



SIGFOX US demonstrator

By ADEUNIS RF

User guide version 1.0
Software version 2.0

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Information

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Helpful Information when Contacting Technical Support

When contacting Technical Support please have the following information ready:

- Product type (e.g. Wireless M-Bus),
- Firmware version (e.g. V3.03)
- Clear description of your question or the problem
- A short description of the application
- Your complete contact details

Declaration of conformity – FCC warning statement

We ADEUNIS RF,
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Declare under our own responsibility that the products

Name SIGFOX US demonstrator
Reference(s) ARF8075BA

Comply with Part 15 of the FCC Rules.

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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter

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

Identification:

- FCC ID : U3Z-ARF8075BA

Product reference:

- USA : ARF8075BA



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Aucune entrée de table d'illustration n'a été trouvée.

INTRODUCTION

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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



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.



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.

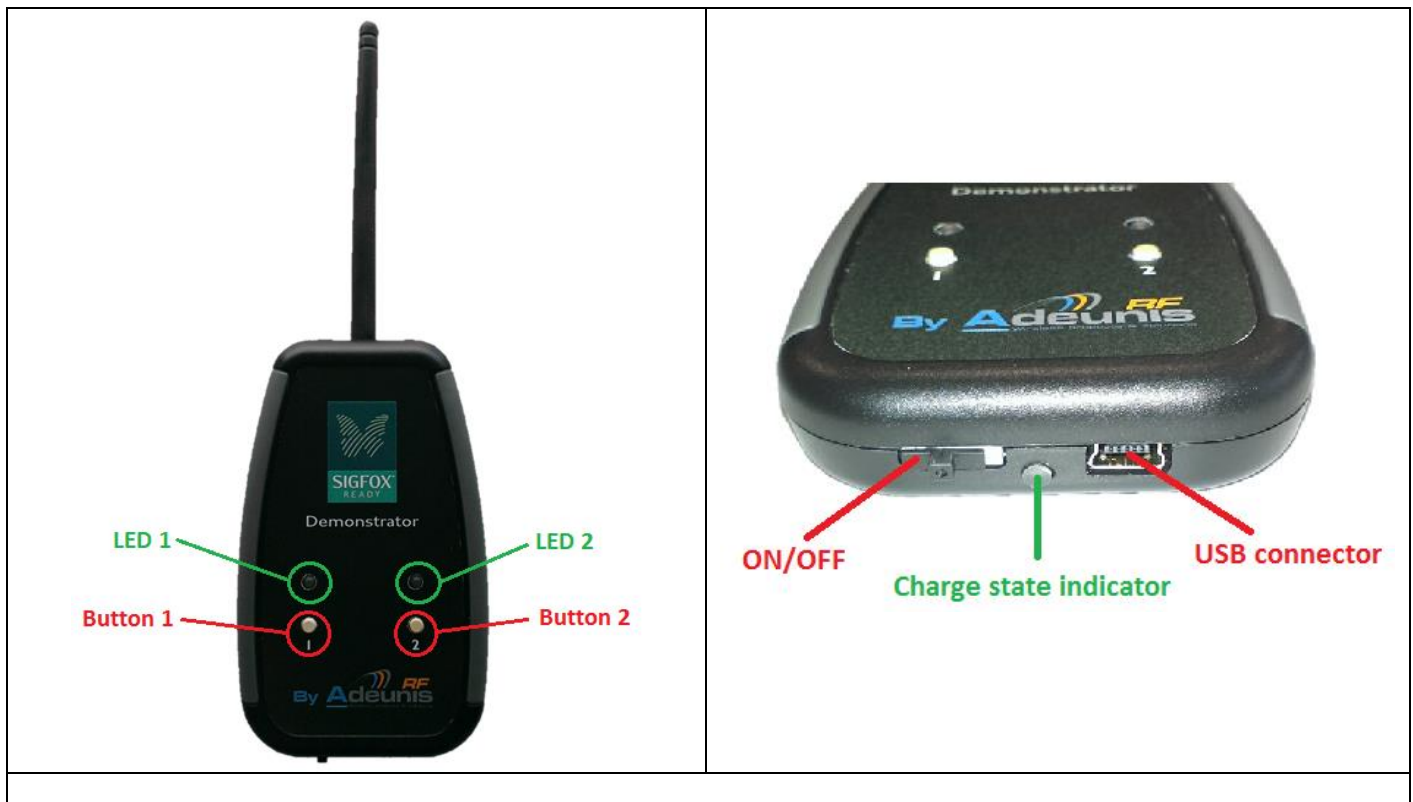
Disposal of waste by users in private households within the European Union



This symbol on the product or on its packaging indicates that this product must not be disposed off with your other household waste. Instead, it is your responsibility to dispose of your waste by taking it to a collection point designated for the recycling of electrical and electronic appliances. Separate collection and recycling of your waste at the time of disposal will contribute to conserving natural resources and guarantee recycling that respects the environment and human health. For further information concerning your nearest recycling centre, please contact your nearest local authority/town hall offices, your household waste collection company or the shop where you bought the product.

1. Physical description

The product takes the shape of a remote control

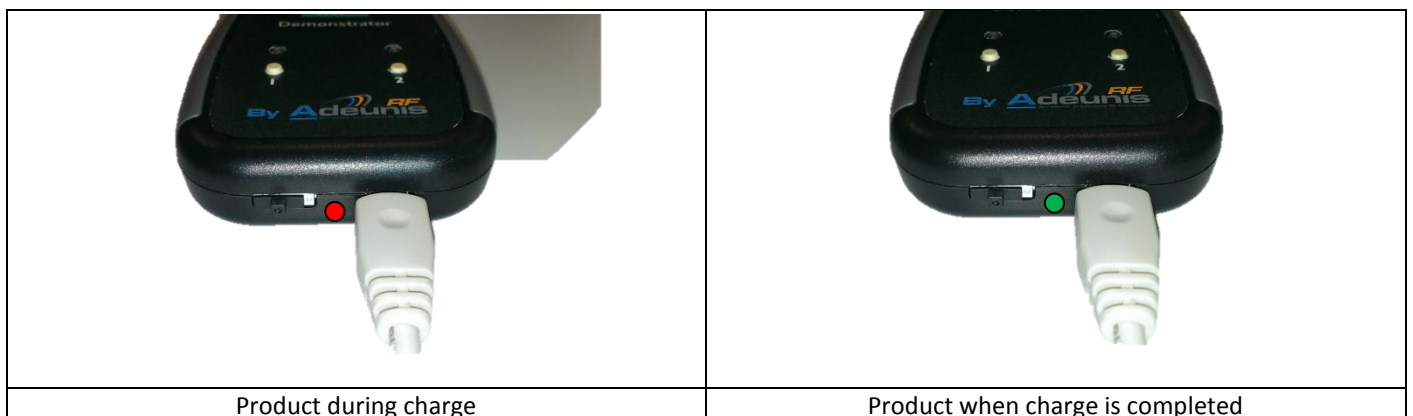


The product contains a GPS module, an accelerometer and a temperature sensor.

2. Charging the demonstrator

The product contains a rechargeable battery, and is rechargeable through USB (5V-500mA max). Upon connecting it to a computer via a mini-USB cable, it will automatically begin charging; even if the ON/OFF switch is on the OFF position (this behavior is similar to the one of mobile phones). The product can still be used while it's charging.

During the charging process, the charge state indicator is steady **red**. When charging is completed, the charge state indicator becomes steady **green**.



If the battery is completely discharged, **it will need 8 hours** of charging time to get back to full charge.

3. Starting the demonstrator

When pushing the ON/OFF switch to the right, the demonstrator is powered up and enters its nominal mode.

Note: One message = one frame followed by two repetitions, i.e. a total of three frames.

3.1 Nominal Mode

- After powering up LED2 will be steady **red for a maximum of 8 minutes**. This phase is the GPS's initialization phase. Its duration is dynamic: if the GPS synchronizes before the 8 minutes are over, LED2 will become steady **green** and the init phase will end 50 seconds later. During this init phase, no action is possible (no RF transmission) besides entering command mode.
- After the initialization sequence, the product will enter sleep mode. The GPS will be periodically awoken to refresh its position, if no SIGFOX transmission is undergoing at that time. Each time the GPS is woken up, LED2 will display steady **red** for a maximum of 15s. If the GPS synchronizes under these 15s, LED2 will become steady **green**; otherwise it will turn off. In either cases, the product will go back to sleep at the end of the 15s.

After the init phase, the user can trigger the execution of nominal cycles. There are two different ways of triggering nominal cycles. **When a nominal cycle is under execution, the user cannot do anything else until the cycle is completed.**

The init phase doesn't exist when the GPS is deactivated.

3.1.1 Accelerometer

The demonstrator has an embedded accelerometer. If the user shakes the demonstrator, it will trigger the execution of one nominal cycle, thus the RF transmission of one SIGFOX message.

3.1.2 Pressing Button 1 (BTN1)

Pressing BTN1 will trigger the execution of one nominal cycle and the transmission of one SIGFOX message.

3.1.3 Description of the LED display behavior during execution of a nominal cycle

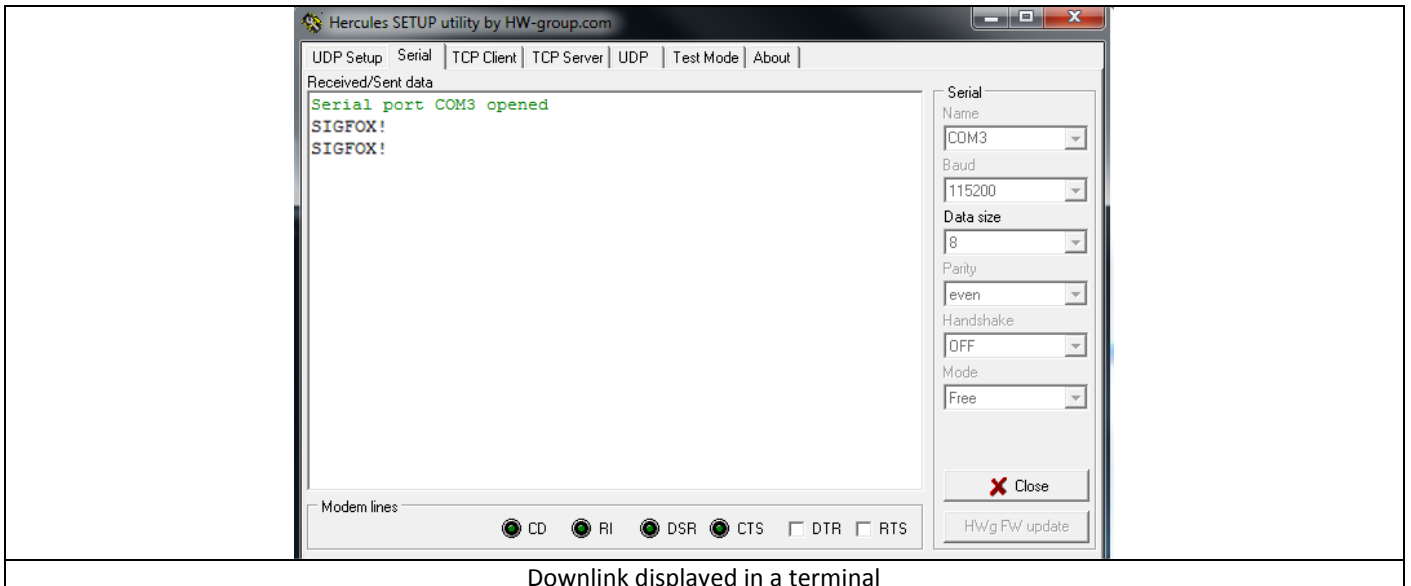
The nominal cycle is made of 5 major steps:

Step	LEDs state	Description
1	LED1 red , blinking fast for a maximum of 15s, LED2 steady red .	GPS wakes up, waiting for synchronization <ul style="list-style-type: none"> - If the GPS synchronizes, LED2 becomes steady green and step 1 ends. - While the GPS is not synchronized, LED2 stays steady red. - If the GPS couldn't synchronize under 15s, LED2 turns off and step 1 ends.
2	LED1 red , blinking 3 times	Transmission of a SIGFOX message
3	LED1 steady green during and for the duration of the RX window	RX window, waiting for an answer from the SIGFOX servers
4	LED1 red , blinking once	Downlink was received. Sending OOB frame
5	LED1 green , blinking fast 5 times	The cycle ended correctly. The downlink received from the server is available via the remote's serial port

If the product is in uplink mode only, steps 3 through 5 are not executed.

If the product is in downlink mode, the answer received from the server will be outputted on the product's serial link. The following procedure allows the user to monitor the answer on a computer:

- When the remote is connected to a computer, it is viewed as a serial peripheral (creation of a virtual COM port). **The VCP driver can be found on Adeunis RF website under the name "VirtualSerialARF".**
- Open a serial Terminal (Eg. HERCULES) and configure the serial link as 115200bps, E, 8, 1.
- As soon as the nominal cycle ends, the answer received from the server will automatically be displayed in the terminal window. In the example below, the callback was programmed to send the message "SIGFOX!"



Downlink displayed in a terminal

3.2 Command Mode

Command Mode gives the user access to the test functions described by SIGFOX in the document “UNB Transceiver AT command set requirements specifications” Rev. 0.8 that was published by SIGFOX.

Entry in command mode is allowed in two situations:

- During the GPS init phase, just after power-up.
- Between two nominal cycles.

Pressing Button 2 places the product in command mode. LED1 becomes steady **red**, indicating that the product is in command mode. To exit command mode, press Button 2 again. LED1 will turn off.

While in command mode, it is possible to execute SIGFOX’s standard test functions from a computer terminal. It is also possible to execute specific configuration functions.

3.2.1 SIGFOX test functions

Command	description
AT\$SB	<p>Send a bit Status</p> <p>Cmd: AT\$SB=<status value> to send a bit status Resp: OK</p> <p>Cmd: AT\$SB=<status value>,1 to send a bit status and wait for response Resp: OK +RX=<8 bytes ASCII bytes></p> <p>status_value = 0/1</p>
AT\$SF	<p>Send/ Receive Payload in bytes</p> <p>Cmd: AT\$SF=<payload data> to send payload Resp: OK</p> <p>Cmd: AT\$SF=<payload data>,1 to send payload and wait for response after 20s after sending during 25s. Resp: OK +RX=<8 bytes ASCII bytes></p> <p>payload_data = each byte coded in 2 ASCII. Payload length is from 1byte to 12 bytes</p> <p>Examples :</p> <p>AT\$SF=313245: Send 0x31 0x32 0x45 payload with no response waited.</p> <p>AT\$SF=010205,1 : Send 0x01 0x02 0x05 payload with a response waited.</p>

ATS302	<p>Set/Get Output Power in dBm.</p> <p>Parameter is Read-only in the demonstrator</p> <p>Cmd: ATS302? Resp: 22</p>
AT\$IF	<p>Carrier Frequency Macro Channel Configuration</p> <p>Cmd: AT\$IF=<frequency> to configure the output carrier macro channel for SIGFOX frames. Resp :OK</p> <p>Cmd: AT\$IF? To get current value for IF parameter. Resp: 902800000</p> <p>Default value = 902200000</p>
AT\$DR	<p>Carrier Frequency Macro Channel Configuration</p> <p>Cmd: AT\$DR=<frequency> to configure the reception carrier macro channel for SIGFOX frames. Resp :OK</p> <p>Cmd: AT\$DR? to get current value for DR parameter. Resp :904000000</p> <p>Default value = 905800000</p>
AT\$TR	<p>Set/Get the number of TX repetitions</p> <p>Parameter is Read-only in the demonstrator</p> <p>Cmd: AT\$TR? to get the current TR parameter value. Resp : 2</p>
AT\$ST	<p>Uplink Test Mode</p> <p>Cmd : AT\$ST=[<count>,<period>,<channel>] : to activate the test mode :</p> <p>Resp: OK</p> <p>count = 0..32767 or -1 : infinite loop sending user frames (count * burst of 3 frames) : default value : 10</p> <p>period = 1..255 seconds for sending test frame every period seconds : default value : 1</p> <p>channel = 0..480 or -1 : hopping activ</p>

<p style="text-align: center;">AT\$SR</p>	<p>Downlink Test Mode</p> <p>Cmd : AT\$SR=<seq_number>,<channel>,<count> : to activate the rx test mode :</p> <p><seq_number> = seq number to receive permanently <count> = number of frame to receive 0 or -1: permanently reception. <channel> = 0..480 : channel around reception center frequency where to receive</p> <p>Resp : RX=<message1> RSSI=<rssi_value for message 1> RX=<message2> RSSI=<rssi_value for message 2> RX=<message n> RSSI=<rssi_value for message n></p>
<p style="text-align: center;">AT\$CW</p>	<p>Continuous Wave</p> <p>Cmd : AT\$CW=<frequency>,<mode>,{<optional power>}</p> <p>Power cannot be set in the demonstrator</p> <p><frequency> = center frequency for carrier <mode>= 0: off 1 : on <power>= value in dBm optional . If power is max power = 22dBm (used for SIGFOX tests) : no need to specify it in AT command parameter. Note: This command is mandatory for certification of your device for CE.</p> <p>Resp : OK</p>

3.2.2 Specific configuration functions

REMINDER: in order to read the content of a register, the user needs to type the name of said register followed by “?”

Example: AT\$282? gives back the content of register S282.

Command	description
AT\$282=x AT+W (save new parameter)	x=1 : product in uplink/downlink mode (bidir) x=0 : product in uplink mode (monodir)
AT\$271=x AT+W (save new parameter)	x≠0: maximum duration of the GPS init phase, in minutes (default 8, max. 8) x=0: deactivates the GPS. Modification of this register needs a product reboot in order to be validated

3.2.3 Serial link parameters

Parameter	Value
Speed	115200 bps
Parity	Even
Bits	8
Stop bit	1

1. Payload content

The payload format is the one described in the document “BBOX_GPS_FORMAT_V1.0” dated from 30/01/2015 and published by SIGFOX

Following a request from SIGFOX, the temperature (in °C) replaces the ground speed (in km/h).

N° Byte	Description
1	MSB Latitude
2	Latitude
3	Latitude
4	LSB Latitude
5	MSB Longitude
6	Longitude
7	Longitude
8	LSB Longitude
9	Bit 7-6 : N/A Bit 5-4 : DOP Bit 3..0 : Number of satellites
10	Temperature in °C
11	Transmitted frames counter
12	Received frames counter

Note: When rebooting the product, pressing BTN1 or triggering the accelerometer, the TX and RX frame counters are reset.

1 ANNEX 1: GPS behavior

After powering up of the demonstrator, the GPS undergoes a Cold Start. The initial phase that can last a maximum of 8 minutes might appear as tedious but is crucial for the GPS to acquire and update its almanac and ephemeris.

Once the GPS has acquired this data, it is put in low-power mode in order to preserve the battery. It is then woken up every minute during a maximum of 15s in order to refresh the device's position. If the GPS had acquired enough data during the initial phase, it should be able to re-synchronize under those 15s. Nonetheless, depending on environmental conditions, it might not always be the case. It is possible that some frames won't contain any GPS information.

IMPORTANT:

When the demonstrator hasn't been used for a long time (days) or has been transported on a long distance (city to city or country to country), the satellite data previously acquired by the GPS module will not be valid anymore. In this case the GPS will encounter difficulties to synchronize, it won't be abnormal if the GPS takes a few minutes (>5min) to re-synchronize during the initial phase.

It is also possible to deactivate the GPS if this functionality is not desired.

2 ANNEX 2: FCC test modes

Command	description	
ATT10<CR>	Carrier Wave	
ATT14<CR>	Permanent modulation	
ATT70 <i>Param1 Param2</i> <CR>	Pulsed transmission	
	Param1	Param2
	0 = transmission of one frame on a fixed frequency. Delay of 500ms between two frames	Number of loops to execute
	1 = transmission of 15 frames of different lengths (max 347ms). Delay of 500ms between two frames. Hopping Active.	
10 = Simulation of nominal mode, automatic transmission on slots 1-6 with periodicity of 46s. Hopping Active.		