# UM01747

## LoRaWAN IOT Industrial GW RHF2S008P4G Specifications

**V0.4**

## Document information

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

# Catalog

# Features

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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 RisingHF, 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.

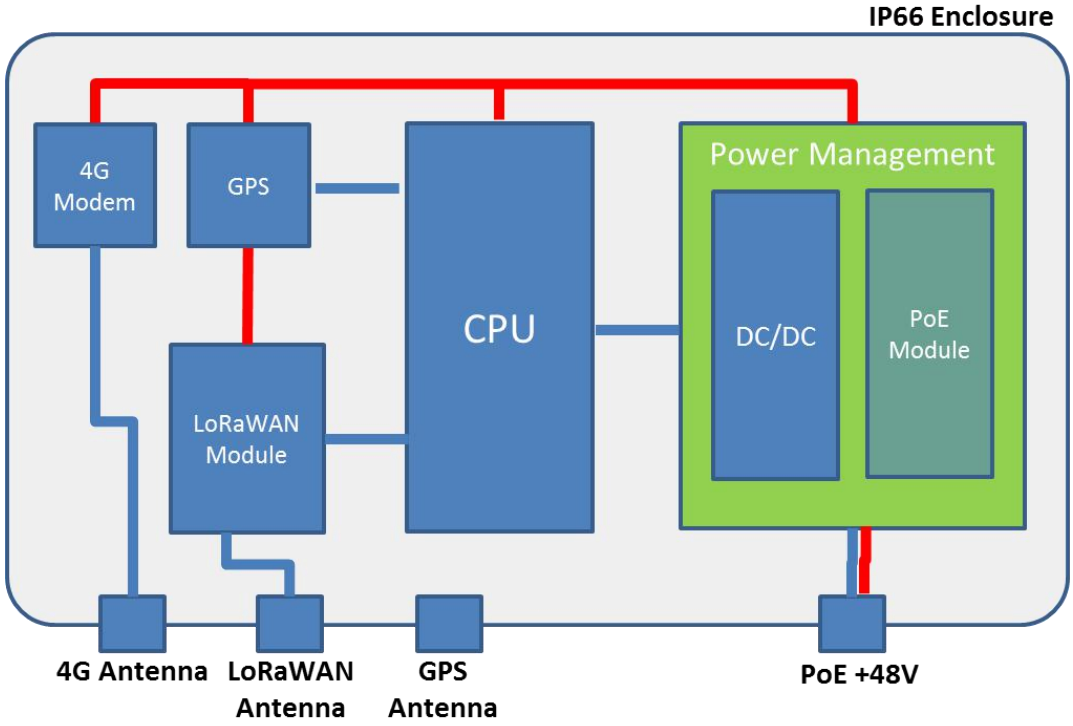


**Figure 2- 1 RHF2S008P4G functional block**

## 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<br>IEEE 802.3 af/at |
| | Average Power Consumption | 5W |
| | LoRa Output Power | type：14dBm@868MHz；17dBm@470MHz<br>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<br>(1/2,3/6 or 4/5,7/8) | 2<br>(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<br>Operation mode: working with service connected<br>Test duration: 12 h | JESD22-A1<br>GB/T 2423 | Appearance ok;<br>LoRaWAN RF performance ok;<br>Function ok; |
| High temperature operation | Temperature: +75°C<br>Operation mode: working with service connected<br>Test duration: 12 h | JESD22-A1<br>GB/T 2423 | Appearance ok;<br>LoRaWAN RF performance ok;<br>Function ok; |
| Low temperature Storage | Temperature: -40°C<br>Operation mode: no power, no package<br>Test duration: 24 h | JESD22-A1<br>GB/T 2423 | Appearance ok;<br>LoRaWAN RF performance ok;<br>Function ok; |
| High temperature Storage | Temperature: +75°C<br>Operation mode: no power, no package<br>Test duration: 24 h | JESD22-A1<br>GB/T 2423 | Appearance ok;<br>LoRaWAN RF performance ok;<br>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<br>Contact Discharge:8kV<br>Positive/Negative |
| Radio Frequency Electromagnetic Field Immunity | IEC 61000-4-3 | 80MHz to 1000MHz and 1400MHz to 2700MHz;<br>3V/m; |
| Electrical Fast Transient/Burst Immunity | IEC 61000-4-4 | AC power port:1kV;<br>Positive/Negative |
| Surge Immunity | IEC 61000-4-5 | Common mode: 4kV<br>Differential mode: 3kV<br>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

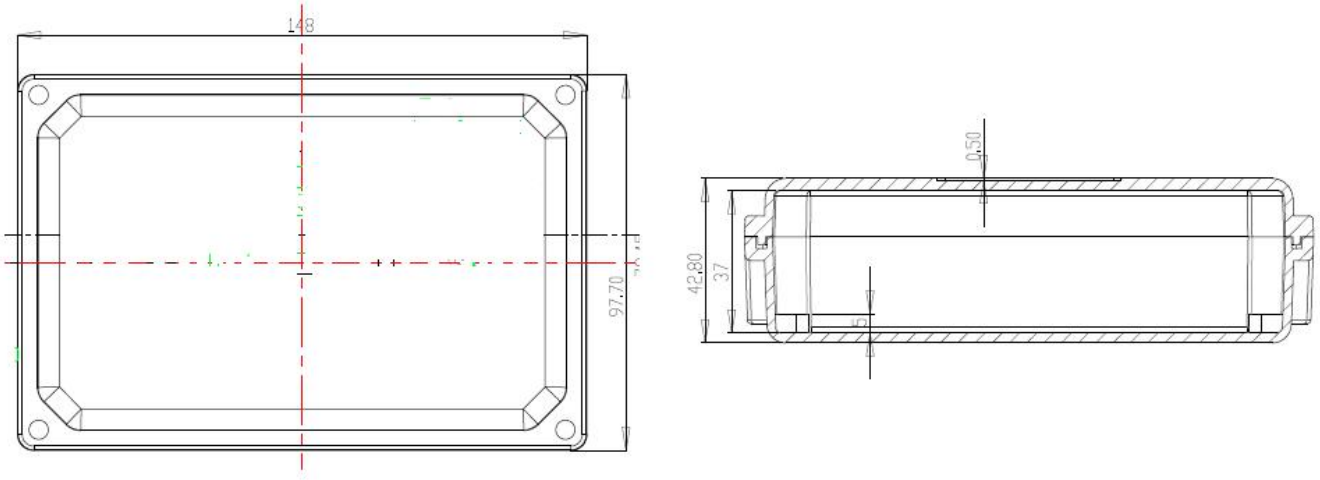


**Figure 5-1 RHF2S008P4G mechanical size**

## 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

Package Size:507*266*125mm.

Weight:3.5kg.


**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@risinghf.com for detailed information.

**Table 6-1 order inforamtion**

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

# Modifications

V0.4 2018-06-01

+ Update with package size and weight

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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