SIGFOX
Si868-25mW RF Module

User guide version V1.3
Software version V1.3

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Information

Document information	
Title	Si868_25mW SIGFOX module User guide
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This document applies to the following products

Name	Reference	Firmware version
Si868-25mW-RTU	ARF7764AA	V1.3

Disclaimer

Technical Support

Website

Our website contains many useful information : modules and stand alone products information, user guides, configuration software and technical documents which can be accessed 24 hours a day.

Email

If you have technical problems or cannot find the required information in the provided documents, contact our Technical Support by email. Use our dedicated email address (arf@adeunis-rf.com) rather than any personal email address of our staff. This makes sure that your request is processed as soon as possible.

Helpful Information when Contacting Technical Support

When contacting Technical Support please have the following information ready:

- Complete product type & reference (e.g. Si868-25mW - ARF7764AA),
- Firmware version (e.g. V1.3.0)
- Clear description of your question or the problem
- A short description of the application
- Your complete contact details

Modules REGULATORY CONSIDERATIONS

DECLARATION OF CONFORMITY

•Si868-25mw MHz module

We ADEUNIS RF
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declare under our own responsibility that the products

Name SIGFOX Si868-25mW
Reference ARF7764AA

to which this declaration refers conforms with the relevant standards or other standardising documents:

- EN 300 220-2 (V2.3.1) (2010-02)
- EN 60950-1 (2001) + A11 (2004)
- EN62311 (2008)
- EN301 489-1 (v1.8.1) (2008-04)
- EN 301 489-3 (v1.4.1) (2002-08)

According to the RTTE Directive 99/5/EC

Notes:

- According to the 1999/519/EC «RF signal» recommendations, a minimum distance of 10cm between the product and the body is required.
- Receiver class (if applicable): 2

- Usage restrictions : It is the user responsibility to be sure that the configuration and use of the NB868 module fulfill all the requirements of Rec 70-03 (describing in annex 1, frequency bands, g, g1, g2, g3 or g4) . In certain cases, you may need to notify the final equipment to European administrations. Adeunis RF can assist you on regulatory aspects

Crolles, January 6th, 2015 VINCENT Hervé - CEO

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Environmental recommendations

All superfluous packaging materials have been eliminated. We have done everything possible to make it easy to separate the packaging into three types of materials: cardboard (box), expanded polystyrene (filler material) and polyethylene (packets, foam protective sheets). Your device is composed of materials that can be recycled and reused if it is dismantled by a specialist company. Please observe local regulations concerning the manner in which waste packaging material, used batteries and your obsolete equipment are disposed of.

Warnings

Valid for SIGFOX modules with the following references: ARF7764AA

Read the instructions in the manual.

The safety of this product is only guaranteed when it is used in accordance with its purpose.
Maintenance should only be carried out by qualified persons.

Please note, do not install the equipment close to a heat source or in damp conditions.

Please note: for your own safety, you must ensure that the equipment is switched off before carrying out any work on it.

Please note: For your safety, the power supply circuit must be SELV (Safety Extra Low Voltage) and must be a limited power sources.

Recommendations regarding use

- Before using the system, check that the power supply voltage shown in the user manual corresponds to your supply. If it doesn't, please consult your supplier.
- Place the device against a flat, firm and stable surface.
- The device must be installed in a location that is sufficiently ventilated so that there is no risk of internal heating and it must not be covered with objects such as newspapers, cloths, curtains, etc.
- The device's aerial must be free and at least 10 cm away from any conducting material.

- The device must never be exposed to heat sources such as heating equipment.
- Do not place the device close to objects with naked flames such as lit candles, blowtorches, etc.
- The device must not be exposed to aggressive chemical agents or solvents likely to damage the plastic or corrode the metal parts.
- Install your device close to its DC power supply.

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Achtung ! Zu Ihrer eigenen Sicherheit die Stromversorgung Schaltung muss SELV (Safety Extra Low Voltage) sein und muss der begrenzten Stromquellen sein.

Empfehlungen für den Einsatz

- Vor dem Einsatz des Systems müssen Sie überprüfen, dass die in der Bedienungsanleitung angegebene Anschlussspannung den Werten Ihrer Stromversorgung entspricht. Anderenfalls wenden Sie sich bitte an Ihren Lieferanten.
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- Das Gerät darf niemals der Einwirkung von Wärmequellen oder Heizgeräten ausgesetzt sein.
- Das Gerät darf sich niemals in der Nähe von Gegenständen mit offener Flamme befinden, wie brennenden Kerzen, Schweißbrennern usw.
- Das Gerät darf niemals der Einwirkung von aggressiven Chemikalien oder Lösemittel ausgesetzt werden, die geeignet sein könnten, den Kunststoff zu beschädigen oder die Metallteile zu korrodieren.
- Stellen Sie Ihr Gerät in der Nähe der Quelle seiner Spannungsversorgung DC auf.

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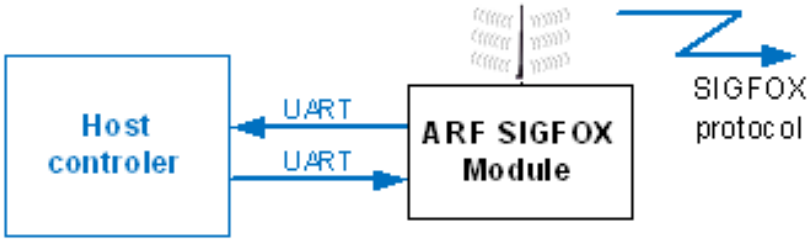
1. Modules overview

1.1. Adeunis RF concept

The idea is to provide the user with a module which is ready for operating in a SIGFOX network environment thus enabling the user to focus on the development of its application. The aim is to relieve the user of having to deal with the complex radio management.

1.2. Module functionality

"Ready To Use" versions are intended for user willing to embed a SIGFOX radio functionality onto their already existing electronic design.
In the "Ready To Use" versions the modules operates in a standalone way. The user has to interface the module with a host processor where the application code will be running.
The diagram above represents the way Adeunis SIGFOX module works :



«Ready to use» offers the following functionalities:

- The module is pre-configuration with SIGFOX Device ID and AES keys to be ready to use in a SIGFOX network
- The module can transmit and optionally receive data messages among the SIGFOX network

The module is low power to deal with battery powered devices environment and long life duration.

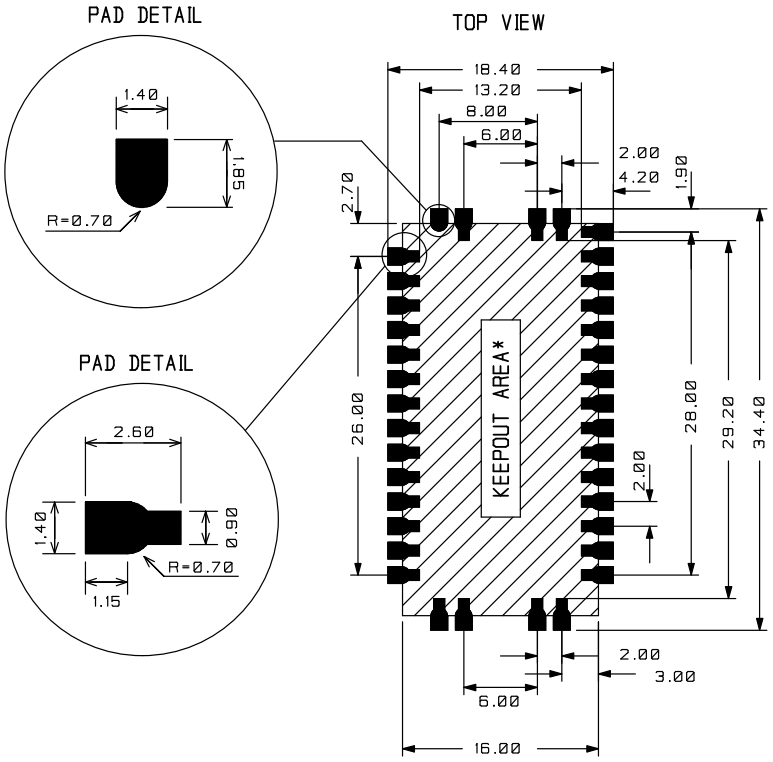
1.3. Technical specifications

Technical specifications	
Communication	SIGFOX protocol and modulation
Module configuration	Through AT commands
Radio data rate	Uplink : 100bps Sigfox specific
	Downlink : 600bps GFSK
UART data rate	115.2 kbauds
UART TTL ports	TXD - RXD
Center Frequency	Uplink : 868.130MHz
	Downlink : 869.525MHz
RF output power	14 dBm
Sensitivity	down to -125 dBm @ FER10-2
Operating range (open space)	External antenna: up to 15000 m
Operating voltage	2.4v to 3,6v (3,3v nominal)
Tx (@14Bm)/ Rx / Standby	Typical 65mA / max 40mA / < 5µA
Operating temperature	-40°C / +85°C
Dimensions	32 x 16 x 2.8 mm
Certification	SIGFOX certification Class 0U ID: P_001F_337F_01
Standard compliance	EN 300-220, EN 301-489, EN 60950,

2. Main characterictics

2.1. Form factor and footprint

Footprint of the module

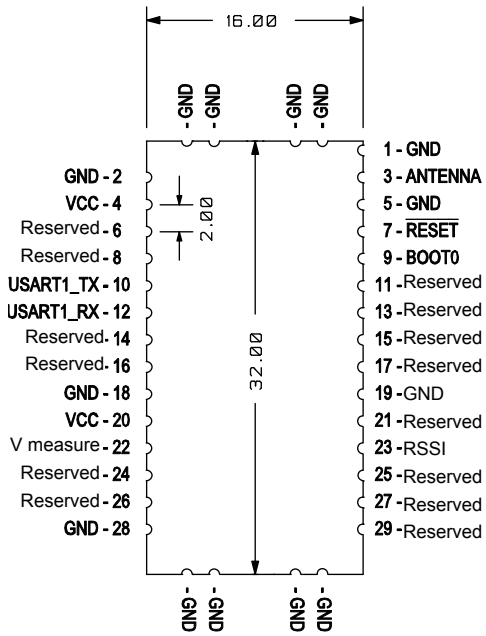


* NO COPPER AND TRACKS UNDER THE MODULE

Note : dxf and gerber files are available on request

2.2. Pins description

2.2.1 Pinout of the module



2.2.2 Pin configuration

Pin module	Pin name	I/O (1)	Description
1	GND		**Ground** (2)
2	GND		**Ground** (2)
3	ANTENNA		**RF output** Must be adapted with 50 ohms matching
4	VCC		**Supply voltage** (2)
5	GND		Ground (2)
6	Reserved		**(3)**
7	RESET	I	**Reset** Should be connected to the host controller, may be left unconnected if reset not used
8	Reserved		**(3)**
9	BOOT_ MODE	I	**Boot loader activation** (note : this pin must not be left unconnected Must be set to GND for normal operation (pull-down 47k Ohms advised) Must be set to VCC for firmware upgrade
10	UART_TX	O	**Data output** Must be connected to the host controller
11	Reserved		(3)
12	UART_RX	I Internal pull-up	**Data input** Must be connected to the host controller, must be left unconnected if not used
13	Reserved		(3)
14	Reserved		**(3)**
15	Reserved		(3)
16	Reserved		**(3)**
17	Reserved		(3)
18	GND		**Ground** (2)
19	GND		**Ground** (2)
20	VCC		**Supply voltage** (2)
21	Reserved		(3)
22	V measure	I Analog input	**Input voltage measure** This pin is intended for power supply measurement.
23	Reserved		**(3)**
24	Reserved		(3)
25	Reserved		(3)
26	Reserved		(3)
27	Reserved		(3)
28	GND		**Ground** (2)
29	Reserved		(3)
8 pins on both little side of the module	GND		Ground (4)

(1) Described from the module point of vue (I : Is an input of the module, O is an output of the module) - The internal pull-up/pull-down is between 30KΩ and 60KΩ, typical 45KΩ.
(2) All GND and VCC pins must be connected
(3) Must be left unconnected or connect to an input of the host controller
(4) Should be connect to GND to get best RF sensitivity

2.3. Electrical & Radio characteristics

2.3.1 Absolute maximum specifications

Parameter	Min	Typ	Max	Unit
Voltage on any GPIOs Pin	-0.3		3.9	V
Vcc	-0.3		3.6	V
RF input Power			10	dBm
Storage Temperature Range	-55		+125	°C

2.3.2 Global Electrical Characteristics

Parameter	Conditions	Min	Typ	Max	Units
Vcc		2.4V	3.3	3.6	V
Specified Operating Temperature Range		-30		70	°C

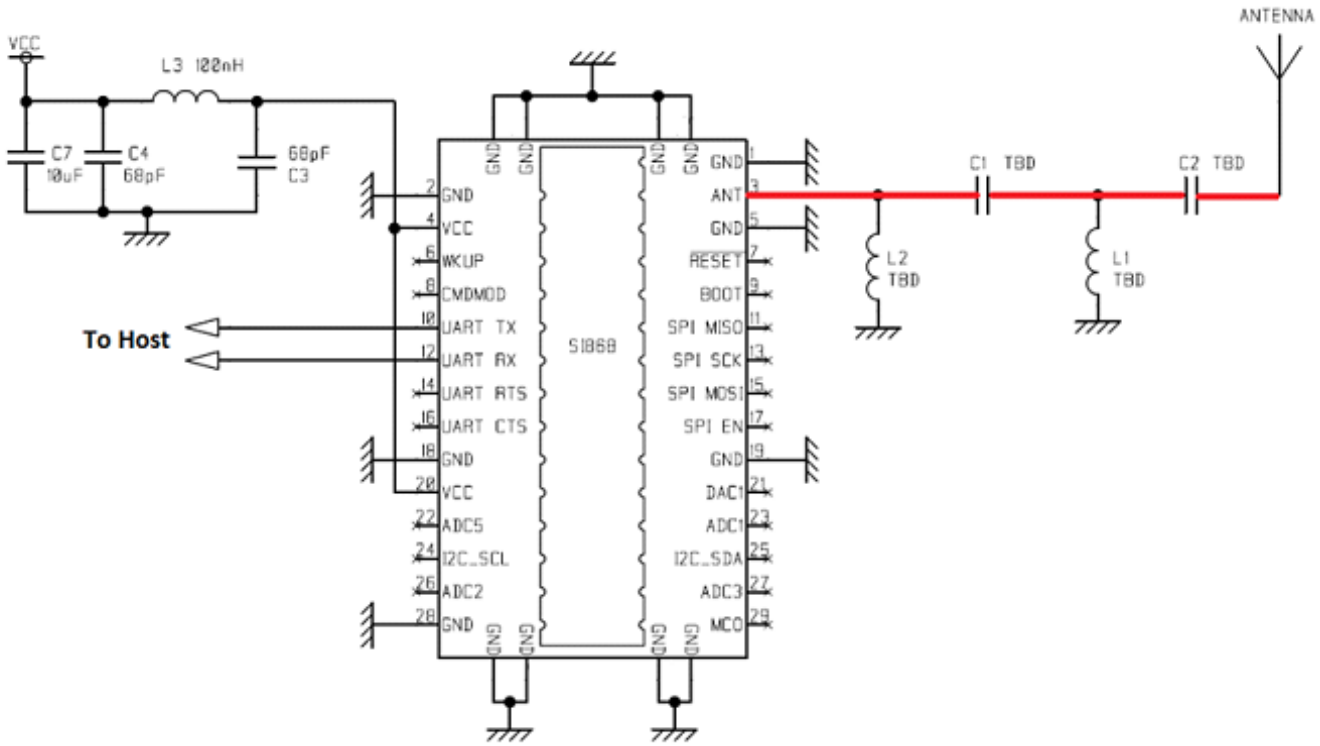
2.3.3 IOs Electrical Characteristics

Parameter	Conditions	Min	Typ	Max	Units
Input High Voltage	VCC= 2.4 to 3.6 V	2			V
Input Low Voltage	VCC = 2.4 to 3.6 V			0.8	V
Output High Voltage	IOH = -8 mA	Vcc – 0.4			V
Output Low Voltage	IOL = 8 mA			0.4	V

2.3.4 Radio limitations using SIGFOX protocol

The Si868 module transmits on a 48 kHz band centered around 868.2MHz at 100bps. Therefore limitations as per Annex 1 band g1.1 apply. In order to fulfill the specification requirement regarding duty cycle on ISM band and to be aligned with SIGFOX network, it is allowed to send up to 72 Bytes per hour (e.g., 6 messages of 12 payload bytes each, e.g 1 message every 10mn).

3. Recommended Design



3.1. Power Supply

The module is powered through VCC (pins 4 and 20) and GND and the power supply voltage must be between 2.4V and 3.6 V, 3.3 V typical. As described in Figure 2, we suggest adding a filter cell on the module voltage power supply pin (VCC). Each «GND» pin must be connected by vias to the ground plane of the motherboard (with the shortest distance). Place as many vias as possible to reduce parasitic inductance to ground plane. The unnumbered «GND» located on both little sides of the module are not required but are strongly recommended for maximum RF performance.

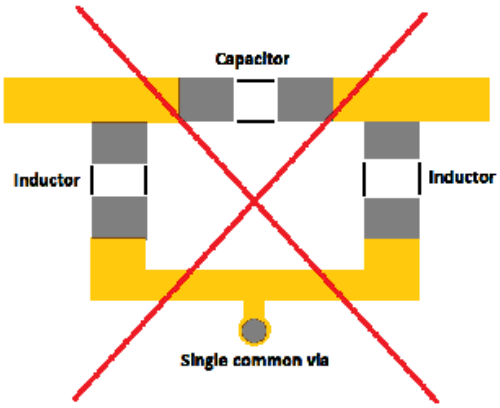
- If used, the 100nH inductor L3 must have a resonant frequency> 1GHz in order to be effective at 869MHz, working frequency band of the SI868 module. An appropriate ferrite could also be used instead of an inductor.
- Capacitors C4 and C3 must be "RF-Grade" capacitors, i.e. with a resonant frequency >1GHz.
- The design of the power supply filter must be able to provide a current up to 300mA.

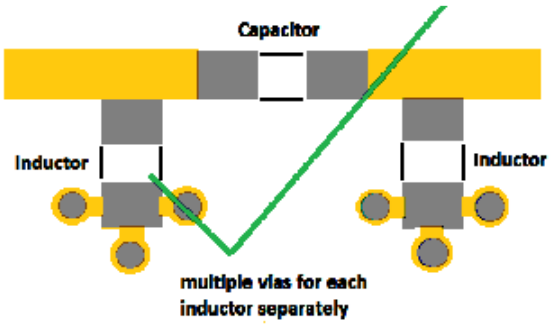
3.2. Antenna design and matching

The network formed by L1, L2, C1 and C2 constitutes the matching network to the antenna. The values of these components have to be re-defined for each different project as they will depend on the characteristics of the antenna, the working RF frequency and the PCB layout. Therefore, no typical values are given in this recommended design.

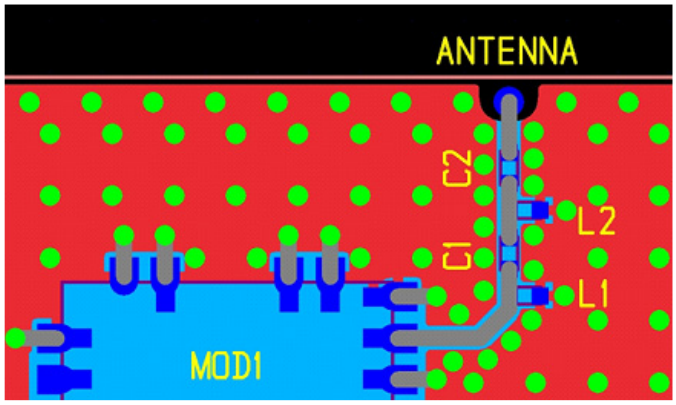
- If no matching network is required, L1 and L2 can be left NC (not connected) and C1 and C2 can be replaced by 0Ω resistors.
- If L1 and L2 are used, proper grounding is critical. Multiple vias to ground should be used for each inductor separately (see Figure 3).
- The PCB trace going from the ANT port of the module to the antenna (Red trace on Figure 2) should be a 50Ω microstrip line.

As antenna problematics are not trivial, ADEUNIS RF will gladly assist you in your choice or design of antennas so as to optimize the performance of your products. Feel free to contact us for more information.





Below an example of proper grounding



3.3. PCB and Ground plane considerations

If possible, the top-side and bottom-side layers of the customer's PCB should be GND planes. Usually components are placed on the top-side. The bottom-side GND plane should be kept clean and uninterrupted, and signals should be routed on the top-side and the internal layers. Disturbing signals such as clocks should be routed on the internal layers.

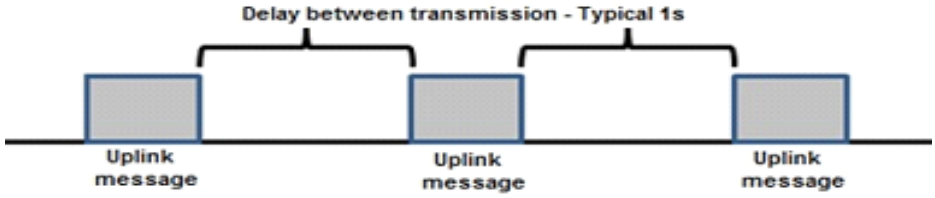
- Multiple vias should connect both GND planes together.
- It is best if the bottom-side GND plane is kept clean and uninterrupted for maximum RF performance
- It is best if the PCB has one of its dimensions (width or length) equal to /4, i.e. 8.6cm at 868MHz for maximum RF performance

4. SIGFOX Cycle

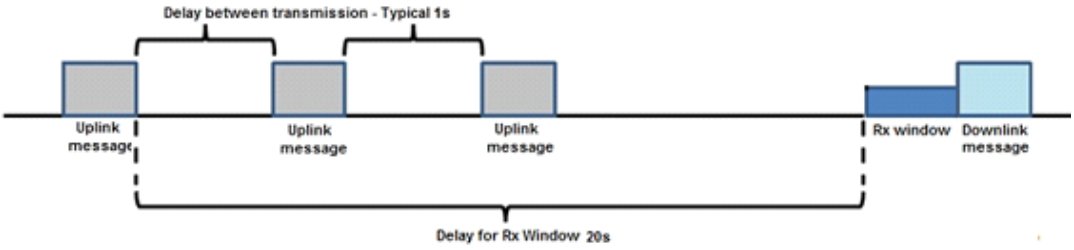
A SIGFOX cycle always start with an uplink transmission i.e. sending data from end device – our ARF module – to the SIGFOX Network. This message is always transmitted three time. It may be optionally followed by the reception of a downlink message sent by the network. I

In a SIGFOX network, "end device" always initiate transmissions. The only way to transmit data for the Network server is to wait for an end device uplink message which has required downlink data !

A typical SIGFOX cycle without downlink communication required from the end device is shown in the following figure:



A typical SIGFOX cycle with downlink communication required from the end device is shown in the following figure:



The maximum payload size of uplink messages is 12 data bytes. For downlink message, the size is 8 bytes.

5. Operating mode

5.1. UART settings

The UART port of the module is the main interface for the host controller.

The communication requires 10 bits for each byte to transmit, including one start bit followed by 8 data bits and then one stop bit. The Start bit value is the logical "0" while the stop is the logical "1" value. There is no parity bit in the transmission. The module is working at 115.2kbps with 8 data bits and no parity.

Please note that this UART port does not support electrical RS232 characteristics. An external RS232 driver has to be used if RS232 interface is required

5.2. Sending a command

By default, the module is running into sleep mode, allowing the lowest possible power consumption. To initiate a SIGFOX cycle or to configure the module, the host controller will send a command on the module UART interface.

Each command must be proceeding by 5 0xFF chars to wake up the module. The module will stay running during the execution of the command and then automatically return back to its sleep mode.

Chars must be transmitted in a flow without char spacing (less than 1 ms is required) to ensure the module will not return into sleep mode before a complete command has been received.

5.3. Available commands

The embedded set of command is based on AT format. AT commands are either used to read and write some registers used for the module configuration or directly to execute operation such as SIGFOX transmission cyle.

AT command matches the following format:
- Five 0xFF chars to wake up the module
- Two ASCII characters "AT",
- One or more characters and data (see C below for the syntax of AT commands available on the module).
- Each command should end with a "CR" or "CR" "LF", the two possibilities are accepted. (CR signifies: Carriage Return, LF signifies: Line Feed)

On receipt of a command the module returns:
- "the data"<cr><lf>, for a reading command, type ATS<n> ? , AT/S or AT/V.
- "O" <cr><lf>, for all other setup commands if it is accepted, "OK" for SIGFOX command.
- "E" <cr><lf>, if it refuses the command because of a syntax error, unknown command, unknown register, invalid parameter, etc.
- "KO" for SIGFOX command ending with an error

5.3.1 Setup command

Setup command allow modem configuration:

Table of AT commands:

Command	Description	Reply
ATS<n>?	Returns the contents of register n	Sn=y where
		Y represents the contents of register n
ATS<n>=<m>	Transfer the value m to register n	«O»<cr> if operation OK
		«E»<cr> if error
AT/S	Display as a list, the content of each User register	Sxxx=y<cr><lf> for each register
AT/V	Display the complete firmware version	SFX-RTU-EU_v1.3
AT/R	Restore the content of registers with default values	«O»<cr> if operation OK
		«E»<cr> if error
ATR	Restore the content of registers with default values	«O»<cr> if operation OK
		«E»<cr> if error

Command	Description	Reply
AT&W	Save the register configuration in E2PROM.	«O»<cr> if operation OK
		«E»<cr> if error
AT&RST	Restart the module	«O»<cr> if operation OK
		«E»<cr> if error
ATO	Exit command mode	«O»<cr> if operation OK
		«E»<cr> if error

Example of a series of commands and corresponding replies as one could see them on a terminal:

Syntax of the Command	Description	Syntax of the response
\FF\FF\FF\FF\FFATS230=24\0D	Set the contents of register 230 to 24	**O**
\FF\FF\FF\FF\FFATS230?\0D	Request the register 230 value	**S230=24**
\FF\FF\FF\FF\FFAT&W\0D	Save the register configuration in E2PROM.	**O**

5.3.2 Description of registers

When switching on, the SIGFOX module operates according to the last configuration saved (factory configuration if its the first switching on, or if this configuration has not been changed).

Modification commands, type ATS<n>=<m> or ATR allow the content of registers to be modified. The product is usable with each new configuration as long as it is not disconnected. On the other hand the modified values will be applied next time the module is switched on only if they have been saved by AT&W command

List of the registers accessible on the SIGFOX module :

Syntax of the Command	Description	Default value	Comments
S200	Central frequency for uplink transmission (in Hz)	868130000	
S201	Central frequency for downlink transmission (in Hz)	869525000	
S202	Number of SIGFOX frame repeat per cycle	2	This value cannot be modified The message is sent 3 times for each SIGFOX cycle
S210	UART baudrate	7	This value cannot be modified Baudrate = 115.2kbps
S211	UART number of data bit	1	This value cannot be modified Number of data bit = 8 bits
S212	UART parity	0	This value cannot be modified Parity = none
S281	SIGFOX device Identifier	Initialized at factory process	This value cannot be modified This value is unique for each device and must be used to identify it on the network

5.3.3 SIGFOX command

SIGFOX commands are used to transmit and receive data from the network.

Command	Description	Reply
AT$SB=<Bit value>,<Bidir/Monodir>	Send a bit value i.e. a simple binary 0 or 1 value over the SIGFOX network.	<Bit value>=0 or 1
		<Bidir/Monodir> = 0 for monodir, 1 for bidir mode
AT$SF=<Message>,<Bidir/Monodir>	Send a message over the SIGFOX network.	<Message>=up to 24 ascii byte coding an hexadecimal value. <Bidir/Monodir> = 0 for monodir, 1 for bidir mode

5.3.3.1 AT$SB command with uplink only

This implements a communication with only uplink data (from end device to network server). The frame is transmitted according the S202 register value + 1. Each transmission is followed by a one second interval.

\FF\FF\FF\FF\FFAT$SB=1,0<CR> Send an bit value of 1 without requesting any data from the network server

OK<CR><LF> The module immediately send an OK to acknowledge the command. The SIGFOX cycle starts. Due to low data rate used and the 1 second interval between repetitions, it will takes several seconds before ending.

TX END<CR><LF> The whole SIGFOX cycle has now completed. The module is back to sleep mode.

5.3.3.2 AT$SB command with uplink and downlink

This implements a bidirectional communication with uplink and downlink data. The frame is transmitted according the S202 register value + 1. Each transmission is followed by a one second interval. After a 20 seconds delay starting from the end of the first transmission, the module opens a reception window allowing the server to send respond. If a respond is received, it is forwarded on the UART of the module in row data mode. A maximum of 8 bytes may be received from the server.

Here is an example of bidirectional transaction successfully ended with the following SIGFOX reply: \53\59\47\46\4F\58\21\0D (note that these hex values corresponds to the ascii char codes "SIGFOX!<CR>"

\FF\FF \FF\FFAT$SB=0,1<CR>	Send an bit value of 0 and request data from the network server
OK<CR><LF>	The module immediately send an OK to acknowledge the command. The SIGFOX cycle starts. Due to low data rate used, the 1 second interval between repetitions and the 20 seconds before starting reception, it will takes several seconds before ending.
RX=SIGFOX!<CR>	The 8 bytes returned from the server preceding by "RX=" Ascii chars.
RX END<CR><LF>	The whole SIGFOX cycle has now completed. The module is back to sleep mode.

The same example will terminate as describe bellow if the downlink frame is not received from the server:

\FF\FF\FF\FF\FFAT$SB=0,1<CR>	Send an bit value of 0 and request data from the network server
OK<CR><LF>	The module immediately send an OK to acknowledge the command. The SIGFOX cycle starts. Due to low data rate used, the 1 second interval between repetitions and the 20 seconds before starting reception,it will takes several seconds before ending.
KO<CR><LF>	The SIGFOX cycle has now completed without reception of downlink message. The module is back to sleep mode.

5.3.3.3 AT$SF command with uplink only

This implements a communication with only uplink data (from end device to network server). The frame is transmitted according the S202 register value + 1. Each transmission is followed by a one second interval. The frame to be sent is coded in ASCII bytes in hexadecimal format. Two ASCII bytes are required to encode one hexadecimal value. Because maximum SIGFOX payload is 12 bytes, the frame must be limited to 24 ASCII bytes. The frame must be encoded with a paired number of ASCII bytes.

Here is an example of transaction with the following payload: \00\01\02\03\04\05\06\07\08\09\0A\0B

\FF\FF\FF\FF\FFAT$SF=000102030405060708090A0B,0<CR>
Send the frame without requesting any data from the network server

TX END<CR><LF>	The module immediately send an OK to acknowledge the command. The SIGFOX cycle starts. Due to low data rate used, the 1 second interval between repetitionsand the 20 seconds before starting reception, it will takes several seconds before ending.
OK<CR><LF>	The whole SIGFOX cycle has now completed. The module is back to sleep mode

5.3.3.4 AT$SF command with uplink and downlink

This implements a bidirectional communication with uplink and downlink data. The frame is transmitted according the S202 register value + 1. Each transmission is followed by a one second interval. After a 20 seconds delay starting from the end of the first transmission, the module opens a reception window allowing the server to send respond. If a respond is received, it is forwarded on the UART of the module in row data mode. A maximum of 8 bytes may be received from the server. After the whole sequence has complete, the module comes back to sleep mode.

For data encoding of uplink message, refer to section 5.3.3.3.

Here is an example of bidirectional transaction successfully ended with the following SIGFOX reply: \53\59\47\46\4F\58\21\0D (note that these hex values corresponds to the ascii char codes "SIGFOX!<CR>"

\FF\FF\FF\FF\FFAT$SF=000102030405060708090A0B,1<CR>
Send the frame and request data from the network server

OK<CR><LF>	The module immediately send an OK to acknowledge the command. The SIGFOX cycle starts. Due to low data rate used, the 1 second interval between repetitionsand the 20 seconds before starting reception, it will takes several seconds before ending.
RX=SIGFOX!<CR>	The 8 bytes returned from the server preceding by "RX=" Ascii chars
RX END<CR><LF>	The whole SIGFOX cycle has now completed. The module is back to sleep mode

The same example will terminate as described below if the downlink frame is not received from the server:

\FF\FF\FF\FF\FFAT$SB=0,1<CR>	Send an bit value of 0 and request data from the network server
OK<CR><LF>	The module immediately send an OK to acknowledge the command. The SIGFOX cycle starts. Due to low data rate used, the 1 second interval between repetitions and the 20 seconds before starting reception,it will takes several seconds before ending.
KO<CR><LF>	The SIGFOX cycle has now completed without reception of downlink message. The module is back to sleep mode.

6. Evaluation Board Si868 SIGFOX

The Adeunis RF Evaluation Board Si868 SIGFOX (P/N : ARF8082AA)is designed to help the user to achieve his objectives as quickly as possible. It's a powerful, compact and nomadic tool which meets three objectives :

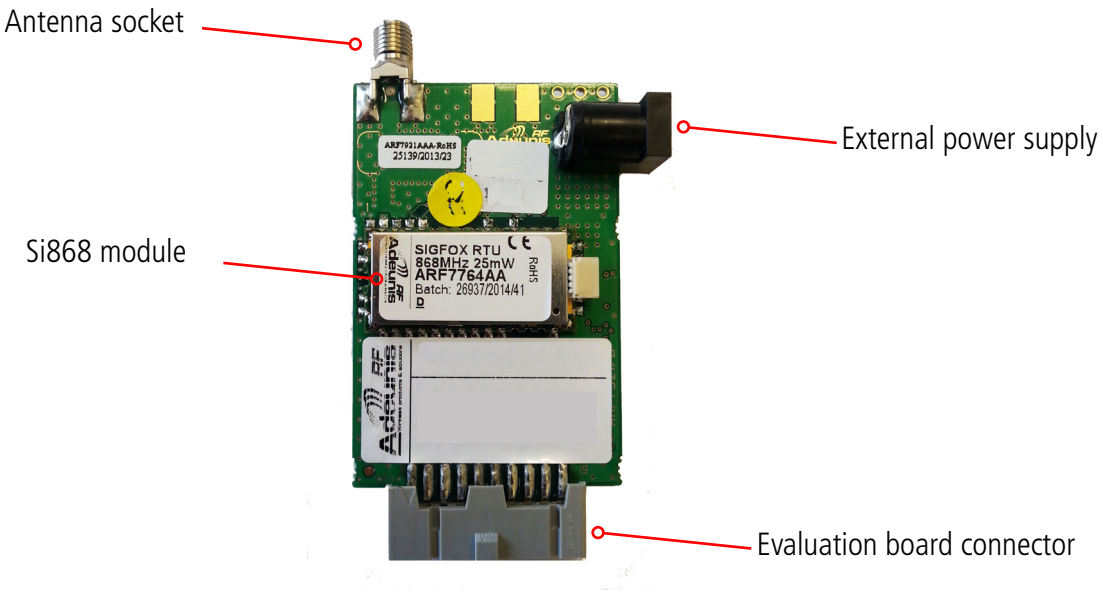
- Evaluate the Adeunis-RF Si868 module
- Connect to SIGFOX network (user must take out a subscription with SIGFOX)
- Follow the user, from the development phases to the optimization of the on-site implementation of the finished product.

In addition, the Evaluation board provides an RF output designs to get the best Si868 module performances.

6.1. Evaluation Board kit content

The evaluation Board Si868 includes
1 x soldered Si868 module (ARF7764AA)
1 x 868MHz antenna

6.2. Evaluation board overview

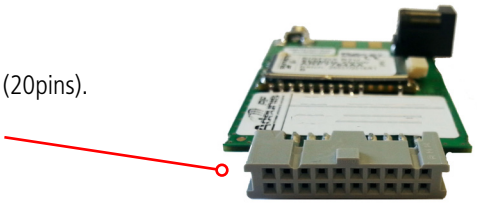


6.3. Power supply

The Evaluation Board Si868 must be power supplied through an external source. The connector is a Jack 3.5.
Operating voltage is 5V-500mA. An external power block is available through Adeunis RF (part number ACC1300BE).

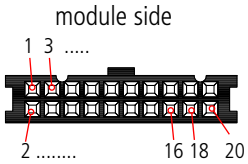
6.4. Evaluation board connector

The connector allows to access the module UART. The connector is a HE13 (20pins).
Main manufacturer is 3M (P/N 8520-4500PL).



6.4.1 Connector Pin out

In order to access to the module, use pins 16, 18 and 20



1 to 15	16	17	18	19	20	
unused	UART TX	unused	UART RX	unused	GND	

7. Process

7.1. Description of module 7764xxx

7764xx module is fully SMT, single side. Assembly process is based on leadfree alloy, no clean flux residues
PCB material is FR4 material, 6 layers, class 6 , nickel-gold finish (ENIG).

7.2. BOM analysis

BOM was analyzed after loading and comparison with SERMA databases; from this job, we get the following data:
- Rohs status
- Obsolescence
- MSL level
- Max peak temp during reflow
- Time max at peak temp
- Number of reflow
- Lead finish of the package
- Termination description for resistor and capacitor chips; presence of nickel barrier or not

The worst case MSL level is 3. Other parts are level 1 classified.

Most parts are compliant with max peak temperature of 260°C during 10 seconds.

Most parts are compatible with 2 reflows.

All resistors and capacitors have nickel barriers in their terminations, which is necessary to avoid leaching effect.

7.3. Risk linked to number of reflows

There is no high risk regarding the assembly of the module on mother board, since the land pattern is larger than the "leads" (maybe the land pattern may be little bit large compared to the "leads" and then there is risk of module slip during reflow soldering)

The stencil foil thickness should be 150 to 170 microns to ensure enough solder fillet; the stencil aperture should be reduced in length and width by 150 microns roughly to avoid solder balling in case misalignment occurs.

Check of maximum temperature (during reflow) on sensitive component body has to be done.

The trickiest point is regarding the moisture sensitivity and the way to consider the module for the assembly on mother board.

Considering the components on the module, we can define the module as a level 3 component, whose floor life under 60% max RH is 168 hours.

Having in mind that module to mother board assembly delay is not under control, same for temporary storage atmosphere, the best solution is to dry the module after test and put it in reels and then pack them in MBB bags.

Jedec JSTD 033 standard is helping us to define the conditions of drying
If drying occurs less than 10 days after first reflow,

24 hours 90°C seems a good compromise between time and temperature;

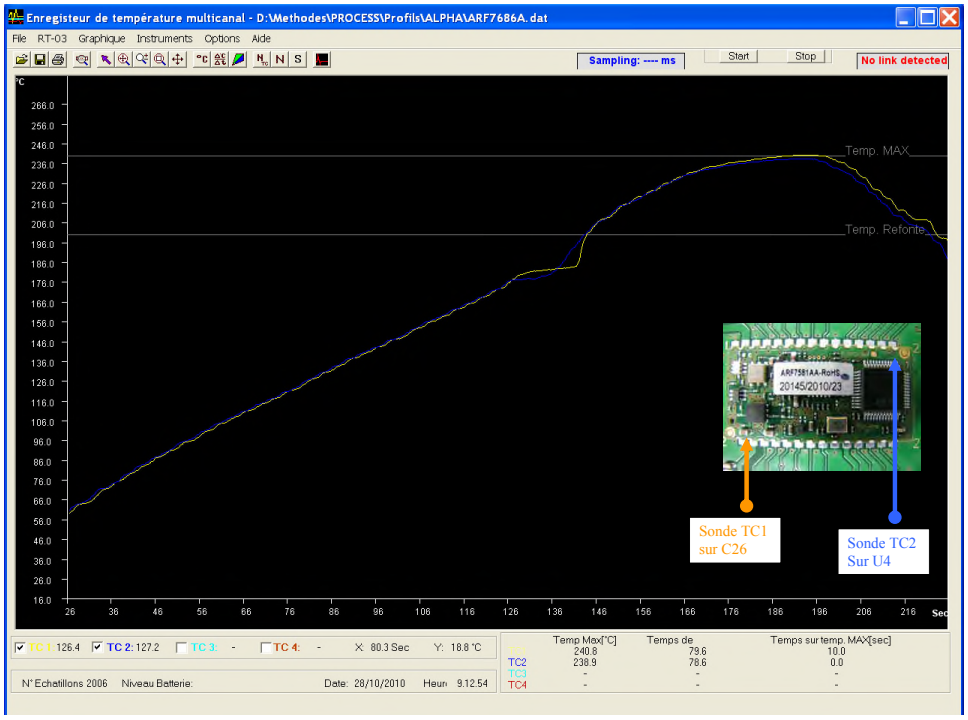
If drying occurs more than 10 days after first reflow,

The drying condition becomes 36 hours 90°C ;

Notes:
1) at end of drying , let the parts come back to room temperature slowly to avoid condensation.

2) take care that reel material cannot withstand 90°C .Then it is needed to dry prior reeling.
Reeling should occur within a few hours after drying.

7.4. Soldering curve



8. Version history

User guide version	Contents
V1.3	Consumption values updated
V1.2	Corrections on commande syntax (p.15)
V1.1	Correction son frame description and grounding
V1.0	UG released