UM01747

LoRaWAN IOT Industrial GW RHF2S008P4G Specifications

V0.3

Document information

Info	Content
Keywords	*Ai-Thinker, LoRaWAN, IOT, GW, specifications*
Abstract	This document describes the specifications of the industrial GW RHF2S008P4G.

Catalog

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1 Preface

This document describe the technical specifications and features of the industrial gateway RHF2S008P4G
RHF2S008P4G LoRaWAN GW is an 8 channel industrial device designed by Ai-Thinker, which is compatible with LoRaWAN protocol and PoE IEEE 802.3af/at.

2 RHF2S008P4G LoRaWAN Gateway description

RHF2S008P4G is an IOT gateway based on LoRaWAN and target to LPWAN network. It is an IEEE 802.3 af/at compatibility PD, which could be powered by PoE. Both Ethernet and LTE-4G are supported to connect to the cloud server. With an integrated GPS module, the GW could support LoRaWAN Class B protocol with the synchronous clock from GPS PPS signal.
This device integrate an high performance CPU ARM Cortex-A53 core, one pcs of baseband processor SX1301, that it could support 8 multi-SF channel (SF12 to SF7), 1 single-SF channel and 1 GFSK channel. Output power could achieve to 27dBm max. Sensitivity is as low as -141dBm@300bps. With specified payload length and transmit period, one GW could support 10k nodes.
RHF2S008P4G is a smart device but with high reliability, that it could work outdoor or in a complexity environment.

2.1 Functional Block

RHF2S008P4G LoRaWAN functional block is shown below.

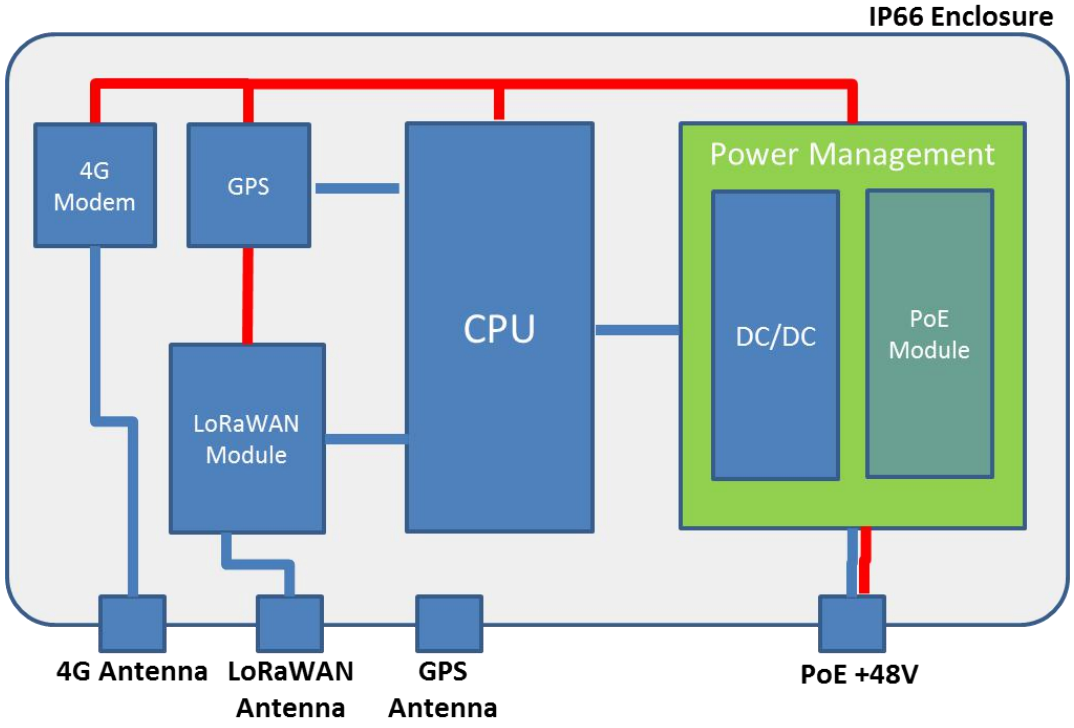

Figure 2- 1 RHF2S008P4G functional block

2.2 Product features and application

Features：

- ✓ LoRaWAN half-duplex operation mode;
- ✓ Uplink include 8 multi-SF LoRa channel, 1 single-SF LoRa channel, and 1 GFSK channel;
- ✓ Output power achieve to 27dBm max，receiver sensitivity as low as -141dBm@300bps;
- ✓ Support LoRaWAN ClassA/B/C mode；
- ✓ Support PoE IEEE 802.3 af/at;
- ✓ Support 10/100M Ethernet connection and GPRS/3G/4G connection，switch automatically;
- ✓ Supply with 100m cable via PoE;
- ✓ High reliability industrial device, IP66 device，easy to setup LPWAN network outdoor

Application：

- ✓ M2M，IOT，and LPWAN
- ✓ Wireless sensor network
- ✓ AMR
- ✓ Industry 4.0，Industrial monitor
- ✓ Wireless remote control and monitor
- ✓ Smart Home, Smart building, Smart community and Smart city;
- ✓ Wireless alarm and security
- ✓ environment monitor

2.3 Specifications

Table 2-1 RHF2S008 Specifications

Item Group	Item	Description
System Configuration	Core	ARM Cortex-A53
	Main Frequency	1.2GHz
	RAM	1Gbytes
	Flash	4Gbytes eMMC
Communication	Wired Network	Ethernet 10M/100Mbps
	Mobile Cellular	GSM/3G/4G Wireless connection
	LoRaWAN	Long Range Wireless Communication
Electrical Specification	Power supply input	PoE +48 Input IEEE 802.3 af/at
	Average Power Consumption	5W
	LoRa Output Power	type：14dBm@868MHz；17dBm@470MHz Max：27dBm
	LoRa Sensitivity	-141dBm@SF12,BW=125kHz
Sensor	Temperature	Monitor device internal temperature
User Interface (External)	Mobile Cellular 4G Antenna	Connect gateway with internet
	LoRaWAN Antenna	LoRaWAN transceiver, IoT data collection
	Ethernet	Connect gateway with internet
	GPS	GPS function
	Power supply	Power supply input
User Interface	Micro SIM Card Slot	Support Micro SIM Card

(External)	USB	USB bootloader (Device Firmware Upgrade)
	UART	UART Terminal for debugging
	LED100 (Internal)	System indicator
	LED200 (Internal)	Ethernet full/half duplex indicator
	LED201 (Internal)	Ethernet link status indicator
	LED202 (Internal)C	Ethernet data speed indicator
	LED203 (Internal)	4G modem
Dimensions Installation	Dimensions	145 x 95 x 40 mm
	Weight	715g
	Installation	Derrick installation, Fixed on the wall
Operating Range	Operational temperature range	-40 to +75°C
	Memory temperature range	-40 to +85°C

2.3.1 Hardware

CPU: ARM Cortex-A53
Main Frequency: 1.2GHz
Memory: 1Gbytes RAM, 4GB eMMC
Hardware Watchdog
Internal Temperature Sensor
PoE module;
GPS module;
LoRaWAN Module：

8 125kHz LoRaWAN receiver channel
1 configurable bandwidth(125kHz/250kHz/500kHz) LoRa channel
1 GFSK channel

4G Modem：

FDD LTE: Band 1, Band 3, Band 8, all bands with diversity
TDD LTE: Band 38, Band 39, Band 40, Band 41, all bands with diversity
DC-HSPA+/HSPA+/HSPA/UMTS: Band 1, Band 5, Band 8, Band 9, all bands with diversity
TD-SCDMA: Band 34, Band 39
GSM/GPRS/EDGE: 1800 MHz/900 MHz

FDD LTE: Band 1, Band 2, Band 3, Band 4, Band 5, Band 7, Band 8, Band 20, all bands with diversity
WCDMA/HSDPA/HSUPA/HSPA+: Band 1, Band 2, Band 5, Band 8, all bands with diversity
GSM/GPRS/EDGE: 850 MHz/900 MHz/1800 MHz/1900 MHz

2.3.2 Software

- Based on Linux Kernal

  - Version: 4.1.19
- SPI Driver
- I2C Driver
- USB Host/Device Driver
- LoRaWAN module Driver
- 4G Modem Driver (Supports GSM/GPRS/3G/4G communication)
- Ethernet driver
- GPS driver to support synchronization
- DMA Driver
- Power Management Driver
- Temperature Sensor Driver
- Watch dog

Bootloader：

- Support image programming
- Support USB downloading
- Support USB booting

3 Reference standards and specifications

RF Test based on ETSI EN300 220-1 V2.4.1（2012-05）；ETSI EN300 220-2 V2.4.1（2012-05）；
EMC Test based on ETSI EN 301 489-1 V1.9.2 (2011-09)；ETSI EN301 489-3 V1.6.1（2013-08）；
ETSI EN301 489-17 V2.2.1（2012-09）：
IEC 61000-4-2；
IEC 61000-4-3；
IEC 61000-4-4；
IEC 61000-4-5；
IEC 61000-4-6；
IEC 61000-4-11。
Safety test based on EN60950-1:2006 +A11: 2009 +A1: 2010 +A12: 2011+A2:2013
IP level test based on GB 4208-2008
Environment test based on below:
JESD22-A1 ；
GB/T 2423.1-2001 Low temperature
GB/T 2423.2-2001 High temperature

4 Global electrical specifications and reliability

4.1 Electrical specifications

4.1.1 Power Supply

RHF2S008P4G is a PD device which is compatible with PoE IEEE 802.3af/at standard, that support up to 100m cable for remote power supply and communications.

Table 4-1 PoE Requirement

Item	802.3af (PoE)	802.3at (PoE plus)
Classification	0～3	0～4
Max current support	350mA	600mA
PSE output voltage	44～57V DC	50～57V DC
PSE output power	≤15.4W	≤30W
PD Input voltage	36～57V DC	42.5～57V DC
PD maximum power	12.95W	25.5W
Cable requirement	Unstructured	CAT-5e or better
Cable length requirement	<100m	<100m
Related cable pair	2 (1/2,3/6 or 4/5,7/8)	2 (1/2,3/6 or 4/5,7/8)

4.1.2 Consumption

Table 4-2 RHF2S008 total consumption

Item	Value typ/W	Test condition
Standby	3	No Tx and Rx in LoraWAN,4G connected
Average	5	LoRaWAN work with 4G connected
Peak	15	All module work with full load

4.1.3 RF Specifications（LoRaWAN）

Conducted Reciever sensitivity and Transmitter output power would be used to evaluate the performance here.

1）Sensitivity

Test condition：32byte payload，PER=10%， +25℃.

Table 4-3 Conducted Receiver sensitivity

Part Number	Bandwidth/kHz	Spreading Factor	Sensitivity/dBm
RHF2S008P4G-434	125	12	-140
		7	-126
	250	12	-137
		7	-123

	500	12	-134
		7	-120
RHF2S008P4G-470	125	12	-140
		7	-125
	250	12	-136
		7	-122
	500	12	-133
		7	-119
RHF2S008P4G-780	125	12	-139
		7	-125
	250	12	-136
		7	-122
	500	12	-133
		7	-119
RHF2S008P4G-868	125	12	-139
		7	-125
	250	12	-136
		7	-122
	500	12	-133
		7	-119
RHF2S008P4G-915	125	12	-139
		7	-125
	250	12	-136
		7	-122
	500	12	-133
		7	-119

2）Output power

Test condition：CW signal，+25℃.

Table 4- 4 Output power

Part Number	Parameter	Min	Typ	Max	Unit
RHF2S008P4G-434	Frequency Range（Rx/Tx）	430		437	MHz
	Max Output power		25		dBm
	Output Power Variation	-1.5		1.5	dB
	TX Power Variation Temperature（-40 to 85℃）	-1.5		1.5	dB
	TX Frequency Variation Temperature（-40 to 85℃）	-3		3	ppm

RHF2S008P4G-470	Frequency Range（Tx）	470		510	MHz
	Frequency Range（Rx）	470		490	MHz
	Max Output power		25		dBm
	Output Power Variation	-1.5		1.5	dB
	TX Power Variation Temperature（-40 to 85℃）	-1.5		1.5	dB
	TX Frequency Variation Temperature（-40 to 85℃）	-3		3	ppm
RHF2S008P4G-780	Frequency Range（Rx/Tx）	779		787	MHz
	Max Output power		26		dBm
	Output Power Variation	-1.5		1.5	dB
	TX Power Variation Temperature	-1.5		1.5	dB
	TX Frequency Variation Temperature	-3		3	ppm
RHF2S008P4G-868	Frequency Range（Rx/Tx）	859		871	MHz
	Max Output power		25		dBm
	Output Power Variation	-1.5		1.5	dB
	TX Power Variation Temperature（-40 to 85℃）	-1.5		1.5	dB
	TX Frequency Variation Temperature（-40 to 85℃）	-3		3	ppm
RHF2S008P4G-915	Frequency Range（Rx/Tx）	900		930	MHz
	Max Output power		25		dBm
	Output Power Variation	-1.5		1.5	dB
	TX Power Variation Temperature（-40 to 85℃）	-1.5		1.5	dB
	TX Frequency Variation Temperature（-40 to 85℃）	-3		3	ppm

4.1.4 Antenna performance

High performance, high efficiency fibre-glass epoxy antenna is used for RHF2S008P4G GW.
Resistence 50Ω
VSWR<2.0
Gain=2dBi@434/470MHz；Gain=3dBi@868/915MHz
Efficiency@434MHz/470MHz>50%
Efficiency @868MHz/915MHz>70%

4.2 Reliability

4.2.1 Environment test

Table 4-5 Environment test requirement

Item	Test condition	Standard	Results
Low temperature operation	Temperature: -40°C Operation mode: working with service connected Test duration: 12 h	JESD22-A1 GB/T 2423	Appearance ok; LoRaWAN RF performance ok; Function ok;
High temperature operation	Temperature: +75°C Operation mode: working with service connected Test duration: 12 h	JESD22-A1 GB/T 2423	Appearance ok; LoRaWAN RF performance ok; Function ok;
Low temperature Storage	Temperature: -40°C Operation mode: no power, no package Test duration: 24 h	JESD22-A1 GB/T 2423	Appearance ok; LoRaWAN RF performance ok; Function ok;
High temperature Storage	Temperature: +75°C Operation mode: no power, no package Test duration: 24 h	JESD22-A1 GB/T 2423	Appearance ok; LoRaWAN RF performance ok; Function ok;

4.2.2 EMC and ESD

RHF2S008P4G is an high reliability industrial device, and ESD, Radio Frequency Electromagnetic Field Immunity, Electrical Fast Transient/Burst Immunity and Surge Immunity are operated on it based on IEC61000-4 standard.

Table 4-6 Reliability test requirement

Item	Standard	Test condition
ESD	IEC 61000-4-2	Air Discharge:15kV Contact Discharge:8kV Positive/Negative
Radio Frequency Electromagnetic Field Immunity	IEC 61000-4-3	80MHz to 1000MHz and 1400MHz to 2700MHz; 3V/m;
Electrical Fast Transient/Burst Immunity	IEC 61000-4-4	AC power port:1kV; Positive/Negative
Surge Immunity	IEC 61000-4-5	Common mode: 4kV Differential mode: 3kV Positive/Negative

4.2.3 IP level for outdoor use

Refered to GB 4208-2008, the level is IP66.

5 Mechanical size and package information

5.1 Mechanical size

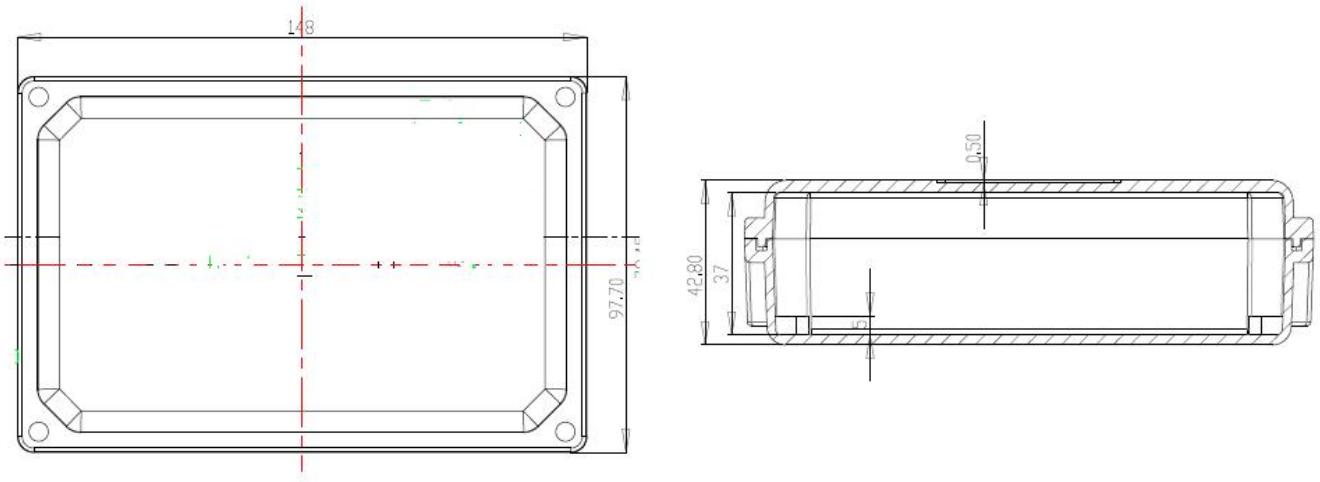

Figure 5-1 RHF2S008P4G mechanical size

5.2 Package information

5.2.1 Package list

Table 5-1 package list

Material	PN	Qty
RHF2S008P4G	RHF2S008P4G-xxx	1
PoE injector	PoE30G-AT	1
LoRaWAN Antenna	RXHF-ANTxxx-GF	1
Fixed collar for LoRaWAN antenna	-	1
Screw for collar	M3x6	4
4G Antenna	RXHF-ANT4G	1
GPS Antenna（N-type， 70cm）	RXHF-ANTGPS	1
Wire for Ground	1.5m length	2
Fixture	-	1
Screw to fix GW（Inner hexagonal M5）	Inner hexagonal M6x8	4
Screw to fix the auxiliary fixture	M5x10	4
Screw for ground	M5x10	2
Surge protector	N-JK-G-Y-6	1
RF cable（connect the antenna to GW）	N（Male）--KSR200（80cm）--N（Female）	1
Box for package	50x26x12 cm	1

5.2.2 Package information

Figure 5-2 RHF2S008P4G package

Figure 5-3 package inside

6 Order information

RHF2S008P4G include several part number, different part number would be used in different band and area, please contact with sales@Ai-Thinker.com for detailed information.

Table 6-1 order inforamtion

PN	descriptions
RHF2S008P4G-434	430-470MHz
RHF2S008P4G-470	Uplink 470-490MHz; Downlink 470-510MHz
RHF2S008P4G-780	779-787MHz
RHF2S008P4G-868	859-871MHz
RHF2S008P4G-915	900-930MHz

Modifications

V0.3 2017-04-08

+ Update with some error modifications

V0.2 2017-04-08

+ Update with reliability requirement
+ Updatew with some package information

V0.1 2017-03-01

+ Create draft.

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