mURM ver. 2.0 shall be optimized for connecting to a coplanar wave guide with ground plane beneath. The coplanar wave guide will have dimensions as shown in the following picture:

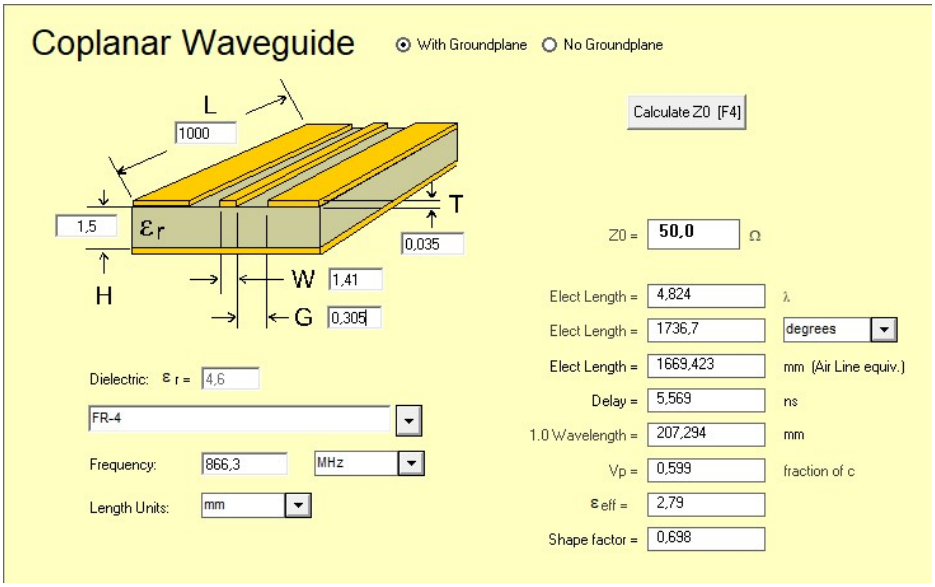


Figure 6: Example of coplanar wave guide dimensions calculation

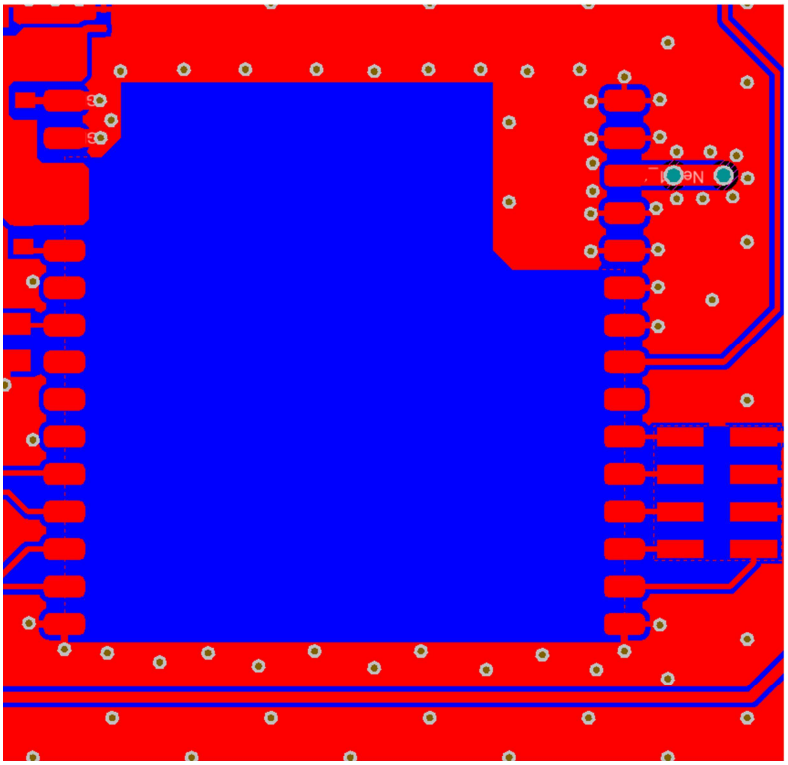


Figure 7 Example of mURM ver. 2.0 host board PCB layout

10 Firmware Upgrade

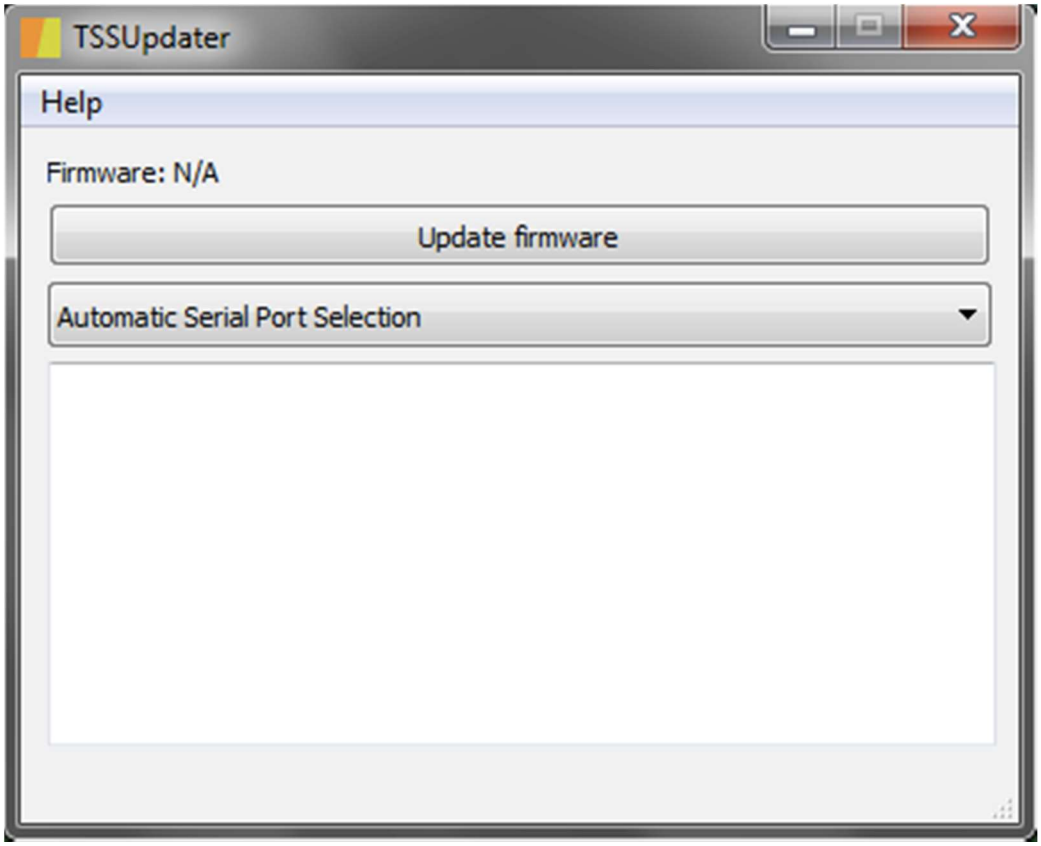
10.1 Installation

- Extract the contents of TSSUpdater.zip into the program directory.
- Double-click vcredist_x86.exe to begin the setup of Microsoft Visual C++ 2013 x86 Redistributable software package
- The setup program will guide you through the installation.
- Wait until Microsoft Visual C++ 2013 x86 Redistributable software package has been successfully installed.

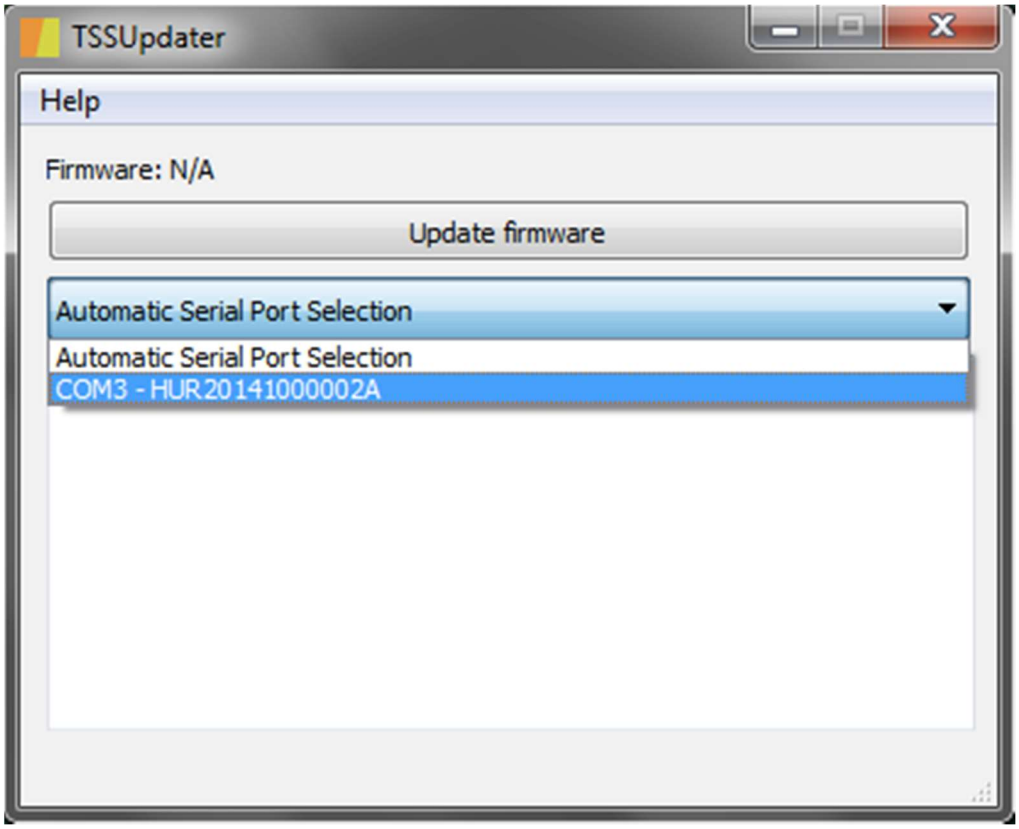
10.2 Firmware update

- Connect the device to a PC via a USB connection. (A USB to Serial driver has to be installed on the PC)

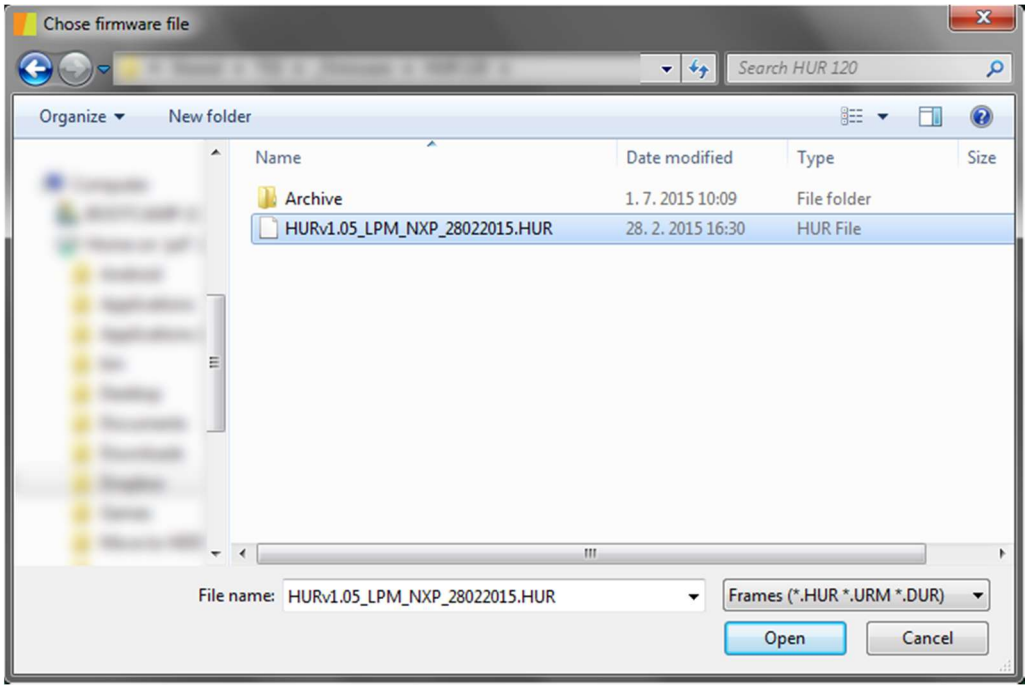
- Run TSSUpdater.exe from the program directory.



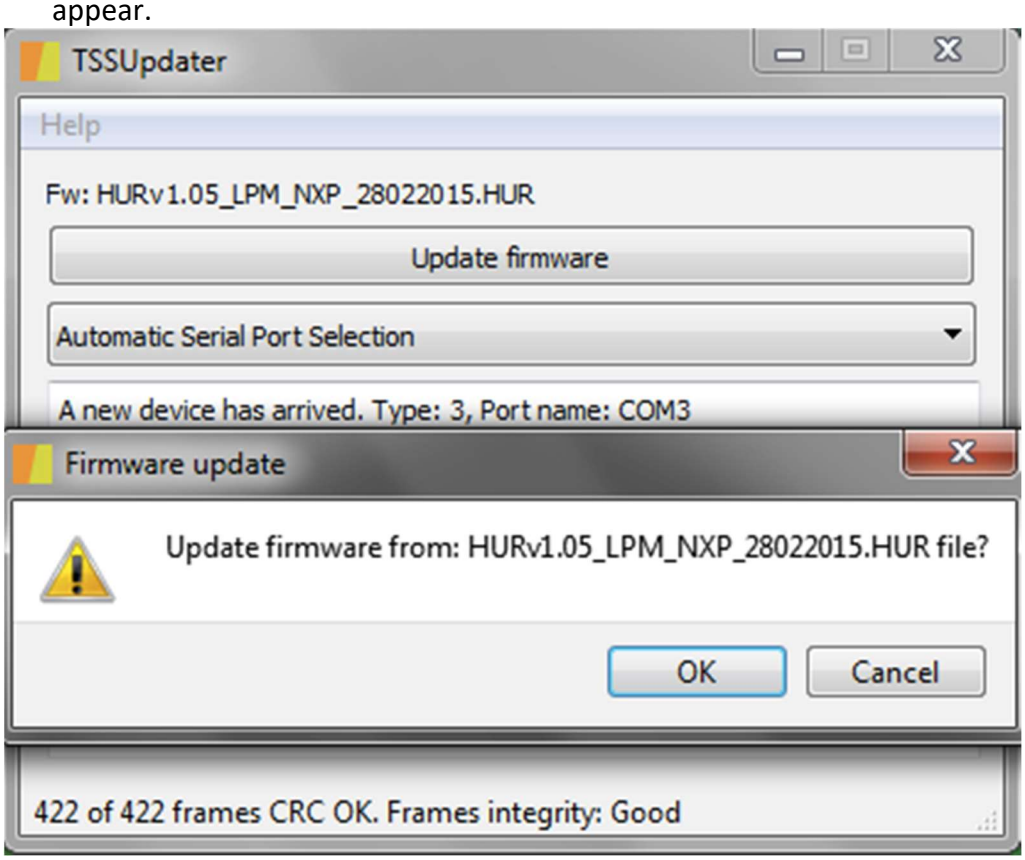
(Optional) If you want to update the firmware of the mURM module in a device other than HUR120, DUR120, or mURM Evaluation Board, please select the device from the combo box menu.



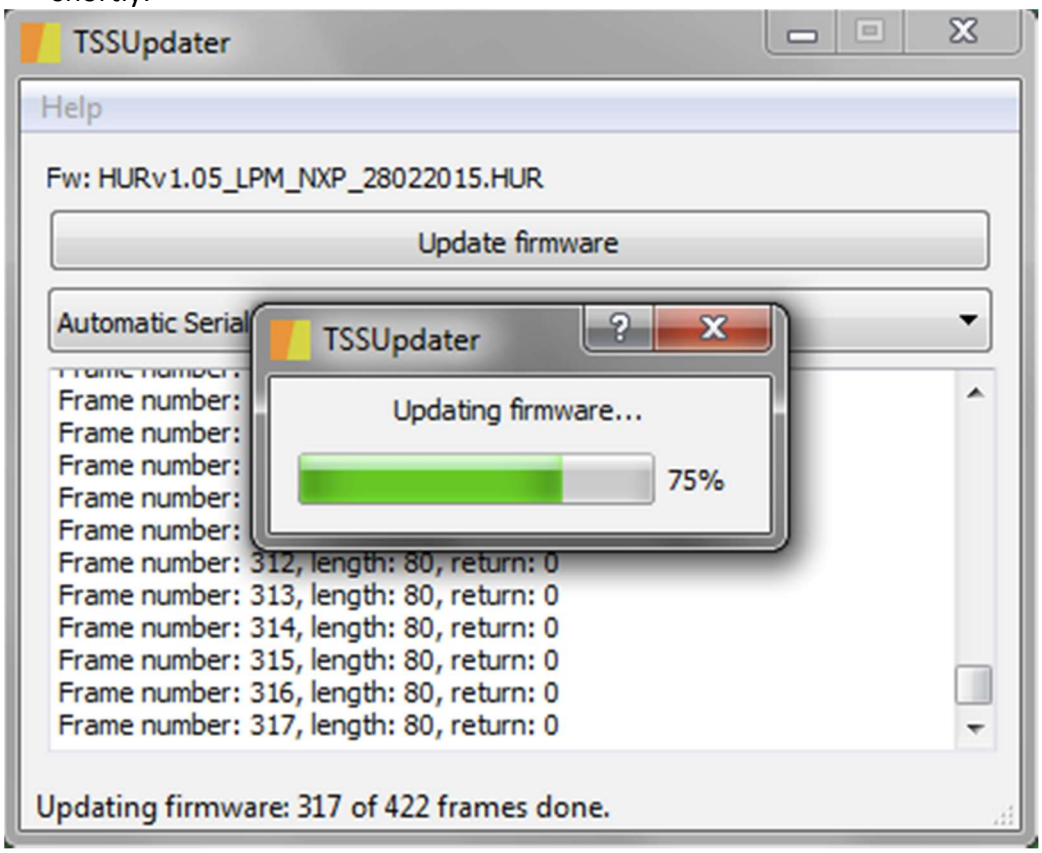
- Click the Update firmware button. The firmware file selection dialog will appear.



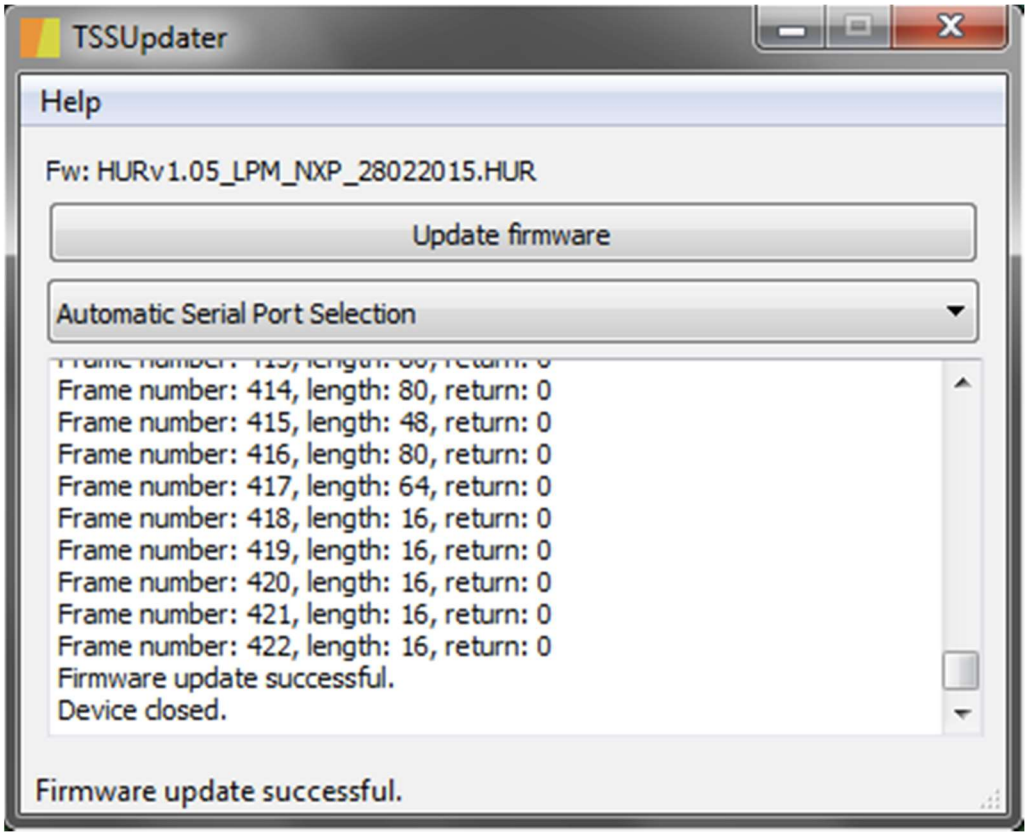
- Select the desired firmware file and click Open. The Update firmware dialog will appear.



- Click OK in the Update firmware dialog. The firmware update process will start shortly.



- Wait until the “Firmware update Successful” message appears in the status bar.



10.3 Troubleshooting

System Error
This error can occur if one of the required DLLs is missing from the program directory, or if the Microsoft Visual C++ 2010 x86 Redistributable software package is not installed.
Extract the contents of TSSUpdater.zip into the program directory and install the Microsoft Visual C++ 2010 x86 Redistributable software package.

Bad Frames integrity
This error can occur if the firmware file is corrupted.
Obtain a new copy of the firmware file.

Serial port error
This error can occur when opening a session while using a serial port.
Restart the application or unplug your device and plug it back in again.

Firmware update error
This error can occur if the device was accidently unplugged before the update process has finished or because of a communications error between the device and the connected computer.
Start the firmware update process again.

Error 33
This error can occur in the rare situation of the device firmware being faulty.

11 References

[1] EPCglobal Low Level Reader Protocol (LLRP), Version 1.1, Ratified Standard, October 13, 2010
http://www.gs1.org/sites/default/files/docs/epc/llrp_1_1-standard-20101013.pdf

[2] EPC Radio-Frequency Identity Protocols, Class-1 Generation-2 UHF RFID, Version 1.2.0
http://www.gs1.org/gsmp/kc/epcglobal/uhfc1g2/uhfc1g2_1_2_0-standard-20080511.pdf

[3] URMSP Serial Communication Protocol, Reference Manual, Ver. 1.2 (TSS_URMSP_ver1.2_15062015.pdf)

[4] TSSAPI-C Application programming interface, Developer's Guide, Ver. 1.3 (TSSAPI_1.3_Developer's_Guide.pdf)

[5] mURM Evaluation Board ver. 1.1, User Guide, Ver. 1.0 (mURM_Evaluation_Board_User_Guide_ver1.0.pdf)

[6] mURM Evaluation Board, ver. 1.1, rev. A, Schematic (mURM_Evaluation_Board_ver1.1_revA_Schematic.pdf)

12 Revision History

Version	Date	Description
1.0	10.7.2015	Initial version
1.1	20.4.2016	Added new Electrical and Mechanical Specifications
2.0	18.5.2018	FCC version added

Disposal of the product
Do not dispose of the product in municipal or household waste. Please check your local regulations for proper disposal and/or recycling of electronic products.