RAK811
AT Command Manual

Note: this version is applicable to firmware version V3.0.0.13.T3 and above.

Contents

1 Summary

1.1 AT Command Interface

The AT Command interface for RAK811 is UART1. Default baud rate: 115200. Data bits: 8. Stop bit: 1. No check.
The available UART for RAK811 is UART1 and UART3, where UART1 is PIN6 (TX1) and PIN7 (RX1) on modules, and UART3 (with a default baud rate of 9600) is PIN25 (TX3) and PIN26 (RX3) on modules. For a detailed definition of the module pin, see Appendix IV for reference.

1.2 AT Command Syntax

Command input:

The maximum length of the AT Command string is 255 characters (including "\r\n").

A command must begin with “**at**” , and end with **<CR><LF> (i.e. \r\n)**. "\r\n" is omitted from the Commands in this article.

The AT command can be divided into:

- Read Command – Reads the configuration or status of the device. The general format is: ***at+get_config=<m>:<m>***. Command name and parameter are separated by **“=”**. If it contains multiple parameters, the parameters are separated by **“:”;**
- Write Command – Writes/modifies the device configuration. The general format is: ***at+set_config=<m>:<n>***. Command name and parameter are separated by **“=”**. If it contains multiple parameters, the parameters are separated by **“:”**;
- Other Commands - There are also other Commands that are neither read nor write Commands. E.g., the Command of LoRa sending data is ***at+send=lora:<m>:<n>***, LoRa entry Command is ***at+join***, and the Command of exiting from boot mode is ***at+run***, etc.

- Special Command — There is a special Command: UART has two modes, AT configuration mode and transmission mode. When switching from transmission mode to AT configuration mode, the Command to be entered is “+++” and does not contain terminators such as ‘\ r’ and ‘\ n’.

Command answers:

The common format of Command answers:

① When the Command configuration is successful:

OK [information]\r\n

Both Commands start with 'OK'. Read Commands have information descriptions, while write Commands do not have an informative description.

Some special Commands can trigger module restart.

For example: "at+set_config=device:restart". These special Commands are described in the introduction of specific AT Commands, which end with "Initialization OK\ r\ n" in the following format:

② When the Command configuration is unsuccessful:

Both Commands start with 'ERROR' and followed by error code. See the ERROR CODE Table in the next chapter.

1.3 EERROR CODE Table

<error code>	含义
1	This is an unsupported AT command.
2	There is an invalid parameter in AT command.
3	There is an error when reading or writing flash.
4	There is an error when reading or writing through IIC.
5	There is an error when sending through UART.
41	The BLE works in an invalid state, so that it can't be operated.
80	The LoRa is busy, so that it can't do more things now.
81	LoRa service is unknown.
82	The LoRa parameters are invalid.
83	The LoRa frequency is invalid.
84	The LoRa datarate(DR) is invalid.
85	The LoRa frequency and datarate are invalid.
86	The device hasn't joined a LoRa network.
87	The length of the packet is too long, so that it can't be sent out over LoRa.
88	Service is closed by server.
89	This is an unsupported region.
90	duty cycle is restricted
91	There is no valid channel can be found.
92	no free channel found
93	status is error
94	LoRa transmiting timeout.
95	LoRa receiving in RX1 timeout.
96	LoRa receiving in RX2 timeout.
97	There is an error when receiving in RX1.
98	There is an error when receiving in RX2.

99	LoRa join failed.
100	downlink repeated A frame with an invalid downlink counter was received. The downlink counter of the frame was equal to the local copy of the downlink counter of the node
101	payload size error with transmit DR.
102	There are too many downlink frames lost.
103	address fail
104	There is an error when verifying the MIC.

2 General AT Command

2.1 at+version

This Command is used to read the version number of the current firmware.（In boot mode, it is used to read the version number of the current bootloader）

Operation	Command	Answer
Read	**at+version**	**OK <version number>**

Parameter: None

Example:

```
at+version\r\n
OK V3.0.0.13.H.T2
```

2.2 at+help

This Command is used to obtain all AT commands supported by the current firmware.

Operation	Command	Answer
Read	**at+help**	**OK <all AT commands>**

Parameter: None

Example:

```
at+help\r\n
OK Device AT commands:
  at+version
  at+help
```

```
  at+run
  at+set_config=device:restart
  at+set_config=device:sleep:X
  at+set_config=device:boot
  at+get_config=device:status
  at+set_config=device:uart:X:Y
  at+set_config=device:uart_mode:X:Y
  at+send=uart:X:YYY
  at+set_config=device:gpio:X:Y
  at+get_config=device:gpio:X
  at+get_config=device:adc:X

LoRaWAM AT commands:
  at+join
  at+send=lora:X:YYY
  at+set_config=lora:region:XXX
  at+get_config=lora:channel
  at+set_config=lora:dev_eui:XXXX
  at+set_config=lora:app_eui:XXXX
  at+set_config=lora:app_key:XXXX
  at+set_config=lora:dev_addr:XXXX
  at+set_config=lora:apps_key:XXXX
  at+set_config=lora:nwks_key:XXXX
  at+set_config=lora:join_mode:X
  at+set_config=lora:work_mode:X
  at+set_config=lora:ch_mask:X:Y
  at+set_config=lora:class:X
  at+set_config=lora:confirm:X
  at+set_config=lora:dr:X
  at+set_config=lora:tx_power:X
  at+set_config=lora:adr:X
  at+set_config=lora:send_interval:X:Y
  at+get_config=lora:status

LoRaP2P AT commands:
  at+set_config=lorap2p:XXX:Y:Z:A:B:C
  at+set_config=lorap2p:transfer_mode:X
  at+send=lorap2p:XXX
```

2.3 at+set_config=device:restart

This Command is used to restart the device.

Operation	Command	Answer
Write	**at+set_config=device:restart**	

Parameter: None

Example

```
at+set_config=device:restart\r\n
UART1 work mode: RUI_UART_NORAMAL
Current work_mode:LoRaWAN, join_mode:ABP, Class: A
Initialization OK
```

2.4 at+set_config=device:boot

This Command is used to force the module to enter BOOT mode.
Note：In BOOT mode, the port baud rate is fixed at 115200 and cannot be modified.

Operation	Command	Answer
Write	**at+set_config=device:boot**	**OK** **<BOOT MODE>**

Parameter: None
Example:

```
at+set_config=device:boot\r\n
OK
<BOOT MODE>
```

2.5 at+run

This Command is used to force the device to exit boot mode and enter the normal operating mode. This Command is only valid in boot mode and will cause the module to restart.

Operation	Command	Answer
	at+run	

Parameter: None

Example:

```
at+run\r\n
```

```
Stop Boot Mode
UART1 work mode: RUI_UART_NORAMAL
Current work_mode:LoRaWAN, join_mode:ABP, Class: A
Initialization OK
```

2.6 at+set_config=device:sleep:<status>

This Command is used to obtain the current status of the device.

Operation	Command	Answer
Write	**at+set_config=device:sleep:<status>**	**OK <STATUS>**

Parameter：

status	0: wake up 1: sleep

Example

```
at+set_config=device:sleep:1\r\n
OK Sleep

at+set_config=device:sleep:0\r\n
OK Wake Up
```

2.7 at+get_config=device:status

This Command is used to set the device on sleep/wake mode.

Operation	Command	Answer
Read	**at+get_config=device:status**	**OK <information>**

Parameter: None

Example:

```
at+get_config=device:status\r\n
OK Board Core:RAK811
MCU:STM32L151CB_A
LoRa chip:SX1276
```

3 AT Command of Interface Type

3.1 at+set_config=device:uart:<index>:<baud_rate>

This Command is used to configure the baud rate for a UART.

Operation	Command	Answer
Write	**at+set_config=device:uart:<index>:<baud_rate>**	**OK**

Parameter：

index	UART Number
baud_rate	UART BaudRate： 1200,2400,4800,9600,19200,38400,57600,115200

Example:

```
at+set_config=device:uart:1:115200\r\n
OK
```

3.2 at+set_config=device:uart_mode:<index>:<mode>

This Command is used to set the UART operation to AT configuration mode or data transmission mode.

Operation	Command	Answer
Write	**at+set_config=device:uart_mode:<index>:<mode>**	**OK**

Parameter：

index	UART Number. Currently, the RAK811 only supports UART1.
mode	UART Mode： Only ‘1’ can be selected, which means the UART is set to data transmission mode. **Note：** If you want to switch mode from data transmission to AT configuration, use “+++” (+++ without\ r\ n).

Example:

```
at+set_config=device:uart_mode:1:1\r\n
OK
```

```
+++
OK
```

3.3 at+send=uart:<index>:<data>

This Command is used to send data over a UART.

Operation	Command	Answer
Write	**at+set_config=device:uart:<index>:<baud_rate>**	**OK**

Parameter：

index	UART Number
data	The maximum data sent is 255 bits, including the Command bits such as “at+...” and “\ r\ n” at the end.

Example:

```
at+send=uart:3:12345\r\n
OK
```

3.4 at+get_config=device:gpio:<pin_num>

This Command is used to obtain the level status of a pin on a module.

Operation	Command	Answer
Read	**at+get_config=device:gpio:<pin_num>**	**OK <status>**

Parameter：

pin_num	Pin index of the module
status（Return Value）	0: Low voltage level 1: High voltage level

Example:

```
at+get_config=device:gpio:2\r\n
OK 1
```

3.5 at+set_config=device:gpio:<pin_num>:<status>

This Command is used to set the level state (high or low) of a pin on a module.

Operation	Command	Answer

Write	**at+set_config=device:gpio:<pin_num>:<status>**	**OK**

Parameter：

pin_num	Pin index of the module
status	0: Low voltage level 1: High voltage level

Example:

```
at+set_config=device:gpio:2:0\r\n
OK
```

3.6 at+get_config=device:adc:<pin_num>

This Command is used to obtain the voltage of an ADC pin on the module.

Operation	**Command**	**Answer**
Read	**at+get_config=device:adc:<pin_num>**	**OK <voltage>**

Parameter：

pin_num	ADC pin index of the module
Voltage（Return Value）	Voltage，Unit mV

Example:

```
at+get_config=device:adc:2\r\n
OK 1663mV
```

4 AT Command of LoRa Type

4.1 at+join

This Command is used to join the LoRaWAN network.

Operation	Command	Answer
	at+join	**OK Join Success**

Parameter: None

Example：

```
at+join\r\n
OK Join Success
```

4.2 at+send=lora:<port>:<data>

This Command is used to send data via LoRaWan.

Operation	Command	Answer
	at+send=lora:<port>:<data>	**OK**

Parameter：

port	Sending port of LoRa
data	The sending data format is double hexadecimal bits. The maximum sending length varies depending on the band frequency and DR (LoRaWan standard). Please refer to Appendix III of this manual for reference.

Example：

When sending data as unconfirm:

```
at+send=lora:1:5A00\r\n
OK
```

When sending data as confirm:

```
at+send=lora:1:5A00\r\n
OK
at+recv=0,-105,-12,0
```

Note ： When sending a confirm package, you will receive an ACK response, i.e. “at+recv=...”. In “0, -105, -12,0", “0" stands for LoRa port, “-105" stands for RSSI, “-12" stands for SNR, and “0" stands for the length of the data (no valid data in ACK).

4.3 at+set_config=lora:region:<region>

This Command is used to set the appropriate working frequency band.

Operation	Command	Answer
Write	**at+set_config=lora:region:<region>**	**OK**

Parameter：

region	EU433, CN470, IN865, EU868, US915, AU915, KR920, AS923.

Example：

```
at+set_config=lora:region:EU868\r\n
OK
```

4.4 at+get_config=lora:channel

This Command is used to read all LoRa channel information for the device's current region.

Operation	Command	Answer
Read	**AT+BAUDRATE**	**OK <channel information>**

Parameter: None

Example (EU868 region):

```
at+get_config=lora:channel\r\n
OK *0,on,868100000,0,5; *1,on,868300000,0,5; *2,on,868500000,0,5; 3,off,0,0,0;
4,off,0,0,0; 5,off,0,0,0; 6,off,0,0,0; 7,off,0,0,0; *8,on,867100000,0,5;
*9,on,867300000,0,5; *10,on,867500000,0,5; *11,on,867700000,0,5;
*12,on,867900000,0,5; 13,off,0,0,0; 14,off,0,0,0; 15,off,0,0,0
```

Note:

With "*0,on,868100000,0,5" as an example，channel parameter analysis:
"*****" at the beginning if the channel is open;
"**0**" is the channel ID;
"**on**" indicates the current status of the channel;
"**868100000**" is the actual frequency of the channel，unit is Hz;
"**0,5**" indicates the DR of the channel, DR0~DR5.

4.5 at+set_config=lora:ch_mask:<channel_number>:<status>

This Command is used to switch a channel (turn on or off) in the current region.

Operation	Command	Answer
Write	**at+set_config=lora:ch_mask:<channel_number>:<status>**	**OK**

Parameter：

channel_number	Channel number
status	0: off 1: on

```
at+set_config=lora:ch_mask:0:0\r\n
OK
```

4.6 at+set_config=lora:dev_eui:<dev_eui>

This Command is used to set the Device EUI parameter for LoRaWAN OTAA mode.

Operation	Command	Answer
Write	**at+set_config=lora:dev_eui:<dev_eui>**	**OK**

Parameter：

dev_eui	Device EUI.

Example：

```
at+set_config=lora:dev_eui:3530353064377716\r\n
OK
```

4.7 at+set_config=lora:app_eui:<app_eui>

This Command is used to set the Application EUI parameter for LoRaWAN OTAA mode.

Operation	Command	Answer
Write	**at+set_config=lora:app_eui:<app_eui>**	**OK**

Parameter：

app_eui	Application EUI.

Example：

```
at+set_config=lora:app_eui:0000000000000001\r\n
OK
```

4.8 at+set_config=lora:app_key:<app_key>

This Command is used to set the Application Key parameter for LoRaWAN OTAA mode.

Operation	Command	Answer
Write	**at+set_config=lora:app_key:<app_key>**	**OK**

Parameter：

app_key	Application Key.

Example:

```
at+set_config=lora:app_key:841986913ACD00BBC2BE2479D70F3228\r\n
OK
```

4.9 at+set_config=lora:dev_addr:<dev_addr>

This Command is used to set the Device Address parameter for LoRaWAN ABP mode.

Operation	Command	Answer
Write	**at+set_config=lora:dev_addr:<dev_addr>**	**OK**

Parameter：

dev_addr	Device Address.

Example:

```
at+set_config=lora:dev_addr:260125D7\r\n
OK
```

4.10 at+set_config=lora:apps_key:<apps_key>

This Command is used to set the Application Session Key parameter for LoRaWAN ABP mode.

Operation	Command	Answer
Write	**at+set_config=lora:apps_key:<apps_key>**	**OK**

Parameter：

apps_key	Application Session Key.

Example:

```
at+set_config=lora:apps_key:841986913ACD00BBC2BE2479D70F3228\r\n
OK
```

4.11 at+set_config=lora:nwks_key:<nwks_key>

This Command is used to set the Network Session Key parameter for LoRaWAN ABP mode.

Operation	Command	Answer
Read	**at+set_config=lora:nwks_key:<nwks_key>**	**OK**

Parameter：

nwks_key	Network Session Key.

Example:

```
at+set_config=lora:nwks_key:69AF20AEA26C01B243945A28C9172B42\r\n
OK
```

4.12 at+set_config=lora:join_mode:<mode>

This Command is used to switch the LoRaWAN's access mode to OTAA or ABP.

Operation	Command	Answer
Write	**at+set_config=lora:join_mode:<mode>**	**OK**

Parameter：

mode	Activation mode 0: OTAA 1: ABP

Example：

```
at+set_config=lora:join_mode:1\r\n
OK
```

4.13 at+set_config=lora:work_mode:<mode>

This Command is used to switch the LoRa's working mode to LoRaWan or LoRAP2p. This Command will cause the module to restart.

Operation	Command	Answer
Write	**at+set_config=lora:work_mode:<mode>**	

Parameter：

mode	Work mode of LoRa 0: LoRaWAN 1: LoRaP2P

Example:

```
at+set_config=lora:work_mode:1\r\n
UART1 work mode: RUI_UART_NORAMAL
Current work_mode:P2P
Initialization OK
```

4.14 at+set_config=lora:class:<class>

This Command is used to set LoRaWan's Class to Class A, Class B, or Class C.

Operation	Command	Answer
Write	**at+set_config=lora:class:<class>**	**OK**

Parameter：

class	0: Class A 1: Class B （Not supported at this time） 2: Class C

Example:

```
at+set_config=lora:class:0\r\n
OK
```

4.15 at+set_config=lora:confirm:<type>

This Command is used to set the type of sending data to Confirm/Unconfirm.

Operation	Command	Answer
Write	**at+set_config=lora:confirm:<type>**	**OK**

Parameter：

type	0: unconfirm type 1: confirm type 2: multicast type 3. proprietary type

Example:

```
at+set_config=lora:confirm:0\r\n
OK
```

4.16 at+set_config=lora:dr:<dr>

This Command is used to set the data rate (DR) of LoRa.

Operation	Command	Answer
Write	**at+set_config=lora:dr:<dr>**	**OK**

Parameter：

dr	The data rate of LoRa is related to the current region. In most LoRa areas, it is common to use 0 to 5. Detailed reference can be made to LoRaWan1.0.2 specification.

4.17 at+set_config=lora:tx_power:<tx_power>

This Command is used to set the level of transmit power level of LoRa.

Operation	Command	Answer
Write	**at+set_config=lora:tx_power:<tx_power>**	**OK**

Parameter：

tx_power	LoRa's transmit power level varies depending on frequency band and DR. Please refer to the LoRaWAN 1.0.2 specification or Appendix II for details.

Example:

```
at+set_config=lora:tx_power:0\r\n
OK
```

4.18 at+set_config=lora:adr:<status>

This Command is used to set (turn on/off) the ADR of LoRa.

Operation	Command	Answer
Write	**at+set_config=lora:adr:<status>**	**OK**

Parameter：

status	0: Turn off 1: Turn on

Example:

```
at+set_config=lora:adr:0\r\n
OK
```

4.19 at+get_config=lora:status

This Command is used to get all current LoRa status information. （Except channel information）

Operation	Command	Answer
Read	**at+set_config=lora:status**	**OK <lora status detail>**

Parameter: None

Example:

```
at+get_config=lora:status\r\n
OK Work Mode: LoRaWAN
```

```
Region: EU868
Send_interval: 600s
Auto send status: false.
Join_mode: ABP
DevAddr: 260125D7
AppsKey: 841986913ACD00BBC2BE2479D70F3228
NwksKey: 69AF20AEA26C01B243945A28C9172B42
Class: A
Joined Network:true
IsConfirm: false
AdrEnable: true
EnableRepeaterSupport: false
RX2_CHANNEL_FREQUENCY: 869525000, RX2_CHANNEL_DR:0
RX_WINDOW_DURATION: 3000ms
RECEIVE_DELAY_1: 1000ms
RECEIVE_DELAY_2: 2000ms
JOIN_ACCEPT_DELAY_1: 5000ms
JOIN_ACCEPT_DELAY_2: 6000ms
Current Datarate: 4
Primeval Datarate: 4
ChannelsTxPower: 0
UpLinkCounter: 1
DownLinkCounter: 0
```

4.20 at+set_config=lorap2p:<frequency>:<Spreadfact>:<Bandwidth>:<Codingrate>:<Preamlen>:<Powerdbm>

This Command is used to set the relevant parameters of LoRAP2p and is only valid when LoRa work mode is LoRaP2P.

Operation	Command	Answer
Write	**at+set_config=lorap2p:<frequency>:<spreadfact>:<bandwidth>:<codingrate>:<preamlen>:<power>**	**OK**

Parameter：

frequency	Frequency, the unit is Hz
spreadfact	Spreading factor

bandwidth	0: 125KHz 1: 250KHz 2: 500KHz
codeingrate	1: 4/5 2: 4/6 3: 4/7 4: 4/8
preamlen	Preamble Length. 5~65535
power	TX power. The unit is dbm. 5~20

Example:

```
at+set_config=lorap2p:869525000:12:0:1:8:20\r\n
OK
```

4.21 at+set_config=lorap2p:transfer_mode:<mode>

This Command is used to set the mode of LoRaP2P to sender/receiver, and only valid when LoRa work mode is LoRaP2P.

Operation	Command	Answer
Write	**at+set_config=lorap2p: transfer_mode:<mode>**	**OK**

Parameter：

mode	1: receiver mode 2: sender mode

Example:

```
at+set_config=lorap2p:transfer_mode:1\r\n
OK
```

4.22 at+send=lorap2p:<data>

This Command is used to send data through LoRaP2P, and only valid when LoRa work mode is LoRaP2P.

Operation	Command	Answer
Send	**at+send=lorap2p:<data>**	**OK**

Parameter：

data	The data to be sent, and the format is hexadecimal

Example:

```
at+send=lorap2p:1234\r\n
OK
```

Note：The LoRAP2p mode receives data in the following format:
at+recv=<RSSI>,<SNR>,< Data Length >:< Data >

5 Appendix I：Data Rate by Region

5.1 EU868/EU433/AS923

DataRate	Configuration	Indicative physical bit rate [bit/s]
0	LoRa: SF12 / 125kHz	250
1	LoRa: SF11 / 125kHz	440
2	LoRa: SF10 / 125kHz	980
3	LoRa: SF9 / 125kHz	1760
4	LoRa: SF8 / 125kHz	3125
5	LoRa: SF7 / 125kHz	5470
6	LoRa: SF7 / 250kHz	11000
7	FSK: 50kbps	50000
8 …15	RFU	

5.2 CN470/KR920

DataRate	Configuration	Indicative physical bit rate [bit/s]
0	LoRa: SF12 / 125kHz	250
1	LoRa: SF11 / 125kHz	440
2	LoRa: SF10 / 125kHz	980
3	LoRa: SF9 / 125kHz	1760
4	LoRa: SF8 / 125kHz	3125
5	LoRa: SF7 / 125kHz	5470
6…15	RFU	

5.3 US915

DataRate	Configuration	Indicative physical bit rate [bit/s]
0	LoRa: SF10 / 125kHz	980
1	LoRa: SF9 / 125kHz	1760
2	LoRa: SF8 / 125kHz	3125
3	LoRa: SF7 / 125kHz	5470
4	LoRa: SF8 / 500kHz	12500
5…7	RFU	
8	LoRa: SF12/500kHz	980
9	LoRa: SF11/500kHz	1760
10	LoRa: SF10/500kHz	3900
11	LoRa: SF9/500kHz	7000
12	LoRa: SF8/500kHz	12500
13	LoRa: SF7/500kHz	21900
14…15	RFU	

5.4 AU915

DataRate	Configuration	Indicative physical bit rate [bit/s]
0	LoRa: SF12 / 125kHz	250
1	LoRa: SF11 / 125kHz	440
2	LoRa: SF10 / 125kHz	980
3	LoRa: SF9 / 125kHz	1760
4	LoRa: SF8 / 125kHz	3125
5	LoRa: SF7 / 125kHz	5470
6	LoRa: SF8/500kHz	12500
7	RFU	RFU
8	LoRa: SF12/500kHz	980
9	LoRa: SF11/500kHz	1760
10	LoRa: SF10/500kHz	3900
11	LoRa: SF9/500kHz	7000
12	LoRa: SF8/500kHz	12500

5.5 IN865

DataRate	Configuration	Indicative physical bit rate [bit/s]

0	LoRa: SF12 / 125kHz	250
1	LoRa: SF11 / 125kHz	440
2	LoRa: SF10 / 125kHz	980
3	LoRa: SF9 / 125kHz	1760
4	LoRa: SF8 / 125kHz	3125
5	LoRa: SF7 / 125kHz	5470
6	RFU	RFU
7	FSK: 50kbps	50000
8 …15	RFU	RFU

6 Appendix II：TX Power by Region

6.1 EU868

By default MaxEIRP is considered to be +16dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1	MaxEIRP – 2dB
2	MaxEIRP – 4dB
3	MaxEIRP – 6dB
4	MaxEIRP – 8dB
5	MaxEIRP – 10dB
6	MaxEIRP – 12dB
7	MaxEIRP – 14dB
8..15	RFU

6.2 US915

TXPower	Configuration (conducted power)
0	30 dBm – 2*TXpower
1	28 dBm
2	26 dBm
3 : 9	....
10	10 dBm
11:15	RFU

6.3 AU915

By default MaxEIRP is considered to be +30dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1:10	MaxEIRP – 2*TXPower
11:15	RFU

6.4 KR920

By default MaxEIRP is considered to be +14dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1	MaxEIRP – 2dB
2	MaxEIRP – 4dB
3	MaxEIRP – 6dB
4	MaxEIRP – 8dB
5	MaxEIRP – 10dB
6	MaxEIRP – 12dB
7	MaxEIRP – 14dB
8..15	RFU

6.5 AS923

By default Max EIRP shall be 16dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1	MaxEIRP – 2dB
2	MaxEIRP – 4dB
3	MaxEIRP – 6dB
4	MaxEIRP – 8dB
5	MaxEIRP – 10dB
6	MaxEIRP – 12dB
7	MaxEIRP – 14dB
8..15	RFU

6.6 IN865

By default MaxEIRP is considered to be 30dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1	MaxEIRP – 2dB
2	MaxEIRP – 4dB
3	MaxEIRP – 6dB
4	MaxEIRP – 8dB
5	MaxEIRP – 10dB
6	MaxEIRP – 12dB
7	MaxEIRP – 14dB
8	MaxEIRP – 16dB
9	MaxEIRP – 18dB
10	MaxEIRP – 20dB
11..15	RFU

6.7 CN470

By default MaxEIRP is considered to be +19.15dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1	MaxEIRP – 2dB
2	MaxEIRP – 4dB
3	MaxEIRP – 6dB
4	MaxEIRP – 8dB
5	MaxEIRP – 10dB
6	MaxEIRP – 12dB
7	MaxEIRP – 14dB
8…15	RFU

6.8 EU433

By default MAxEIRP is considered to be +12.15dBm.

TXPower	Configuration (EIRP)
0	MaxEIRP
1	MaxEIRP – 2dB
2	MaxEIRP – 4dB
3	MaxEIRP – 6dB
4	MaxEIRP – 8dB
5	MaxEIRP – 10dB
6..15	RFU

7 Appendix III：Maximum Transmission Load by Region

Note: M in the following list is the length with MAC header, N is the length without MAC header, and the maximum sending data length is N.

7.1 EU868

DataRate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6	250	242
7	250	242
8:15	Not defined	

7.2 US915

DataRate	*M*	*N*
0	19	11
1	61	53
2	133	125
3	250	242
4	250	242
5:7	Not defined	
8	61	53
9	137	129
10	250	242
11	250	242
12	250	242
13	250	242
14:15	Not defined	

7.3 AU915

DataRate	*M*	*N*
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6	250	242
7	Not defined	
8	61	53
9	137	129
10	250	242
11	250	242
12	250	242
13	250	242
14:15	Not defined	

7.4 KR920

DataRate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6:15	Not defined	

7.5 AS923

DataRate	*Uplink MAC Payload Size (M)*		*Downlink MAC Payload Size (M)*	
	UplinkDwellTime = 0	UplinkDwellTime = 1	DownlinkDwellTime = 0	DownlinkDwellTime = 1
0	59	N/A	59	N/A
1	59	N/A	59	N/A
2	59	19	59	19
3	123	61	123	61
4	250	133	250	133
5	250	250	250	250
6	250	250	250	250
7	250	250	250	250
8:15	RFU		RFU	

7.6 IN865

DataRate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6	250	242
7	250	242
8:15	Not defined	

7.7 CN470

DataRate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6:15	Not defined	

7.8 EU433

DataRate	M	N
0	59	51
1	59	51
2	59	51
3	123	115
4	250	242
5	250	242
6	250	242
7	250	242
8:15	Not defined	

8 Appendix IV:Pin Description of RAK811

The pin definition of the RAK811 module can be reviewed in the following documentation:
https://doc.rakwireless.com/datasheet/rakproducts/pin-definition---rak811-lora-module
Here are some descriptions of the pins of the RAK811 module:

1) About the UART pin. Pin6(TX1)、Pin7(RX1)/UART1, Pin25(TX3)、Pin26(RX3)/UART3, All four pins are configured by default as push-pull outputs and pull resistors, so these four pins are at high voltage level.
2) About the JTAG debug pin. Pin10 and Pin13 are used for JTAG debug port. The power-up default configuration is push-pull output and not connected to the pull-down resistor. The two power-up pins are high impedance.
3) About the power pin. The power pin on the RAK811 module includes :VCC/GND, Pin1、Pin11、Pin12、Pin21、Pin28、Pin29、Pin30、Pin31、Pin32、Pin34。
4) About the reset pin. The reset pin on the RAK811 module is PIN24;
5) About the BOOT pin. The BOOT pin on RAK811 module is PIN17;
6) About the RF antenna pin. The RF antenna pin on RAK811 module is PIN33;
7) About the ADC pin. The ADC pins on RAK811 are different from high to low-frequency modules. The low-frequency modules can be used as the ADC pin are: The high-frequency modules can be used as the ADC pin are;
8) About the GPIO. The pins can be GPIO on the RAK811 module are.