BREATH

Technical Reference Manual

EU868 LoRaWAN / Sigfox RC1

Applicable aux versions >= 2.4.x

Version Document			
Version	Date	Auteur	Commentaire
2.4.0	09/06/2021	GDL	Création

NEW DOCUMENTATION / NOUVELLE DOCUMENTATION

	ENGLISH	FRANCAIS
USER GUIDE	• Dedicated to a product • Cautions & electrical warnings • Declaration of conformity • Product functionalities and modes • Casing dimensions • Characteristics (casing and electrical) • LED explanations • Specific wiring on terminal blocks	• Dédié à un produit • Recommandations et avertissements électriques • Déclaration de conformité • Fonctionnalités et modes du produit • Dimensions du boitier • Caractéristiques (boitier et électrique) • Explication des LED • Câblage sur bornier spécifique au produit
TECHNICAL REFERENCE MANUAL	• Dedicated to a product • Registers content • Frame explanations (uplink and downlink)	• Dédié à un produit • Contenu des registres • Explication des trames (uplink et downlink)
INSTALLATION GUIDE	• For all adeunis® products • Configuration of the products • Installation and fixing • Start-up of the products • Opening and closing the case • Replace battery	• Pour tous les produits adeunis® • Configuration des produits • Installation et fixation • Démarrage des produits • Ouvrir et fermer les boîtiers • Remplacer la batterie

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1 REGISTERS

1.1 Generic registers

Register	Size (bytes)	Base	Description	Default Value	Range (Min-Max)	Comments
304	2	10	PIN code	0 (deactivated)	0 - 9999	PIN code used with ATPIN command. Value 0 disables the PIN code.
306	1	10	Product mode	0	0: PARK 1: RUN	In PARK mode, product is not using Radio. In RUN mode, product send/receive UL/DL.

1.2 Applicative registers

Register	Size (bytes)	Base	Description	Default value	Min-Max Value	Comments
300	1	10	Daily Frame	1	0: Disable 1: Daily transmission	1: Daily frame sent every 24H
301	2	10	Transmit period of data	1 ➔ Sigfox 6 ➔ LoRa	0 ... 65535	Number of backups (history logs) to be done before sending a frame (thus defining the sending period). The value 0 is equivalent to disabling the periodic mode. NOTE: for Sigfox only 0 or 1 is tolerated.
308	4	16	LED activity	0x0394007F	0 … 0xFFFFFFFF	Default: 0x0394007F Other values: reserved
320	2	10	History period	600 (10 minutes)	60 ... 3600	History logging period in seconds
321	1	10	Alarm repetition activation	0	0 ... 1	If an alarm is active, this register allows the product to send periodically a reminder. 0: disabled 1: enabled
322	2	10	Alarm repetition period	600 (10 min)	60 ... 3600	Alarm repetition period in seconds
323	1	10	Number of additional (redundant) samples per frame	0	0 ... 5	Number of samples to be repeated in the next frame *Sigfox: do not use, not enough space*

1.3 Alarm registers

1.3.1 TVOC

Register	Size (bytes)	Base	Description	Default value	Min-Max value	Comments
330	1	10	Alarm type	0	0: Alarm disabled 1: Alarm enabled	
331	2	10	Threshold value	0	0 … 65535	Unit µg/m^3
332	2	10	Threshold hysteresis	0	0 … 65535	Unit µg/m^3

1.3.2 PM10

Register	Size (bytes)	Base	Description	Default value	Min-Max value	Comments
340	1	10	Alarm type	0 (inactive)	0: Inactive 1: Active	
341	2	10	Threshold value	0	0 … 65535	Unit µg/m³
342	2	10	Threshold hysteresis	0	0 … 65535	Unit µg/m³

1.3.3 PM2.5

Register	Size (bytes)	Base	Description	Default value	Min-Max value	Comments
350	1	10	Alarm type	2	0: all disabled 1: Alarm enabled 2: Led indicator enabled 3: Alarm and Led indicator enabled	
351	2	10	Threshold value	0	0 … 65535	Unit µg/m³
352	2	10	Threshold hysteresis	0	0 … 65535	Unit µg/m³
353	2	10	PM2.5 indicator, orange, medium threshold	10	0 … 65535	Unit µg/m³
354	2	10	PM2.5 indicator, Red LED, high threshold	25	0 … 65535	Unit µg/m³

1.3.4 PM1

Register	Size (bytes)	Base	Description	Default value	Min-Max value	Comments
360	1	10	Alarm type	0	0: Alarm disabled 1: Alarm enabled	
361	2	10	Threshold value	0	0 … 65535	Unit µg/m³
362	2	10	Threshold hysteresis	0	0 … 65535	Unit µg/m³

1.4 Daily Frame

Register	Size (bytes)	Base	Description	Default value	Min-Max value	Comments
370	2	10	TVOC threshold for the alarm duration measured in the daily frame	600	0 … 65535	Unit µg/m³
371	2	10	PM10 threshold for the alarm duration measured in the daily frame	50	0 … 65535	Unit µg/m³
372	2	10	PM2.5 threshold for the alarm duration measured in the daily frame	25	0 … 65535	Unit µg/m³

1.5 Digital inputs

Register	Size (bytes)	Base	Description	Default value	Min-Max Value	Comments
380	1	10	Button configuration	1	0 = Alarm OFF 1 = Alarm ON	Only short press (<500ms) on the button is considered as an event Alarm.
381	2	10	Button threshold	1	1 ... 65535	Number of detections before the alarm is triggered
382	1	16	Configuration of the digital input	0x00 (deactivated)	<7:4> Debounce duration 0: no debounce 1: 10 ms 2: 20 ms 3: 50 ms 4: 100 ms 5: 200 ms 6: 500 ms 7: 1 s 8: 2 s 9: 5 s A: 10 s B: 20 s C: 40 s D: 60 s E: 5 minutes F: 10 minutes <3:0> Type 0 = Deactivated 1 = Event ON 2 = Event OFF 3 = Event ON/OFF	
383	2	10	Digital input threshold	1	1 ... 65535	Number of detections before the alarm is triggered
390	4	10	Global counter for button	0	0 – 4294967295	*Read Only* In-RAM counter that counts the number of events detected on the channel This register is not saved in EEPROM. Its value is therefore set to 0 if the product is not powered anymore
391	4	10	Global counter for digital input	0	0 – 4294967295	

1.6 Radio registers

1.6.1 LoRaWAN Network Registers

Register	Description	Encoding	Details
201	Spreading Factor (SF) by default (Read Only)	Decimal	Default: 12 Min/max: 7 to 12 Unit: None
204	Reserved	Hexadecimal	Do not use
214	LORA APP-EUI (first part – MSB)	Hexadecimal	Default: 0 Key encoded on 16 characters. Each register contains a part of the key. Used during the JOIN phase in OTAA mode E.g.: APP-EUI = 0018B244 41524632 • S214 = 0018B244 • S215 = 41524632
215	LORA APP-EUI (second part – MSB)	Hexadecimal	
216	LORA APP-KEY (first part – MSB)	Hexadecimal	Default: 0 Key encoded on 32-byte characters. Each of the 4 registers contains 8 characters. Used during the JOIN phase in OTAA mode E.g.: APP-KEY = 0018B244 41524632 0018B200 00000912 • S216 = 0018B244 • S217= 41524632 • S218=0018B200 • S219= 00000912
217	LORA APP-KEY (second part – MID MSB)	Hexadecimal	
218	LORA APP-KEY (third part – MID LSB)	Hexadecimal	
219	LORA APP-KEY (fourth part – LSB)	Hexadecimal	
220	LoRaWAN Options	Hexadecimal	Default: 5 Bit 0: Activation of the ADR ON(1)/OFF(0) Bit 1: Reserved Bit 2: DUTY CYCLE ON(1)/DUTY CYCLE OFF(0) Bits 3 & 4: Reserved Bits 5: CLASS C (1)/ CLASS A (0) Bits 6 to 7: Reserved CAUTION: Deactivation of the Duty cycle may result in a violation of the conditions of use of the frequency band, depending on the use of the device, thus violating the regulations in force. In the case of disabling the Duty cycle, liability is transferred to the user.
221	Mode of activation	Decimal	Default: 1 Choice: (see NOTE 1 after the table) • 0: ABP • 1: OTAA
222	LORA NWK_SKEY (first part – MSB)	Hexadecimal	Default: 0 Parameter encoded on 16 bytes. 4 registers contains 4 bytes.
223	LORA NWK_SKEY (second part - MID MSB)	Hexadecimal	
224	LORA NWK_SKEY (third part - MID LSB)	Hexadecimal	
225	LORA NWK_SKEY (fourth part – LSB)	Hexadecimal	
226	LORA APP_SKEY (first part – MSB)	Hexadecimal	Default: 0 Parameter encoded on 16 bytes, each register with 4 bytes.
227	LORA APP_SKEY (second part - MID MSB)	Hexadecimal	
228	LORA APP_SKEY (third part - MID LSB)	Hexadecimal	

229	LORA APP_SKEY (fourth part – LSB)	Hexadecimal	
280	NETWORK ID	Hexadecimal	Default: 0 Read only
281	DEVICE ADDRESS	Hexadecimal	Default: 0

NOTE 1: The “Over The Air Activation” (OTAA) mode uses a JOIN phase before being able to transmit on the network. This mode uses the APP_ EUI (S214 and S215) and APP_KEY (S216 to S219) codes during this phase to create the keys for network communication. Once this phase is completed, the codes APP_sKEY, NWK_sKEY and DEVICE ADDRESS will be present in the corresponding registers. A new JOIN phase is started every time the device exits Command mode, a reset is performed, or the device is turned on.
Codes:
• APP_EUI identifier for global use (provided by default by adeunis®)
• APP_KEY device application key (provided by default by adeunis®)
The “Activation by personalization” (ABP) mode has no JOIN phase; it transmits directly on the network using the codes NWK_sKEY (S222 to S225), APP_sKEY (S226 to S229) and DEVICE ADDRESS (S281) to communicate.
Codes:
• NWK_sKEY network session key (provided by default by adeunis®)
• APP_KEY applicative session key (provided by default by adeunis®)
• DEVICE ADDRESS Address of the device in the network (provided by default by adeunis®)

Register	Size (bytes)	Base	Description	Default Value	Range (Min-Max)	Minimum required Application version	Comments
303	1	10	LoRaWAN Confirmed mode	0	0-1	V1.2.0	0: deactivation 1: activation
312	4	10	Maximum delay between 2 authentication attempts	43200 (12h)	60-2592000	V2.1.0	X 1 second Period: 1 minute to 30 days
313	2	10	Weighting factor for initial authentication attempts	1	1-65535	V2.1.0	
314	1	10	Number of tries for each authentication attempt	10	1-255	V2.1.0	

1.6.2 Sigfox Network Registers

Register	Size (bytes)	Base	Description	Default Value	Range (Min-Max)	Minimum required Application version	Comments
307	2	10	Sigfox Downlink period	1440 (24h)	0-65535	>= V2.0.0	X 1 minute ⇨ Period : 1 min to 45 days
317	1	10	Sigfox Duty cycle	1	0-1	V1.2.0	0 : Duty cycle deactivated 1 : Duty cycle activated Not displayed anymore in LoRaWAN since 2.0.0

1.7 Coherency check

A configuration coherency check is made at the time of the backup.
Cases where backups are refused because considered as inconsistent:

Cases refused	Description
(S330 = 1) && (S332 > S331)	TVOC: hysteresis > threshold
(S340 = 1) && (S342 > S341)	PM10: hysteresis > threshold
((S350 = 1) || (S350 = 3)) && (S352 > S351)	PM2.5: hysteresis > threshold
((S350 = 2) || (S350 = 3)) && (S353 > S354)	PM2.5: orange threshold > red threshold
(S360 = 1) && (S362 > S361)	PM1: hysteresis > threshold

2 RADIO PROTOCOL

Data with size greater than 1 byte will be transmitted MSB first.
In LoRaWAN, frames are sent on port 1.

2.1 Status byte

All frames sent by the product contain a status byte. Its format is identical for all IoT Adeunis products.

Alarm Status	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Frame Counter			AppFlag2	AppFlag1	Timestamp	Low Bat	Config
No Error	0x00 to 0x07			0	0	0	0	0
Configuration done				0	0	0	0	1
Low bat				0	0	0	1	0
Timestamp				0	0	1	0	0
AppFlag1				0	1	0	0	0
AppFlag2				1	0	0	0	0

The status byte provides two bits reserved for a specific use of each product (AppFlag1 and AppFlag2).
For this product:

- AppFlag1: configuration inconsistency
  - Samples lost in periodic data frame because the payload is not sufficient.
- AppFlag2: sensor error
  - Error reading a sensor.
  - Poor sensor health status.
  - This bit is reset after each sending of a periodic frame.

2.2 Uplink Frame format

2.2.1 Product configuration (0x10)

This frame is sent following the reception of a frame with code 0x01, or at the start of the product.

Offset (in byte)	Data	Description
0	0x10	Frame code
1	Status	Status byte
2	S300	Daily frame transmission (0: Deactivated / 1: Activated)
3-4	S301	Transmission period of the periodic frame
5-6	S320	History period
7	S321	Alarm repeat enable
8-9	S322	Alarm repeat period
10	S323	Number of additional (redundant) samples per frame

Decoding example:

Offset (in byte)	Data	Description
0	0x10	Frame code
1	0x00	Frame counter: 0 Bit1@0: no LowBat
2	0x01	Daily frame activated
3-4	0x0001	1
5-6	0x003C	60 => 1 minute
7	0x01	Alarm repeat enabled
8-9	0x0258	Alarm repeat period 600 => 10 minutes

10	0x00	No redundancy

2.2.2 Digital input configuration (0x1F)

This frame is sent following the start of the product (except when it is a reboot after a downlink).

Offset (in byte)	Data	Description
0	0x1F	Frame code
1	Status	Status byte
2	S380	Configuration Button
3-4	S381	Alarm threshold Button
5	S382	Configuration Digital input
6-7	S383	Alarm threshold Digital input

Decoding example:

Offset (in byte)	Data	Description
0	0x1F	Frame code
1	0xA0	Status byte
2	0x01	Button activated
3-4	0x0001	Alarm button sent after 1 detection
5	0x21	Digital input: 20 ms debounce, Event ON
6-7	0x0001	Alarm Digital input sent after 1 event

2.2.3 Network configuration (0x20)

This frame is sent following the reception of a frame with code 0x02, or at the start of the product.

2.2.3.1 *LoRaWAN 868*

Offset (in byte)	Data	Description
0	0x20	Frame code
1	Status	Status byte
2	S220	LoRaWAN options Bit 0: Activation of the ADR ON(1)/OFF(0) Bit 1: Reserved Bit 2: DUTY CYCLE ON(1)/DUTY CYCLE OFF(0) Bits 3 & 4: Reserved Bit 5: CLASS A (0) / CLASS C (1) Bits 6 to 7: Reserved
3	S221	Provisioning mode (0: ABP, 1:OTAA)

Decoding example:

Offset (in byte)	Data	Description
0	0x20	Frame code
1	0x20	Frame counter: 1 Bit1@0: no LowBat
2	0x05	CLASS A Duty cycle activated ADR ON
3	0x01	OTAA

2.2.3.2 *Sigfox RC1*

Offset (in byte)	Data	Description
0	0x20	Frame code
1	Status	Status byte
2	S202	Retry count
3-4	S307	Downlink period

Decoding example:

Offset (in byte)	Data	Description
0	0x20	Frame code
1	0x20	Frame counter: 1 Bit1@0: no LowBat
2	0x02	2 retries
3-4	0x05A0	1440 (24h)

2.2.4 Software version (0x37)

This frame is sent at the start of the product only if KARE+ is enabled.

Offset (in byte)	Data	Description
0	0x37	Frame code
1	Status	Status byte
2-4	APP version	Byte 5: MAJOR Byte 6: MINOR Byte 7: PATCH
5-7	RTU version	Byte 5: MAJOR Byte 6: MINOR Byte 7: PATCH

Decoding example:

Offset (in byte)	Data	Description
0	0x37	Frame code
1	0x20	Frame counter: 1 Bit1@0: no LowBat
2-4	0x020400	APP v2.4.0
5-7	0x020001	RTU v2.0.1

2.2.5 Daily frame (0x30)

This frame is sent every 24 hours or following the reception of a frame with code 0x05

In this frame, all information based on sensor acquisition are evaluated on measurements (samples) done over the past 24h.

2.2.5.1 *LoRaWAN 868*

Offset (in byte)	Data	Description
0	0x30	Frame code
1	Status	Status byte
2-3	TVOC Min	In µg/m³
4-5	TVOC Max	In µg/m³
6-7	TVOC Average	In µg/m³
8-9	TVOC Duration	Duration (in minutes) above TVOC threshold (S370)
10-11	PM10 Min	In µg/m³
12-13	PM10 Max	In µg/m³
14-15	PM10 Average	In µg/m³
16-17	PM10 Duration	Duration (in minutes) above PM10 threshold (S371)
18-19	PM2.5 Min	In µg/m³
20-21	PM2.5 Max	In µg/m³
22-23	PM2.5 Average	In µg/m³
24-25	PM2.5 Duration	Duration (in minutes) above PM2.5 threshold (S372)
26-27	PM1 Min	In µg/m³
28-29	PM1 Max	In µg/m³
30-31	PM1 Average	In µg/m³

Decoding example:

Offset (in byte)	Data	Description
0	0x30	Frame code
1	0x80	Frame counter: 4 Bit1@0: LowBat not detected
2-3	0x0008	TVOC min = 8 µg/m³
4-5	0x04D3	TVOC max = 1235 µg/m³
6-7	0x0066	TVOC average = 102 µg/m³
8-9	0x0005	TVOC Duration of threshold crossing = 5 minutes
10-11	0x0001	PM10 min = 1 µg/m³
12-13	0x0020	PM10 max = 32 µg/m³
14-15	0x0004	PM10 average = 4 µg/m³
16-17	0x0000	PM10 Duration of threshold crossing = 0 minutes
18-19	0x0001	PM2.5 min = 1 µg/m³
20-21	0x0019	PM2.5 max = 25 µg/m³
22-23	0x0003	PM2.5 average = 3 µg/m³
24-25	0x0000	PM2.5 Duration of threshold crossing = 0 minutes
26-27	0x0001	PM1 min = 1 µg/m³
28-29	0x0014	PM1 max = 20 µg/m³
30-31	0x0002	PM1 average = 2 µg/m³

2.2.5.2 *Sigfox RC1*

Offset (in byte)	Data	Description
0	0x30	Frame code
1	Status	Status byte
2-3	TVOC Max	In µg/m³
4-5	PM10 Max	In µg/m³
6-7	PM2.5 Max	In µg/m³
8-9	PM1 Max	In µg/m³

Decoding example:

Offset (in byte)	Data	Description
0	0x30	Frame code
1	0x80	Frame counter: 4 Bit1@0: LowBat not detected
2-3	0x04D3	TVOC max = 1235 µg/m³
4-5	0x0020	PM10 max = 32 µg/m³
6-7	0x0019	PM2.5 max = 25 µg/m³
8-9	0x0014	PM1 max = 20 µg/m³

2.2.6 Periodic data frame (0x6D)

The measure frequency is defined by: S320
The sending frequency is defined by: S320 * S301
The number of samples is defined by: (S301 + S323)

Maximum number of samples per frame:

- LoRaWAN 868: 6 samples
- Sigfox RC1: 1 sample

Offset (in byte)	Data	Description
0	0x6D	Frame code
1	Status (AppFlag2 = 0)	Status byte
2-3	TVOC°$_{(t0)}$	In µg/m³
4-5	PM10$_{(t0)}$	In µg/m³
6-7	PM2.5$_{(t0)}$	In µg/m³
8-9	PM1$_{(t0)}$	In µg/m³
10-11	TVOC$_{(t-1)}$	
12-13	PM10 $_{(t-1)}$	
14-15	PM2.5$_{(t-1)}$	
16-17	PM1$_{(t-1)}$	
18-19	TVOC $_{(t-2)}$	
20-21	PM10$_{(t-2)}$	
22-23	PM2.5$_{(t-2)}$	
24-25	PM1$_{(t-2)}$	
…	…	…

Decoding example:

Offset (in byte)	Data	Description
0	0x6D	Frame code
1	0x80	Frame counter: 4

		Bit1@0: LowBat not detected
2-3	0x01B3	435 ➔ TVOC = 435 µg/m³ for t=0
4-5	0x003E	62 ➔ PM10 = 62 µg/m³ for t=0
6-7	0x001E	30 ➔ PM2.5 = 30 µg/m³ for t0
8-9	0x0014	20 ➔ PM1 = 20 µg/m³ for t0

2.2.7 Alarms (0x6E)

This frame is sent during the appearance, or disappearance, of a threshold exceeding alarm.

Offset (in byte)	Data	Description
0	0x6E	Frame code
1	Status (AppFlag2 = 0)	Status byte
2	Alarm status	Bit 3: PM1 0: alarm is not active 1: alarm is active Bit 2: PM2.5 0: alarm is not active 1: alarm is active Bit 1: PM10 0: alarm is not active 1: alarm is active Bit 0: TVOC 0: alarm is not active 1: alarm is active
3-4	TVOC	In µg/m³
5-6	PM10	In µg/m³
7-8	PM2.5	In µg/m³
9-10	PM1	In µg/m³

Decoding example:

Offset	Data	Description
0	0x6E	Frame code
1	0x80	Frame counter: 4 Bit1@0: LowBat not detected
2	0x01	Bit3@1: Alarm PM1 is not active Bit2@1: Alarm PM2.5 is not active Bit1@1: Alarm PM10 is not active Bit0@0: Alarm TVOC is active
3-4	0x02DB	731 ➔ TVOC = 731 µg/m³
5-6	0x000C	12 ➔ PM10 = 12 µg/m³
7-8	0x0007	7 ➔ PM2.5 = 7 µg/m³
9-10	0x0003	3 ➔ PM1 = 3 µg/m³

2.2.8 Button alarm (0x51)

This frame is sent when the number of detected events exceeds the threshold.

Offset (in byte)	Data	Description
0	0x51	Frame code for button
1	Status	Status byte
2	Alarm state	Precisely define the input state.

		<0> Current state <1> State in the previous frame
3-6	Global counter	Global counter of detected events
7-8	Instant counter	Number of events detected since the last alarm

Decoding example:

Offset	Data	Description
0	0x51	Frame code
1	0x80	Frame counter: 4, Bit1@0: LowBat not detected
2	0x01	Bit0@1 => Current state: ON/CLOSED Bit1@0 => Previous state: OFF/OPENED
3-6	0x000001230	0x1230 => 4656 events detected since the device is in production mode
7-8	0x0003	3 events detected since the last alarm sending

2.2.9 Digital input (0x52)

This frame is sent when the number of detected events exceeds the threshold.

Offset (in byte)	Data	Description
0	0x52	Frame code for digital input
1	Status	Status byte
2	Alarm state	Precisely define the input state. (ON/CLOSED : 1, OFF/OPEN : 0) <0> Current state <1> State in the previous frame
3-6	Global counter	Global counter of detected events
7-8	Instant counter	Number of events detected since the last alarm

Decoding example:

Offset	Data	Description
0	0x52	Frame code
1	0x80	Frame counter: 4 Bit1@0: LowBat not detected
2	0x01	Bit0@1 => Current state: ON/CLOSED Bit1@0 => Previous state: OFF/OPENED
3-6	0x000001230	0x1230 => 4656 events detected since the device is in production mode
7-8	0x0003	3 events detected since the last alarm sending

2.2.10 Response to Get register request (0x31)

Following reception of a downlink frame with the code 0x40, the frame 0x31 is transmitted. It contains all the values of the registers requested in the downlink frame 0x40.

Offset (in byte)	Data	Description
0	0x31	Frame code
1	Status	Status byte
2-3	Value 1	If value 1 is a 2-byte register
4	Value 2	If value 2 is a 1-byte register
5-8	Value 3	If value 3 is a 4-byte register
…		

If an error is detected in the request, the returned 0x31 frame will be empty.

Note: the size of the data registers is variable depending on the register number. Refer to the list of registers to determine the size of each one and to deduce the total size of the data returned by the 0x31 frame.

Decoding example:

Offset (in byte)	Data	Description
0	0x31	Frame code
1	0x80	Frame counter: 4 Bit1@0: LowBat not detected
2-3	0x1234	4660 (considering that value 1 is a 2-byte register)
4	0xFF	255 (considering that value 2 is a 1-byte register)
5-8	0x00000000	0 (considering that value 3 is a 4-byte register)
…		

2.2.11 Response to Set register request (0x33)

Following reception of a downlink frame with the code 0x41, the frame 0x33 is transmitted. It shows whether the downlink frame (0x41) has been received and gives information on the support status of the latter.

Offset (in byte)	Data	Description
0	0x33	Frame code
1	Status	
2	Request status	- 0x00: N/A - 0x01: success - 0x02: success – no update (value to set is the current register value) - 0x03: error – coherency - 0x04: error – invalid register - 0x05: error – invalid value - 0x06: error – truncated value - 0x07: error – access not allowed - 0x08: error – other reason
3-4	Register Id	Indicates to the user the register that caused the error (only if “Request Status” is different from 0x01).

CAUTION: if the request 0x41 concerns several registers, the device will stop the analysis of the Downlink request at the first error and will send the Status frame with the reason and the identifier of the register concerned.

In the event of an error, if a partial reconfiguration has taken place before the error was detected, the device restarts and returns to its last valid configuration. As a result, you will have to configure the device again with the new data.

Decoding example:

Offset (in byte)	Data	Description
0	0x33	Frame code
1	0x80	Frame counter: 4 Bit4@0: 1 sensor activated Bit1@0: LowBat not detected
2	0x04	invalid register
3-4	0x0140	320: register S320 does not exist (should be S3XX)

2.2.12 Transmit conditions

Frame code	Description	Sending conditions
0x10	Status (configuration)	• Product start up • Exit configuration mode (AT command) • Reception of frame 0x01 (get product config)
0x20	Network configuration	• Product start up • Exit configuration mode (AT command) • Reception of frame 0x02 (get network config)
0x30	Daily frame	• Periodically, every 24H • Reception of frame 0x05 (get value)
0x6D	Periodic data	• Periodically
0x6E	Alarm	• Threshold crossing

2.3 Downlink Frame format

2.3.1 Get applicative configuration (0x01)

Offset (in byte)	Data	Description
0	0x01	Frame code

When the device receives the downlink, it will generate a product configuration frame (0x10).

2.3.2 Get network configuration (0x02)

Offset (in byte)	Data	Description
0	0x02	Frame code

When the device receives the downlink, it will generate a network configuration frame (0x20).

2.3.3 Get value (0x05)

Offset (in byte)	Data	Description
0	0x05	Frame code

When the device receives the downlink, it will send back the last Daily frame (0x30).

2.3.4 Get registers (0x40)

This frame (0x40) allows you to inform the device through the network that it must send the values of specific S3XX registers in an uplink frame (0x31).

Offset (in byte)	Data	Description
0	0x40	Frame code
1	CONFID1	Index of the register to be sent. The corresponding register is 300 + CONFIDX value.
2	CONFID2	
3	CONFID3	

IMPORTANT: the user can specify several CONF IDs in the downlink frame, but it is up to the user's responsibility to verify that according to the protocol, the size of the data available in a downlink will be large enough to contain all the desired data. Otherwise, the application will send only the first values.

In Sigfox mode: backend may request to send 8 bytes in a downlink. All unused bytes should set to 0xFF to ask the product to stop the downlink frame parsing.

Coding example:

Offset (in byte)	Data	Description
0	0x40	Frame code
1	0x00	Get register S300
2	0x14	Get register S320
3	0x20	Get register S332
4-7	0xFFFFFFFF	In SFX: ignored by product

2.3.5 Set registers (0x41)

This frame (0x41) allows you to change the value of requested S3XX registers.

Offset (in byte)	Data	Description
0	0x41	Frame code
1	CONFID1	The corresponding register is “300 + CONFID1“
2	Value of CONF ID 1	Value to set, In this example, its value is contained in 1 byte
3	CONFID2	The corresponding register is “300 + CONFID2”
4-5	Value of CONF ID 2	Value to set, In this example, its value is contained in 2 bytes
…		

Following the sending of the downlink 0x41, the associated uplink 0x33 is immediately returned. If the update of the register(s) went well, the device will perform a backup and begin its restart procedure automatically. In addition, the Config bit of the status byte will be set to 1 in the next scheduled uplink frame (periodic or alarm or keep alive frame) if everything went well.

Coding example:

Offset (in byte)	Data	Description
0	0x41	Frame code
1	0x14	Register to modify is S320
2-3	0x00AA	Value to set in S320 is 170 (S320 is a 2-byte register)
4	0x1E	Register to modify is S330
5	0x02	Value to set in S330 is 2 (S330 is a 1-byte register)
…		

2.3.6 Reboot (0x48)

This frame (0x48) allows you to reboot the device.

Offset (in byte)	Data	Description
0	0x48	Frame code
1-2	delay	Delay before reboot in minutes (from 1 to 65535)

Following the sending of the downlink 0x48, an uplink ACK (0x2F) is sent. After the specified delay, the device will then begin its restart procedure.

Coding example:

Offset (in byte)	Data	Description
0	0x48	Frame code
1-2	0x05A0	Reboot of the product in 24 hours (1440 minutes)