Adeunis RF
Wireless products & solutions

FIELD TEST DEVICE

LoRaWAN Europe

Mode d'emploi
V1.2.0

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ENGLISH

INFORMATIONS

Document Information	
Title	FIELD TEST DEVICE
Subtitle	LoRaWAN Europe
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This document applies to the following products:

GB

Nom	Référence	Version Firmware
FIELD TEST DEVICE - LoRaWAN Europe	Up to : ARF8123AAB	APP Up to : V01.00.07 RTU Up to : V01.02.00

DISCLAIMER

TECHNICAL SUPPORT

Website
Our website contains a lot of useful information: information on modules and wireless modems, user guides, and configuration software and technical documents which can be accessed 24 hours a day.

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

Helpful Information when Contacting Technical Support
When contacting Technical Support, please have the following information ready:

- Product type (for example Field Test Device)
- Firmware version (for example V1.0)
- A clear description of your question or the problem
- A short description of the application

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

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Valid for LoRaWAN PULSE products: ARF8046AA/PA


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: When the equipment is open, do not carry out any operations other than the ones set out in this document.


Please note: Do not open the product as there is a risk of electrical shock.


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 own safety, the power supply circuit must be SELV (Safety Extra Low Voltage) and must be from limited power sources.


Please note: When the aerial is installed outside, it is essential to connect the cable screen to the building's earth. We recommend using lightning protection. The protection kit chosen must permit the coaxial cable to be earthed (eg: coaxial lightning arrester with earthing of the cable at different places on the aerial at the base of pylons and at the entrance, or just before entering the premises).

The product must be equipped with a switching mechanism so that the power can be cut. This must be close to the equipment. Any electrical connection of the product must be equipped with a protection device against voltage spikes and short-circuits.

RECOMMANDATIONS 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 harsh chemical agents or solvents likely to damage the plastic or corrode the metal parts.

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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 of 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

Warning: If the charger is used with any other batteries or products whatsoever, there is a risk of an explosion. After use, the batteries must be disposed of at an appropriate recycling centre. They must not be thrown away to degrade in the environment. When batteries are replaced, the device must be corectly implemented.

Warning for Switzerland : the annex 4.10 of SR 814.013 Standad must be applied for batteries.

⎓ This symbol on the devode or its packaging means the use of a DC voltage.

1. INTRODUCING THE DEVICE

1.1. Description

The Field Test Device (FTD) from Adeunis-RF is a Class A & C LoRaWAN compatible device. This is not a point to point device and may not be used in this manner. This indicates that it must be used on a private or public operated network.

The LoRaWAN Field Test Device from Adeunis-RF is a ready-to-use device, which makes it possible to communicate with all network operators using the LoRaWAN V1.0 protocol. The system makes it possible to transmit and receive radio frames and to instantly view the results.
Equipped with a large LCD screen, you can view various information relating to how the network being used is functioning (Uplink, Downlink, SF, PER, etc.) in addition to information from sensors (GPS coordinates, temperature, battery level, etc.). This device is specifically adapted for application validation, such as communicating sensors, tracking, smart building, metering, security and M2M.

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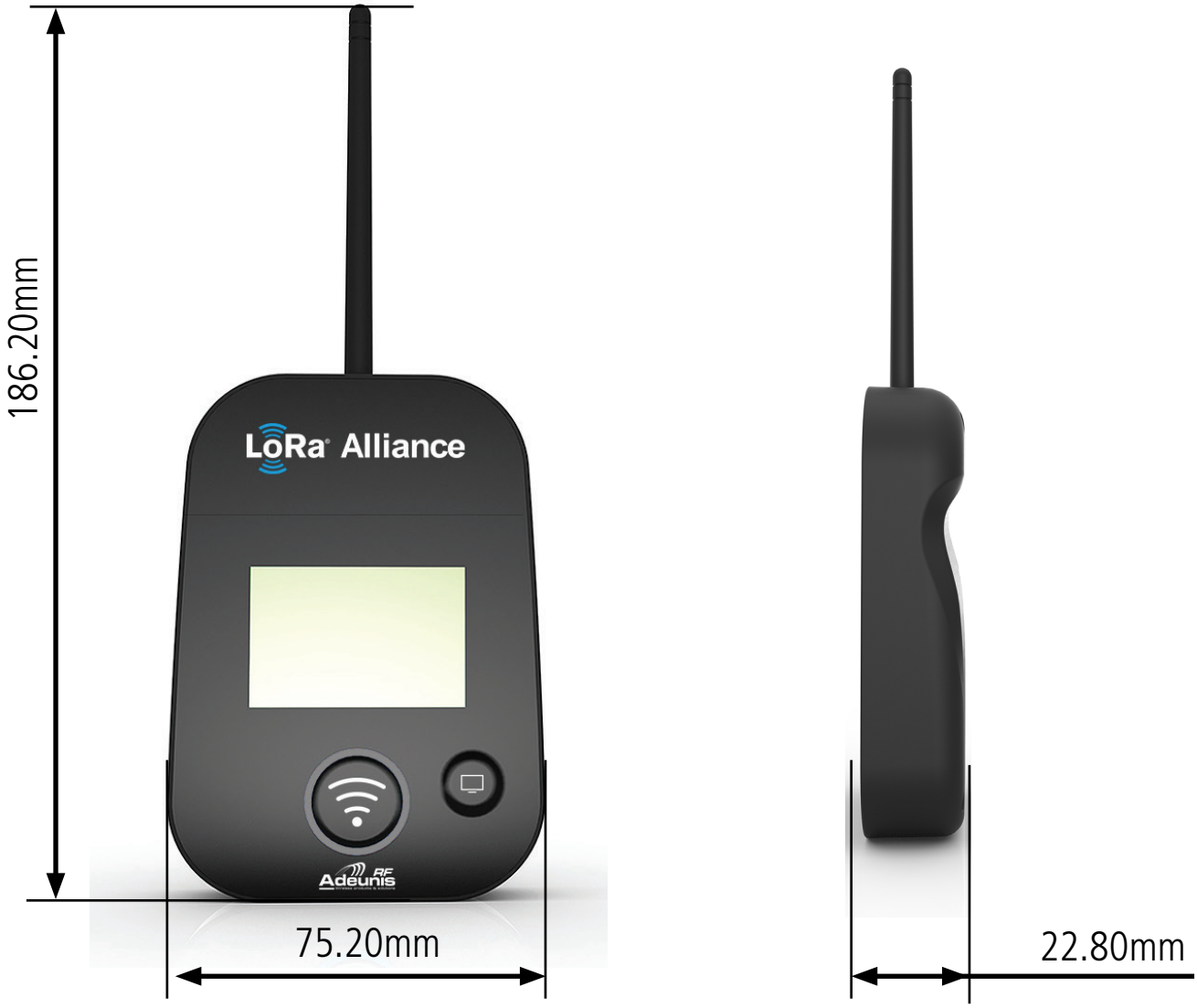
Thanks to its rechargeable battery, the FTD allows several hours of functioning and can be recharged using a standard mobile phone micro-usb.

1.2. Mechanical features

Unit specifications	
Dimensions	H186.20 x L75.20 x P22.80
Weight	140g
Materials	Unit: ABS GP22 + Black Colouring (HB à 1.6mm) Lexan: Autotex Polycarbonate Antenna: Thermolast K TC7AA (d) (a) UL#E214855



1.3. Technical specifications

Radio	
Communication	LoRaWAN protocol & LoRa Modulation
LoRaWan Specification compliant	V1.0.1
Radio Rate	Variable (SF12/125kHz (~183 bps) to FSK (~50kbps)
Frequency	ISM band 865-870MHz
RF Power	14dBm (25mW)
Sensitivity	down to -140 dBm in SF12/CR4
Range (Open)	Up to 15km
Standards met	EN 300-220, EN 301-489, EN 60950

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Supply	
Connector	Micro-USB - 5V - 500mA
Battery	Lithium-Ion Polymer 3.7V 2Ah 7.4Wh

Opérational	
Device configuration	Via AT commands (see relevant chapter to find a full list of available AT commands)
Serial rate	115.2 kbps
Parity	None
Amount of data	8
Stop bit	1
Functioning temperature	-30°C / +70°C

1.4. Charging the FTD

The device is equipped with a rechargeable battery. Once the device has been connected to a USB charger or the USB socket of a computer, it will start to charge automatically; even if the ON/OFF communicator is set to OFF (this functions in exactly the same way as a mobile phone). The device can be used while it is charging. During charging, the charge indicator will be red. When the device is fully charged, the indicator will turn green.

Figure 1 : Device charging

Figure 2 : Device is fully charged

If the battery is completely empty, it will be necessary to recharge the device for 6 hours in order for it to be fully charged.

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2. DEVICE DESCRIPTION

2.1. User interface

Figure 3 : Front view

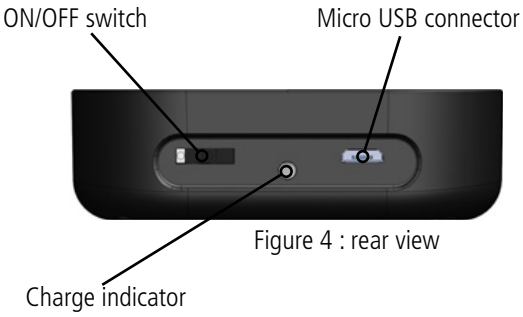
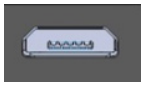


Figure 4 : rear view

2.2. Button description

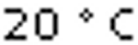
Interface operation	
 Pushbutton 1	This button allows you to carry out radio transmissions in manual mode. In the PER menu, a long press will allow you to reset the counters to zero.
 Pushbutton 2	This button allows you to manage the LCD screen. When the LCD backlight is switched off, pressing this button will switch on the backlight. When the LCD backlight is switched on, each press will allow you to scroll through the different screens available on this device.
 ON/OFF Switch	The ON/OFF switch allows you to switch the device on or off. Moving the switch to the right will turn the device on.
 Micro-USB connector	The micro-USB connector allows you to charge the device (see paragraph 1.4) or configure it (see paragraph 3).
 Charge indicator	The charge LED shows you the device's charge status (see paragraph 1.4).

3. SCREEN DESCRIPTION

The LCD screen of the product is split on few part :

- The START screen (Showing the firmware version) - Only on the powering up
- The JOIN screen - Only on the powering up and after a command mode exit
- The UPLINK/DOWLINK screen
- The GPS screen
- The PER screen (Packet Error Rate)
- The DOWNLINK FRAME screen

The following icon are present on each screen of the product

Item	Icon	Description
GPS status (First on the left)	No icon	GPS has been deactivated
		GPS has not been synchronised
		GPS has been synchronised
Temperature (Third on the left)		Temperature in °C
Battery (Last on the left)		Battery level
		Product in charge

3.1. Start Screen

The device is switched on using the ON/OFF switch located on the underside of the device. Once it has been switched on, the device's LCD screen will light up and the start menu will be displayed. This screen show the 2 firmware versions during few seconds.

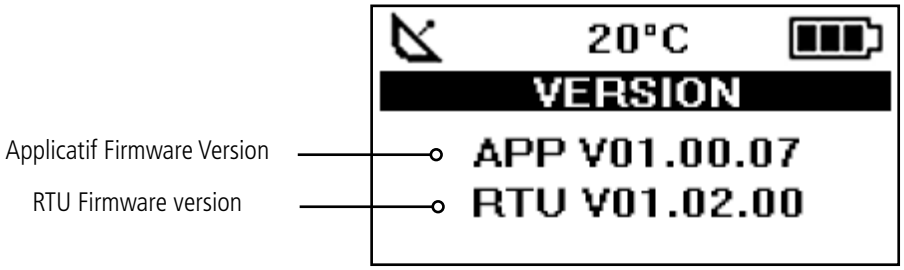


Figure 5 : Firmware version

NOTE : If the device does not switch on, this could mean that there is insufficient battery charge. You would then need to connect the device to a USB charger. When the battery is completely empty, it is possible that the device will not switch on, even when connected. Please wait a few minutes before the device can be used.

3.2. Join Screen

When the device is configure in OTAA mode (Over the Air Activiation) default mode, the product start a join request session (JRx) and show the frequency, SF and power used during this sesssion. When the product receive a Join Accept (JA) from the network, the information is displayed on the screen and the product switch to the main screen (Uplink/Downlink).

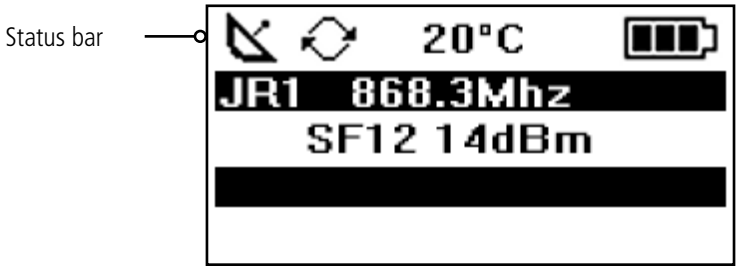


Figure 6 : Join Request

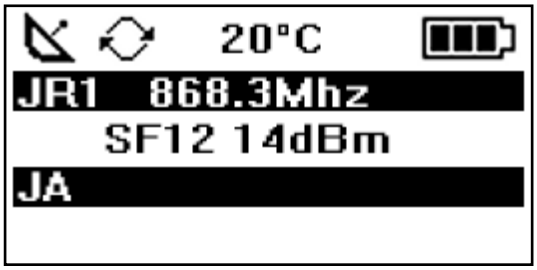


Figure 7 : Join Accept

The request are identify «JR» following with a number showing the number of request done. The frequency used for the request is showing after this information.

Note : If there is no network available, the «Join Request» will be send indefinitely, and the product will stay in this screen.

Item	Icon	Description
RF status (Second on the left)	No icon	The JOIN phase is completed and the device is operational on the network
		The device is in JOIN phase, and is trying to connect to the network

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3.3. Uplink/Downlink screen

This screen is displayed when the device is operational on a network but also when the device has been configured in ABP (Activation By Personalisation) mode.

Uplink and Downlink transmission information will be displayed on the LCD screen.
The first line show the Uplink information «ULx» with x for the number and frequency of repetition.
The second line show the SF and the power used
The third line show the Downlink information «DLx» with x for the number and frequency of the reception window
The last line show the SF, RSSI and SNR of the frame received

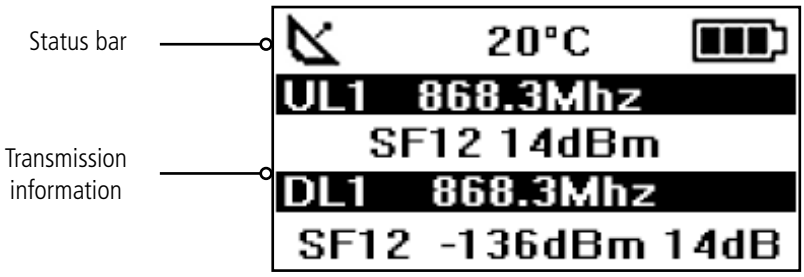

Figure 8 : Principal screen

Item	Icon	Description
Transmission Status (Second on the left)	No icon	There is currently no radio transmission
		Manual transmission has been triggered (transmission cycle in progress)
		Periodic transmission has been triggered (transmission cycle in progress)
Uplink information (Black Line)		Display showing the number of Uplink (UL1 to UL8) frame repetitions as well as the transmission frequency of the frame, accurate to one decimal place.
Uplink Information (White Line)		Display showing the SF used as well as the transmission power of the frame.
Downlink Information (Black Line)		Display showing the listening window of the device (DL1 or DL2) as well as the reception frequency of the frame, accurate to one decimal place.
Downlink Information (White Line)		Display showing the SF, the RSSI and the SNR of the most recent frame received.

The Downlink information displayed on the device relates to a Downlink frame sent from a LoRaWAN network. If no information can be found in this section, this does not indicate that the device will not function on the network but only that it has not received any information from the network. To validate the upload link (sending a frame from the device to the network) it is necessary to use an interface that will allow you to read frames from the network (example: back-end or application).

The device can either be configured in CONFIRMED mode or UNCONFIRMED MODE (see paragraph 5.4) In CONFIRMED mode, the confirmation frame allows you to obtain Downlink information. In UNCONFIRMED mode, this information will not automatically be displayed.

3.4. GPS screen

This screen can be accessed by briefly pressing on pushbutton 2 after the home screen. It will allow you to view the functioning information of the GPS module, as well as the device's GPS positioning.

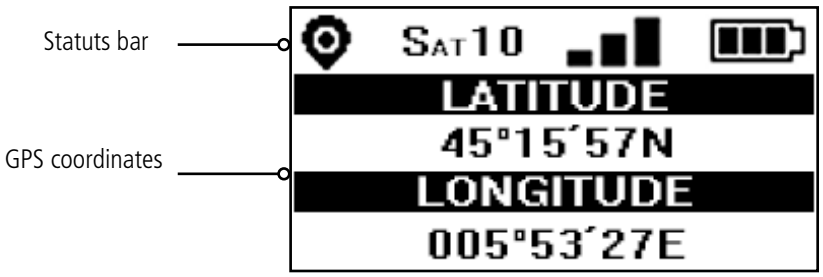

Figure 9 : GPS screen

Item	Icon	Description
Number of Satellites (Second on the left)	SAT xx	Indicates the number of satellites received by the device
GPS signal (Third on the left)		Indicator showing the quality of the GPS signal 1 bar: weak reception 2 bars: average reception 3 bars: good reception
LATITUDE		Display showing latitude coordinates in degrees, minutes and seconds
LONGITUDE		Display showing longitude coordinates in degrees, minutes and seconds

When GPS has not yet been "fixed", no information on latitude or longitude will be displayed on the screen and the information icon will indicate that GPS has not been synchronised.

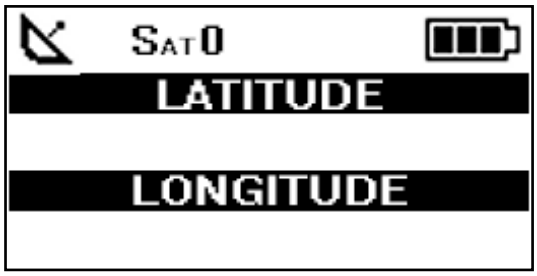

Figure 10 : GPS screen (No synchronisation)

If the device falls out of synchronisation with GPS, the information on this screen will no longer be available. There will be no memory of the last received position.

3.5. PER (Packet Error Rate) screen

This menu can be accessed by briefly pressing on pushbutton 2 after the GPS menu. It will allow you to evaluate the quality of the radio connection between the device and the network.

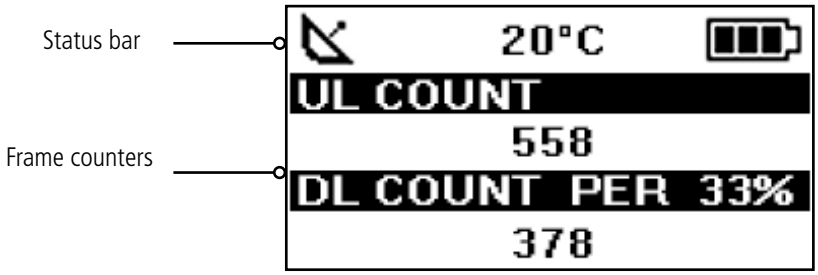

Figure 11 : PER screen

The screen will display:
- The number of frames sent (UL COUNT), including repetitions
- The number of frames received (DL COUNT)
- The Packet Error Rate (PER) as a percentage

The PER measurement is calculated by comparing the number of frames transmitted to the number of frames received:
- PER (%) = (DL_COUNT/UL_COUNT) * 100

3.6. Downlink screen

This menu can be accessed by briefly pressing on pushbutton 2 after the PER menu. It will allow you to view a downlink frame sending by the network. This frame is displayed in ASCII caracters. The non printable caracters are replace by a point.

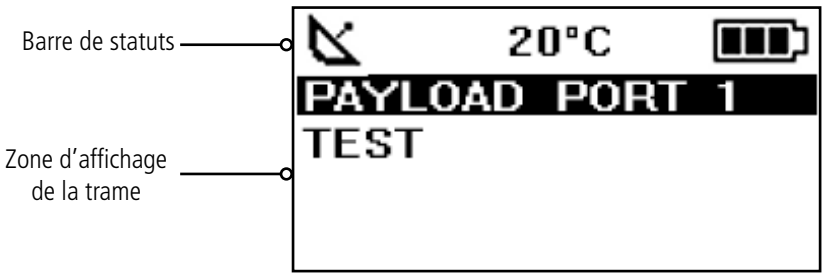

Figure 12 : Ecran Downlink

The screen allow a viewing of 51 caracters (17 caracters per lines). If the size of the payload is upper than 51 bytes, the product will not display the extra bytes.

4. DECODING THE PAYLOAD

The size of the Field Test Device's payload can vary depending on the information transmitted. The first byte will enable you to identify the presence of information contained in the payload. Information will always be shown in the order indicated in the following table.

Example of a payload received: BF1B4515969000553450272020 0FC95207
This example will be used in order to explain how the payload is decoded.

Order	1	2	3				4				5	6	7	8		9	10
Number of bytes	1	1	4				4				1	1	1	2		1	1
Description	Statut	Temperature	GPS Latitude				GPS Longitude				GPS Qualité	UL Counter	DL Counter	Battery level		RSSI	SNR
Example	**BF**	**1B**	**45**	**15**	**96**	**90**	**00**	**55**	**34**	**50**	**27**	**20**	**20**	**0F**	**C9**	**52**	**07**

4.1. Status

Hex	Décimal		N°	Bit N°	Commentaires	Valeur
BF	**1**		**1**	7	Presence of temperature information	0 or 1
	0			6	Transmission triggered by the accelerometer	0 or 1
	1			5	Transmission triggered by pressing pushbutton 1	0 or 1
	1			4	Presence of GPS information	0 or 1
	1			3	Presence of Uplink frame counter	0 or 1
	1			2	Presence of Downlink frame counter	0 or 1
	1			1	Presence of battery level information	0 or 1
	1			1	Presence of RSSI and SNR information	0 or 1

0: Data missing from the payload
1: Data present in the payload

4.2. Température

Hex	Binaire		N°	Bit N°	Commentaires	Valeur
1B	**0001 1011**		**2**	1	Temperature in °C (two's complement)	-128 ... +127

Aid for decoding temperature

Hex	Sign Bit	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Value T°C
Value		64	32	16	8	4	2	1	
1B	0	0	0	1	1	0	1	1	+27°C
F4	1	1	1	1	0	1	0	0	-12°C

- For a positive temperature (sign bit = 0) : Value T°C = 16 + 8 +2 + 1 = +27°C
- For a negative temperature (sign bit = 1) : Value T°C = (64+32+16+4)-128 = -12°C

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4.3. Latitude

Hex			N°	Bit N°	Commentaires	Valeur
45			**3**	7..4	BCD coding of the entire degree section (tenth of a degree)	**4**5°15,9820
				3..0	BCD coding of the entire degree section (whole degrees)	4**5**°15,9820
15				7..4	BCD coding of the entire minute section (tenth of a minute)	45°**1**5,9820
				3..0	BCD coding of the entire minute section (whole minutes)	45°1**5**,9820
96				7..4	BCD coding of the decimal section (tenth)	45°15,**9**820
				3..0	BCD coding of the decimal section (one hundredth)	45°15,9**6**20
90				7..4	BCD coding of the decimal section (one thousandth)	45°15,989**0**
				3...1	Not used	
				0	Hemispheric coding	0 : North 1 : South

Note: the value expressed in the payload will be in degrees, minutes and fractions of a second. A conversion to degrees, minutes and seconds must be carried out in order to make a comparison with the coordinates displayed on the device's LCD screen.

4.4. Longitude

Hex			N°	Bit N°	Commentaires	Valeur
00			**4**	7..4	BCD coding of the entire degree section (one hundredth of a degree)	**0**05°34,500
				3..0	BCD coding of the entire degree section (one tenth of a degree)	0**0**5°34,500
55				7..4	BCD coding of the entire degree section (whole degrees)	00**5**°34,500
				3..0	BCD coding of the entire minute section (one tenth of a minute)	005°**3**4,500
34				7..4	BCD coding of the entire minute section (whole minutes)	005°3**4**,500
				3..0	BCD coding of the decimal section (tenth)	005°34,**5**00
50				7..4	BCD coding of the decimal section (one hundredth)	005°34,5**0**0
				3...1	Not used	
				0	Hemispheric coding	0 : Est 1 : Ouest

Note: the value expressed in the payload will be in degrees, minutes and fractions of a second. A conversion to degrees, minutes and seconds must be carried out in order to make a comparison with the coordinates displayed on the device's LCD screen.

4.5. GPS quality (Not available in Legacy mode)

Hex	Valeur		N°	Bit N°	Commentaires	Valeur
27	2		5	7..4	Reception scale	1: Good 2: Average 3: Poor
	7			3..0	Number of satellites	1 ... 16

The byte's MSB allows you to find out the quality of the GPS signal
The byte's LSB allows you to find out the number of satellites viewed by the device

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4.6. UL counter

Hex	Decimal		N°	Bit N°	Commentaires	Valeur
20	32		6	1	Uplink frame counter	0 ... 255

Please note: This counter is not the LoRaWAN stack frame counter, but an internal frame counter. Therefore, there is no correlation between this counter and the one that you can view on the network.

4.7. DL counter

Hex	Decimal		N°	Bit N°	Commentaires	Valeur
20	32		7	1	Downlink frame counter	0 ... 255

Please note: This counter is not the LoRaWAN stack frame counter, but an internal frame counter. Therefore, there is no correlation between this counter and the one that you can view on the network.

4.8. Battery level

Hex	Decimal		N°	Bit N°	Commentaires	Value
0F C9			8	1	MSB value of the battery level (in mV)	4041
				2	LSB value of the battery level (in mV)	

4.9. RSSI

Hex	Decimal		N°	Bytes	Commentaires	Valeur
52	82		9	1	RSSI Value in dBm (Absolute value)	0 ... 255

In the example the RSSI value is -82dBm

4.10. SNR

Hex	Decimal		N°	Bytes	Commentaires	Valeur
07	07		10	1	SNR Value in dB (Two's complement)	-128 ... +127

In the example the SNR alue is 7 dB

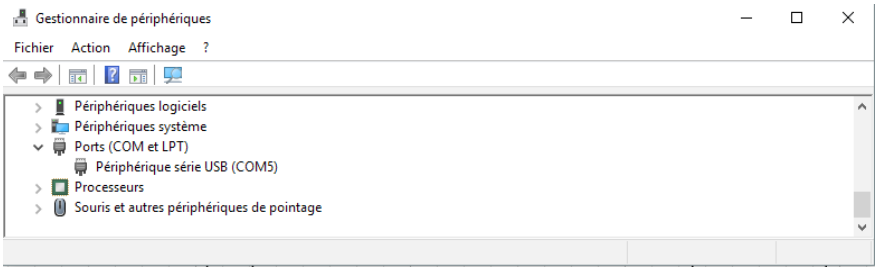
5. DEVICE CONFIGURATION

The device can be configured using the USB connector. This connection allows you to communicate with the device via a virtual com port and to transmit AT commands in order to modify the parameters of the device.

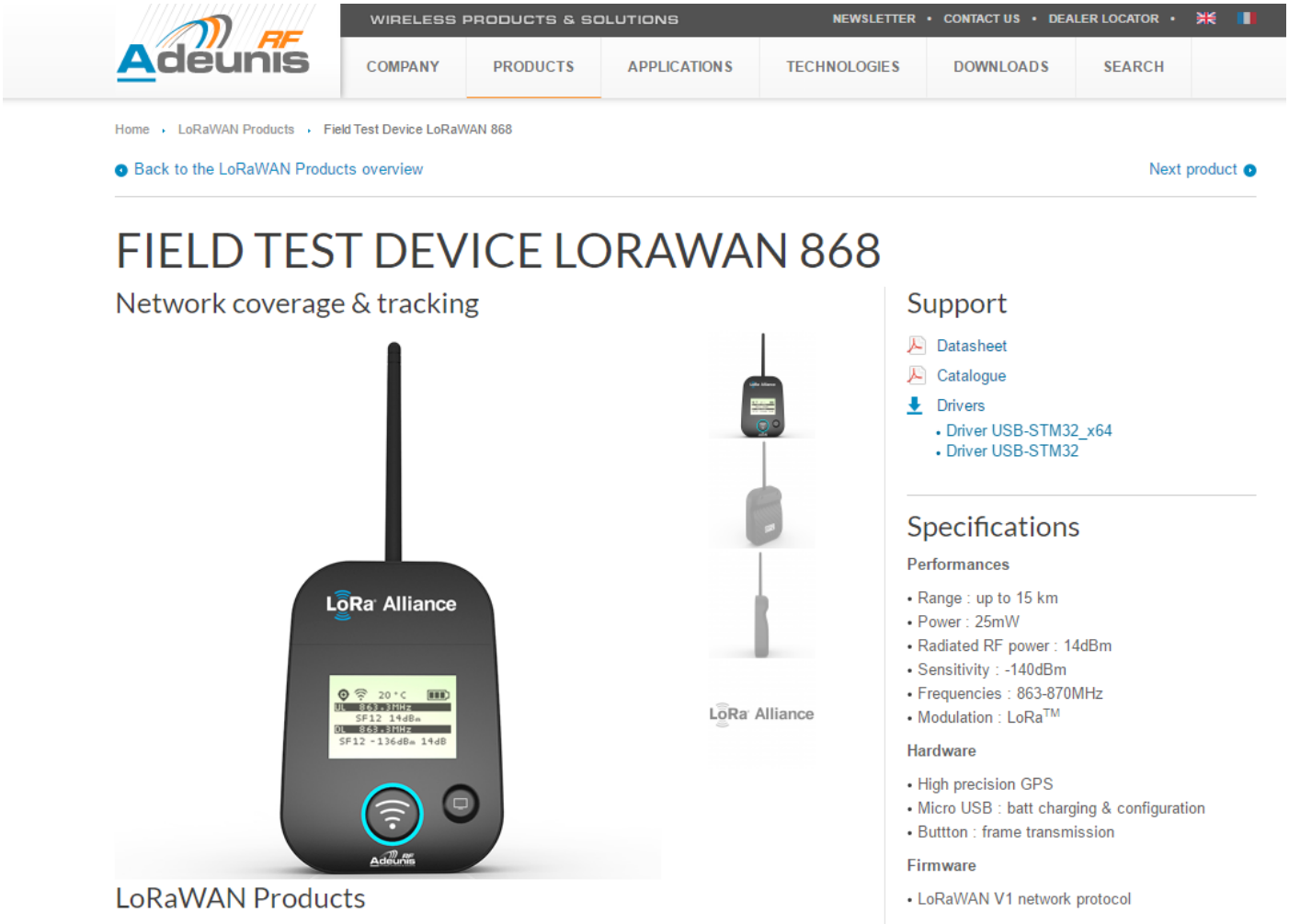
5.1. Connecting the device to a computer

Connect the Field Test Device (FTD) to the USB input of a computer. The FTD device has a Type B micro USB connector.
During connection, the device must be recognised by the computer as a Virtual Com Port (VCP) device.

Using Windows: Verification that the device has been recognised to be functioning properly can be obtained by consulting the device manager. You should see the USB series device with a corresponding COM port number appear during connection.



If you are not able to see a device of this type, you must install the USB driver for this device, available to download from our website: http://www.adeunis-rf.com/fr/produits/lorawan-devices/field_test_device_lorawan_868



- Select:
- Driver USB-STM32_x64, si votre ordinateur est un système 64 bits
- Driver USB-STM32, si votre ordinateur est un système 32 bits

5.2. Command mode

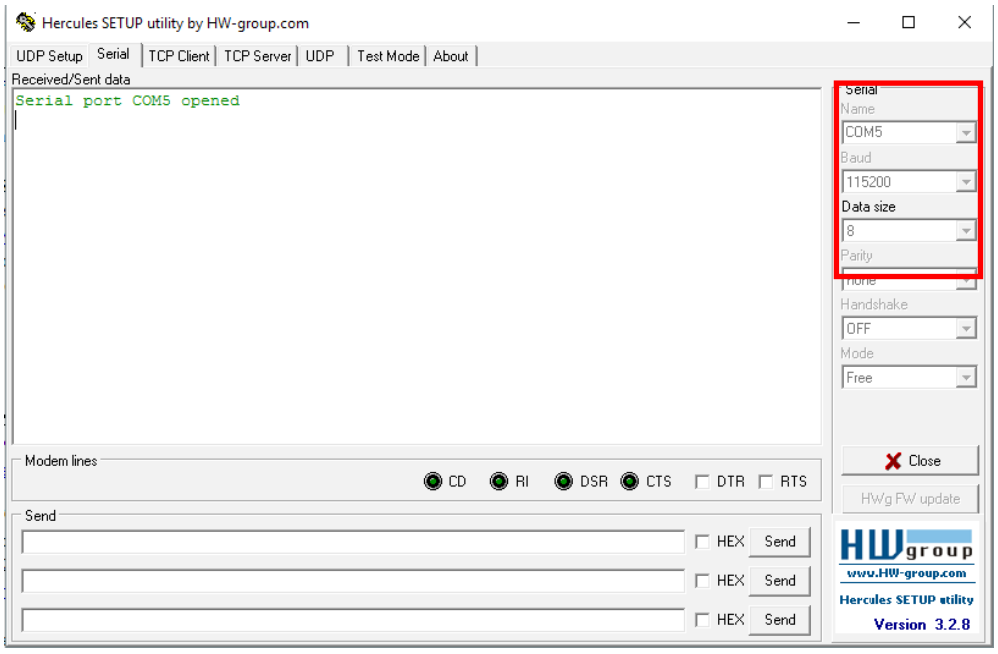
Use a COM port terminal in order to communicate with the device. We use the HERCULES COM port soft terminal available to download for free by clicking on the following link: http://www.hw-group.com/devices/hercules/index_en.html

- With Hercules, select the "Serial" tab, then configure the serial port with the following serial parameters:

Parameters	Value
Rate	115 200 bps
Parity	None
Data	8
Stop Bit	1

- Select the serial port on which the device has been created with Windows (Name).
- Click on the "Open" button to open the serial port.

PLEASE NOTE: If the com port has been opened correctly, Hercules will display the message "Serial COM3 port opened".
Alternatively, "Serial port com opening error" will be displayed, meaning either that the com port is already open for another application, or it does not exist.



- To supply power to the device, move the switch to the right.

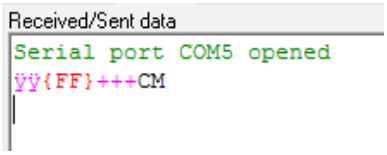
Bottom view

You must send a specific frame in order to move the device to configuration mode.
Frame expressed in hexadecimals: 0xFF 0xFF 0xFF 0xFF 0xFF 0x2B 0x2B 0x2B

For Hercules, this frame must be entered in one of the 3 lines available at the bottom. The hexadecimal format must be expressed using a "$" in this program, which gives us the following frame: FFFFFFFFFF2B$2B$2B

- Send the transition frame in command mode in order to switch the device to configuration mode by clicking on the SEND button.

After a few seconds, you should see the COMMAND MODE screen appear on the device's LCD. This may take some time due to the fact that transition to command mode can only happen during a transmission cycle.



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On the com port terminal, you should also have "CM" feedback for Command Mode.
Sending a character on Hercules is displayed in magenta and receiving a character is displayed in black. If you do not see sending characters, this is probably because ECHO is not active on this program. To activate the option in the accessible menu, right click in the viewing window.

5.3. AT command

A command starts with 2 ASCII characters: "AT", followed by one or more characters and data (see the list below for the syntax of AT commands available on the modem).
Each command must finish with a "CR" or "CR" "LF" – both are acceptable.
(CR indicates: Carriage Return, LF indicates: Line Feed)

Once the command has been received, the modem will feedback:
<cr><lf> "Data" for ATS type playback control <n> ?, AT/S or AT/V
"O" <cr><lf>, for any other command when this has been accepted.
"E" <cr><lf>, if it refuses the command due to a syntax error, unknown command, unknown range, invalid parameter, etc.
"CM" <cr><lf>, if it accepts the input in command mode

Table of AT commands:

Commande	Description	Réponse
ATS<n> ?	Feeds back the content of the **n** range	Sn=y where y represents the content of the n range
ATS<n>=<m>	Transfers the **m** value to the **n** range	"O" if the operation has been accepted "E" if the operation has been refused "W" if the operation has encountered a problem during configuration
AT/S	Edits the content of all of the user ranges in the form of a list.	Sxxx=y for each range
AT/V	Feeds back the version of the software	Example: 8123AAA_PRG_1601_V01.00.00:8134AAA_PRG_1601_V01.00.00 (chapter 6)
ATR	Restores the value of all non-volatile memory ranges to volatile memory.	**"O"** if the operation has been accepted. **"E"** if the operation has been refused.
AT&W	Saves the current configuration to non-volatile memory.	**"O"** if the operation has been accepted. **"E"** if the operation has been refused.
AT&RST	Restart the device	**"O"** if the operation has been accepted. **"E"** if the operation has been refused.
AT0	Exit command mode	**"O"** if the operation has been accepted. **"E"** if the operation has been refused.
ATT63 PROVIDER	Unblock the operating range	**"O"** if the operation has been accepted. **"E"** if the operation has been refused.

Example of a set of commands and corresponding responses that can be seen on the terminal:

Syntaxe de la Commande	Description	Syntaxe de la réponse à la ligne suivante
\FF\FF\FF\FF+++	Input request in command mode	**CM**
ATS221=1	Transition request in OTAA activation mode	**O**
ATS214=0018B200	APP_EUI MSB modification change	**E** -> This command is not validated (register no unlocked)
ATT63 PROVIDER	Unblock the operating range	**O**
ATS214=0018B200	APP_EUI MSB modification change	**O**
ATS215?	Feeds back the value of the S215 range	**S200=44512451**
AT&W	Memory request for the state range	**O**
ATO	Output request in command mode	**O**

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Interpreting the previous example: the user wanted to modify the start of the APP_EUI after having made an unauthorised command (answer **E**), and the ranges were unblocked in order to modify the range. The second section of the APP_EUI was verified and the parameters were saved before exiting. When exiting command mode, the device will make a JOIN request.

5.4. Register description

Once supplied with power, the Field Test Device will function according to the last saved configuration (factory settings if this is the first time the device has been switched on, or if this configuration has not been changed).

ATS<n>=<m> or ATR type modification commands allow you to modify the content of these ranges.
It is essential to save the parameters using the AT&W command before exiting the command mode, otherwise all of your changes will be lost.

5.4.1 Fonction register

Below is a list of the ranges accessible on the device (by default). These ranges make it possible to modify the device's behaviour.
Details on how each range functions can be found elsewhere in the table.

Range	Content	Default value	Comments
S370	Payload format	0	0 : Format Legacy (Demonstrator) 1 : Format Field Test Device
S371	GPS configuration	11	0: GPS deactivated 1: GPS activated/Continuous Mode 11 : GPS activated/Continuous Mode + GPS Reset (Cold Start)
S380	Frame transmission period	600	0: No periodic transmission 1 to 86400 (expressed in seconds) : Periodic transmission
S382	ACK and Class mode	1	0: Class A Unconfirmed 1: Class A Confirmed 16: Class C Unconfirmed 17: Class C Confirmed All other values will be retained.
S383	Uplink Port	1	1-223

Range	Content	Default value	Comments
S385	Personnalized Payload Size	0	0 : Deactivated 1 to 16 : Size of the payload
S386	Personalize Payload Text - Bloc 1	0	Each bloc allow to define 4 bytes of the payload
S387	Personalize Payload Text- Bloc 2	0	
S388	Personalize Payload Text- Bloc 3	0	
S389	Personalize Payload Text - Bloc 4	0	

S370 : Payload format

The Field Test Device (FTD) is compatible with the previous version of the device (the LoRaWAN Demonstrator). In order to modify the format of the payload and to make it compatible with the previous device, it will be necessary to modify this range.

S371 : GPS configuration

The way in which the GPS module is configured is completely independent from the main firmware. Two functioning modes are available:

- Permanent Mode
- Periodic Mode

In **permanent mode**, the GPS is always active and will operate at maximum power (like the GPS in a car). This is the most efficient mode and we would recommend using it when it is necessary to move the Field Test Device (example: if the device will be in a car), or if satellite visibility is poor.

In **periodic mode**, the GPS will start for a period of 5 mins at maximum power before switching to periodic power. In this mode, the GPS will become active for 30-40 seconds every 10 minutes. The rest of the time, it will be in rest mode, which will aid the device's independence. This mode should be used for static use (fixed position, or very slow movement), or where satellite visibility is very good.

The user can also choose to reset the GPS once it is switched on. This operation will allow you to delete the GPS memory as well as all previously acquired information. This can be useful when the GPS is not able to synchronise itself while it is starting up. Essentially, the GPS will use its internal memory to set a position and to locate satellites, but when the GPS has not been used for a long period of time or has travelled a great distance (for example, if it has travelled on-board an aircraft to another country), the information will be inaccurate and must be deleted.

If the GPS coordinates are available during transmission of a LoRa frame, these coordinates will be included in the payload. Otherwise the corresponding bytes will be deleted, rendering the payload shorter.

S380 : Frame transmission period

The device is capable of automatically making periodic transmissions. The transmission period is defined in seconds and can be anywhere between 0 and 86400 (24 hours).

If the value for the period is equal to 0, the function will then be deactivated.

S382 : Class and ACK Mode

The range will allow you to select the method of functioning for the device:
- Unconfirmed Mode
- Confirmed Mode

as well as the functioning Class:
- Class A
- Class C

S383 : Uplink Port

The communication port for the Uplink frame can be configured in this frame. You can select a value between 1 and 223

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S385 : Personnalize Payload Size

This option allow to send a define payload instead of the standard define inside the product
The user can set the size of the payload and the texte to send
When the value of the register is set to , the function is deactivated and the product use the standard payload.
When the value get a number, the product send the caracters of the registers S386 to S389.

S386 to S389 : Personnalize Payload Text

The 4 registers allow to set a specific payload :
- The register S386 allow to define the bytes 1 to 4 of the frame
- The register S386 allow to define the bytes 5 to 8 of the frame
- The register S386 allow to define the bytes 9 to 11 of the frame
- The register S386 allow to define the bytes 12to 16 of the frame

The value must be set in hexadecimal code : example for the «TEST» word --> 54455654

WARNING : The register need to be completed with zero to send a byte, or the product will completed by himself the register and you will not have the result you would like to have. Example with : ATS385=1.
- ATS386=AB000000 --> The system understand the frame **AB**000000 and send the first byte --> You will receive **AB**
- ATS386=AB --> The system understand the frame **00**0000AB and send the first byte --> You will receive **00**

5.4.2 Network register

Range	Content	Default value	Comments
S201	Spreading Factor value	12	7 : SF7 8 : SF8 9 : SF9 10 : SF10 11 : SF11 12 : SF12
S204	RESERVE	34C194C1	Read-only

Range	Content	Default value	Comments
S214	LORA APP_EUI (First section)	0018B244	Parameter coded with 16 characters. Each range contains a section of the key.
S215	LORA APP_EUI (Second section)	41524632	
S216	LORA APP_KEY (First section)	(voir note)	Parameter coded with 16 bytes. Each of the 4 ranges will contain 4 bytes.
S217	LORA APP_KEY (Second section)	(voir note)	
S218	LORA APP_KEY (Third section)	(voir note)	
S219	LORA APP_KEY (Fourth section)	(voir note)	
S220	Activation ADR	1	0 : Inactive 1 : Active
S221	Activation mode	1	0 : ABP 1 :OTAA
S222	LORA NWK_sKEY (First section)	0	Parameter coded with 16 bytes. Each of the 4 ranges contains 4 bytes.
S223	LORA NWK_sKEY (Second section)	0	
S224	LORA NWK_sKEY (Third section)	0	
S225	LORA NWK_sKEY (Fourth section)	0	
S226	LORA APP_sKEY (First section)	0	Parameter with 16 bytes. Each of the 4 ranges contains 4 bytes.
S227	LORA APP_sKEY (Second section)	0	
S228	LORA APP_sKEY (Third section)	0	
S229	LORA APP_sKEY (Fourth section)	0	

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Range	Content	Default value	Comments
S250	Configuration Channel 0	1	Mandatory operational channel LoRaWAN Do not change this value
S251	Configuration Channel 1	1	
S252	Configuration Channel 2	1	
S53	Configuration Channel 3	0	0 : Channel desactivated Other : User configuration
S254	Configuration Channel 4	0	
S255	Configuration Channel 5	0	
S256	Configuration Channel 6	0	
S257	Configuration RX2	1	0: Channel deactivated 1: LoRaWAN default configuration Other: User configuration
S260	RESERVE	2200	Read-only
S261	RESERVE	3600	Read-only
S280	NETWORK ID	0	Read-only
S281	DEVICE ADDRESS		

S201: SF value

The range allows you to set a "Spreading Factor" (SF) value to use when the device has not been configured to "Adaptive Data Rate" (ADR). This value will then be used to transmit the frame on the LoRaWAN network. When the ADR is active, the SF will automatically be managed by the network.

S214 and S215: LORA APP_EUI

The S214 and S215 ranges determine the APP_EUI key used during the JOIN phase in OTAA mode. The key is made up of 16 characters spread across these 2 ranges, which can each contain 8 characters. The S214 range contains the start of the key, while the S215 range contains the end of the key.

Example : 0018B244 41524632

S214 = 0018B244
S215 = 41524632

S216 to S219: LORA APP_KEY
The ranges from S216 to S219 determine the APP_KEY used during the JOIN phase in OTAA mode. The key is made up of 32 characters spread across these 4 ranges, which can each contain 8 characters. The S216 range contains the first 8, the S217 range contains the next 8, the S218 range contains the next 8 and the S219 range contains the last 8.

Example : 0018B244 41524632 0018B200 00000912

S216 = 0018B244
S217= 41524632
S218 = 0018B200
S219 = 00000912

S220: ADR activation
If the ADR mode has been activated, the device will have no control over the SF because the parameter can only be modified by the network. If the ADR has been deactivated, the SF value used is that contained in the S201 register.

S221: Activation mode
This range will allow you to configure the device's activation mode:

- The "Over The Air Activation" (OTAA) mode uses a JOIN phase before it can transmit on the network. This mode uses the code APP_EUI (S214 and S215) and the code APP_KEY (S216 to S219) during this phase in order to create the network communication keys. Once this phase has finished, the APP_sKEY, NWK_sKEY and DEVICE ADDRESS codes will be present in the corresponding ranges. A new JOIN phase will start each time the device exits command mode, is reset or is supplied with power.

Code	Description
APP_EUI	Global application identifier
APP_KEY	Device application key

- The "Activation By Personalisation" (ABP) mode does not have a JOIN phase, but transmits directly on the network by directly using the codes NWK_sKEY (S222 to S225), APP_sKEY (S226 to S229) and DEVICE ADDRESS (S281) in order to communicate.

Data Rate (DR) value	Description
NWK_sKEY	Network session key
APP_sKEY	Application session key
DEVICE ADDRESS	Network device address

S222 à S225: LORA NWK_sKEY
The ranges from S222 to S225 determine the NWK_sKEY used during network exchanges. The key is made up of 32 characters spread across these 4 ranges, which can each contain 8 characters. The range S222 contains the first 8, the S223 range contains the next 8, the S224 register contains the next 8 and the S225 range contains the last 8.

Example: 0018B244 41524632 0018B200 00000912

S216 = 0018B244
S217= 41524632
S218 = 0018B200
S219 = 00000912

S226 to S229: LORA APP_sKEY
The ranges from S226 to S229 determine the APP_sKEY used during network exchanges. The key is made up of 32 characters spread across these 4 ranges, which can each contain 8 characters. The S226 range contains the first 8, the S227 range contains the next 8, the S228 range contains the next 8 and the S229 range contains the next 8.

Example : 0018B244 41524632 0018B200 00000912

S216 = 0018B244
S217= 41524632
S218 = 0018B200
S219 = 00000912

S253 à S256 : Configuration Channel
By default, the channels from 0 to 2 use the default parameters of the LoRaWAN network, while the 4 other channels are inactive. A range value different from 0 or 1 will allow you to configure the channel as follows:

Bit	7	6	5	4	3	2	1	0
Description	Channel frequency						DR Max	DR Min
Example	868100						5	3

Data Rate (DR) value	Description
0	SF12
1	SF11
2	SF10
3	SF9
4	SF8
5	SF7
6	SF7 - BW 250Khz
7	FSK 50 kbps

NOTE: the example given will allow you to configure a 868.1 Hz frequency and authorises a SF from 7 to 9. The command to send in order to carry out this operation is:
ATS250=86810053<cr>

S281: DEVICE ADDRESS
This range will allow you to determine the address of the device on the network when using the ABP mode. In the OTAA mode, this parameter is automatically input during the JOIN phase.

6. DEVICE UPDATES

The firmware versions of the device can be updated. The device has 2 firmwares that can be updated individually:
RTU firmware
APPLICATIVE firmware
It is possible to find out the references for versions loaded onto the device using the command AT/S

Example :
8123AAB_PRG_1601_**V01.00.07**:8134AAB_PRG_1601_**V01.02.00**

The RTU firmware version is: V01.00.07 The APPLICATIVE firmware version is: V01.02.00

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The full procedure is available on the device page of our website: www.adeunis-rf.com

7. DOCUMENT HISTORY

Version	Content
V1.0.0	Creation
V1.1.0	New function • RSSI-SNR Managment in the payload • SF setting in ADR Mode desactivated • Downlink frame screen • Personnalize payload • Join Screen • Firmware version screen on start
V1.1.2	• Delete Doc
V1.2.0	• Frequencies

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