DS02306

RHF0M302B Mini-PCIE interface LoRa® gateway module Product

V1.0

Document information

Info	Content
Keywords	RisingHF, LoRa® Gateway module，Mini-PCIE
Abstract	This document is the specification of RHF0M302B Mini-PCIE gateway module

Content

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1 Introduction

RHF0M302B Mini-PCIE interface gateway module is a high-performance LoRa®/ LoRaWAN® Module based on Semtech gateway chip SX1302. The SX1302 is a new generation of high-speed baseband LoRa® chip for gateways, it is capable of handling a higher amount of traffic, embeds 16 different modem and supports high speed SF5 and SF6 packets.
The RHF0M302B Mini-PCIE interface gateway module integrates high-performance RF front-end, including low-noise LNA, PA and also RF switch. The RHF0M302B module is controlled through SPI interface. Small size and standardized Mini-PCIE hardware design helps customer develop their own multi-channel GW easily.

Features

- Small size：60mm * 30mm * 3mm
- 52 pin Mini-PCIE interface package, easy to integrate application
- Frequency band
  - 470MHz / 868MHz / 915MHz
- Embeds 16 different modems：
  - 8xSF5-SF12, 8 multi-SF LoRa® modems
  - 8xSF5-SF10, 8 multi-SF LoRa® modems specifically demodulating SF5 to SF10 traffic
- 1 high-speed LoRa® modem (125, 250 or 500 kHz), handling a single declared SF
- Adaptively adjust the spreading factor from SF12 to SF5 (for 8 channels supporting multiple spreading factors)
- High performance：
  - -138dBm Receiving sensitivity /SF12 125KHz
  - 26dBm TX power
- interface design: SPI interface connection
- Support GPS PPS pulse input for network synchronization and LoRaWAN® class B
- power supply + 3.3V
- Full support for LoRaWAN® protocol class A, class B and class C

This product specification includes a detailed description of the performance and functions of the RHF0M302B Mini-PCIE interface gateway module.

2 Description

RHF0M302B Mini-PCIE interface gateway module is based on Semtech LoRaWAN ® Concentrator reference design. RF switch is used to realize half-duplex mode. Figure 1 shows a simple block diagram of the module.

Schematic frame：

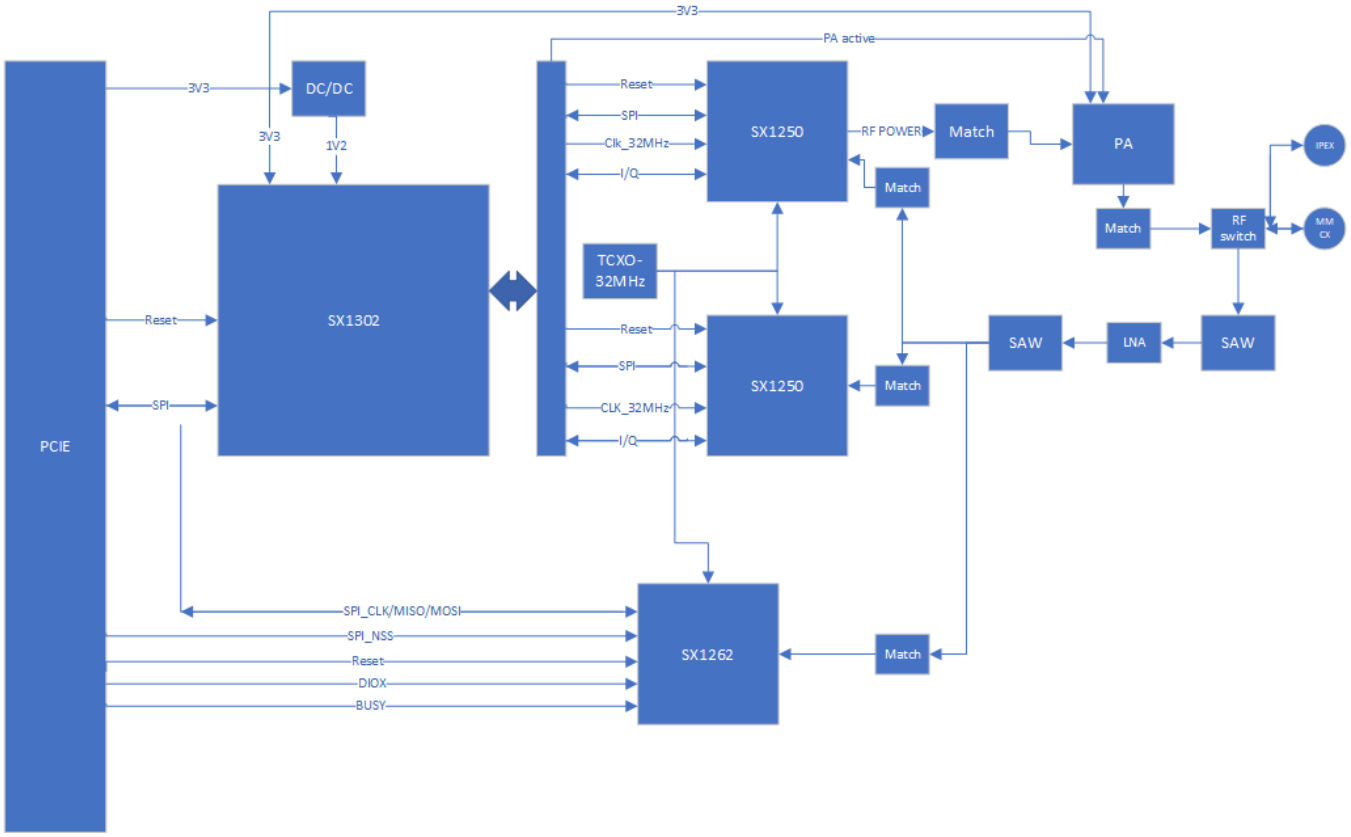

Figure 1 RHF0M302B MINI-PCIE Schematic diagram

2.1 Pin definition

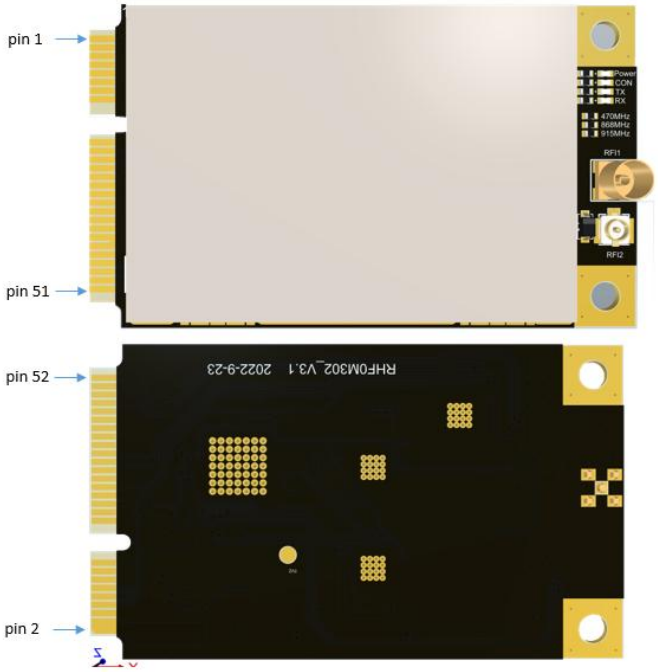

Figure 2 RHF0M302B Mini-PCIE Interface Pin arrangement

Table 1 RHF0M302B Mini-PCIE Interface pinout

Number	Name	Type	Description
1	NC	/	/
2	VCC_3.3V	S	Power
3	NC	/	/
4	GND	S	Ground
5	NC	/	/
6	GPIO(6)	I/O	SX1302 GPIO6
7	NC	/	/
8	SX1261_BUSY	I/O	SX1261_BUSY
9	GND	S	Ground
10	SX1261_NRESET	I/O	SX1261 Reset
11	NC	/	/
12	NC	/	/
13	NC	/	/
14	NC	/	/
15	GND	S	Ground
16	NC	/	/
17	NC	/	/
18	GND	S	Ground
19	PPS	I/O	GPS timing input

20	NC	/	/
21	GND	S	Ground
22	SX1302_RESET	I/O	SX1302 Reset
23	NC	/	/
24	VCC_3.3V	S	Power
25	SX1261_SPI_NSS	I/O	SX1261 Spi chip select signal input
26	GND	S	Ground
27	GND	S	Ground
28	NC	/	/
29	GND	S	Ground
30	NC	/	/
31	SX1261_DIO2	I/O	SX1261_DIO2
32	NC	/	/
33	SX1261_DIO1	I/O	SX1261_DIO1
34	GND	S	Ground
35	GND	S	Ground
36	NC	/	/
37	GND	S	Ground
38	NC	/	/
39	VCC_3.3V	S	Power
40	GND	S	Ground
41	VCC_3.3V	S	Power
42	NC	/	/
43	GND	S	Ground
44	NC	/	/
45	SPI_SCK	I/O	SPI clock signal input
46	NC	/	/
47	SPI_MISO	I/O	SPI data output
48	NC	/	/
49	SPI_MOSI	I/O	SPI data input
50	GND	S	Ground
51	SPI_CSN	I/O	Spi chip select signal input
52	VCC_3.3V	S	Power

3 Electrical characteristics

3.1 Absolute Maximum Ratings

Reaching or exceeding the rated maximum values listed in the table below will result in equipment damage。

Table 2 Absolute Maximum Ratings

Item	Description	min	type	max	unit
VCCmr	Supply Power	-0.3	+3.3	+3.6	V
Cmr	Supply current	1.5			A
Tmr	Operating temperature	-40	+25℃	+85	℃
Pmr	RF input	-		-13	dBm

Note: The maximum current is about 600mA with max RF output power with 50 Ω impedance match and bout 1A if the output port is mismatching (antenna is mismatch for example).

3.2 RF Characteristics

3.2.1 TX Characteristics

Table 3 RHF0M302-SPI-470B RF transmitter characteristics

Part Number	Parameter	Min	Type	Max	Unit
RHF0M302-SPI-470B	Frequency Range(TX)	470.2		509.9	MHz
	Frequency Range(RX)	470.2		490	MHz
	Max output power		25.5		dBm
	TX power ariation temperature (-40~85℃)	-1.5		1.5	dBm
	TX frequency ariationtemperature (-40~85℃)	-3		3	ppm

Table 4 RHF0M302-SPI-868B RF transmitter characteristics

Part Number	Parameter	Min	Type	Max	Unit
RHF0M302-SPI-868B	Frequency Range(TX)	859		928	MHz
	Frequency Range(RX)	859		871	MHz
	Max output power		24		dBm
	TX power ariation temperature (-40~85℃)	-1.5		1.5	dBm
	TX frequency ariation temperature (-40~85℃)	-3		3	ppm

Table 5 RHF0M302-SPI-915B RF transmitter characteristics

Part Number	Parameter	Min	Type	Max	Unit
RHF0M302-SPI-915B	Frequency Range(TX)	859		928	MHz
	Frequency Range(RX)	902.3		927.9	MHz
	Max output power		26		dBm
	TX power ariation temperature (-40~85℃)	-1.5		1.5	dBm
	TX frequency ariation temperature (-40~85℃)	-3		3	ppm

3.2.2 Rx Characteristics

Table 6 RHF0M302-SPI-470B RF receive characteristics

Part Number	Bandwith/KHz	Spreading Factor	Sensityvity/dBm
RHF0M302-SPI-470B	125KHz	12	-138
		5	-117
	250KHz	12	-135
		5	-114
	500KHz	12	-132
		5	-111

Table 7 RHF0M302-SPI-868B RF receive characteristics

Part Number	Bandwith/KHz	Spreading Factor	Sensityvity/dBm
RHF0M302-SPI-868B	125KHz	12	-138
		5	-117
	250KHz	12	-135
		5	-114
	500KHz	12	-132
		5	-111

Table 8 RHF0M302-SPI-915B RF receive characteristics

Part Number	Bandwith/KHz	Spreading Factor	Sensityvity/dBm
RHF0M302-SPI-868B	125KHz	12	-138
		5	-117
	250KHz	12	-135
		5	-114
	500KHz	12	-132
		5	-111

3.3 Frequency response

3.3.1 RHF0M302-SPI-470B

Available band: 470MHz to 490MHz (uplink); 470MHz to 510MHz (downlink);

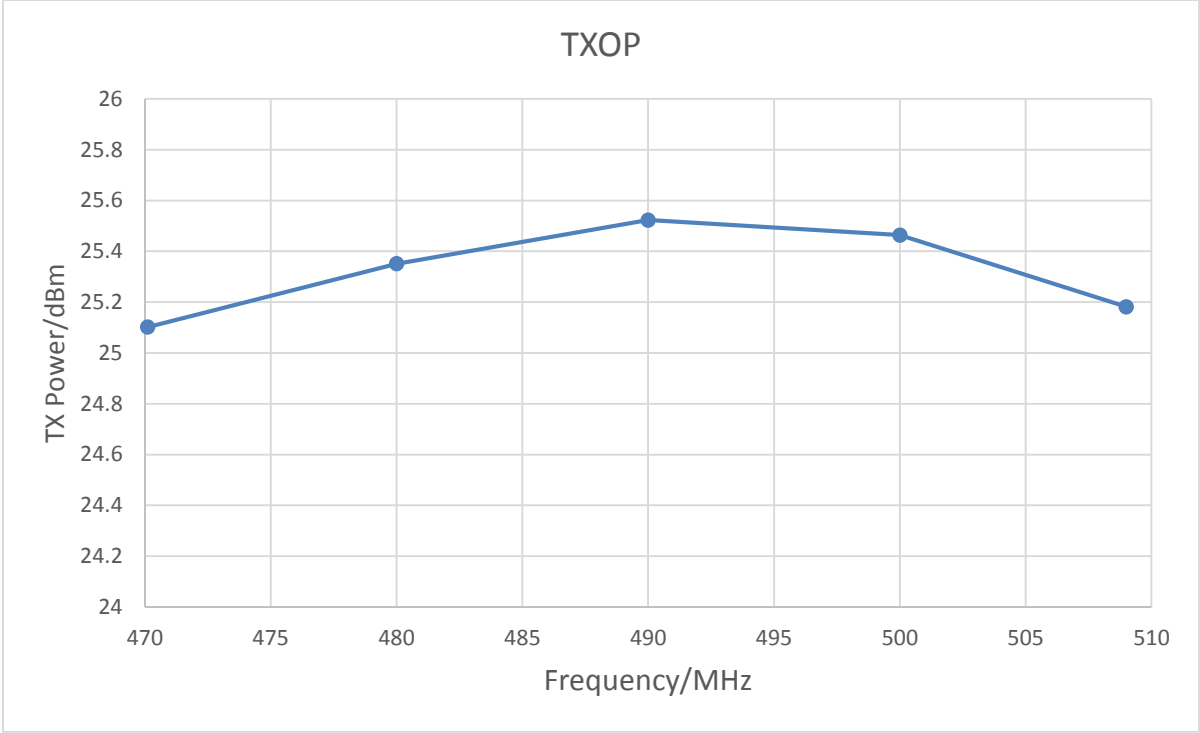

Figure 3 Txop vs Freq for RHF0M302-SPI-470B

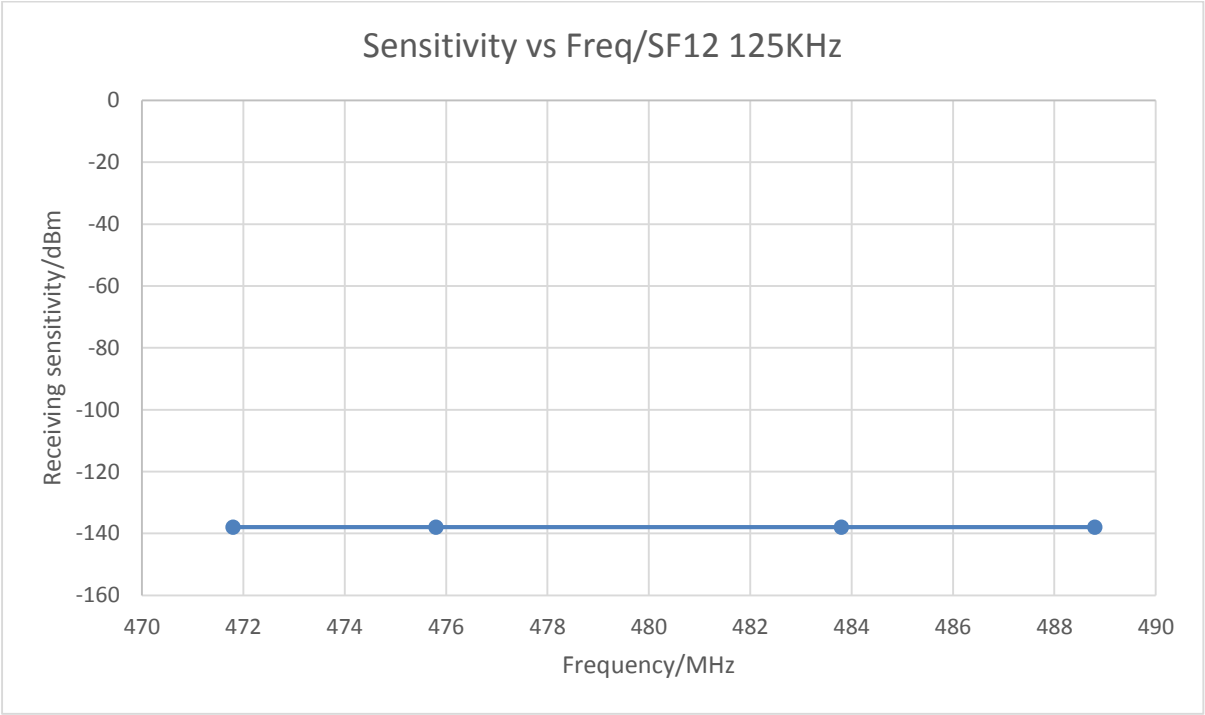

Figure 4 Sensitivity vs Freq for RHF0M302-SPI-470B

3.3.2 RHF0M302-SPI-868B

Available band: 859MHz to 871MHz

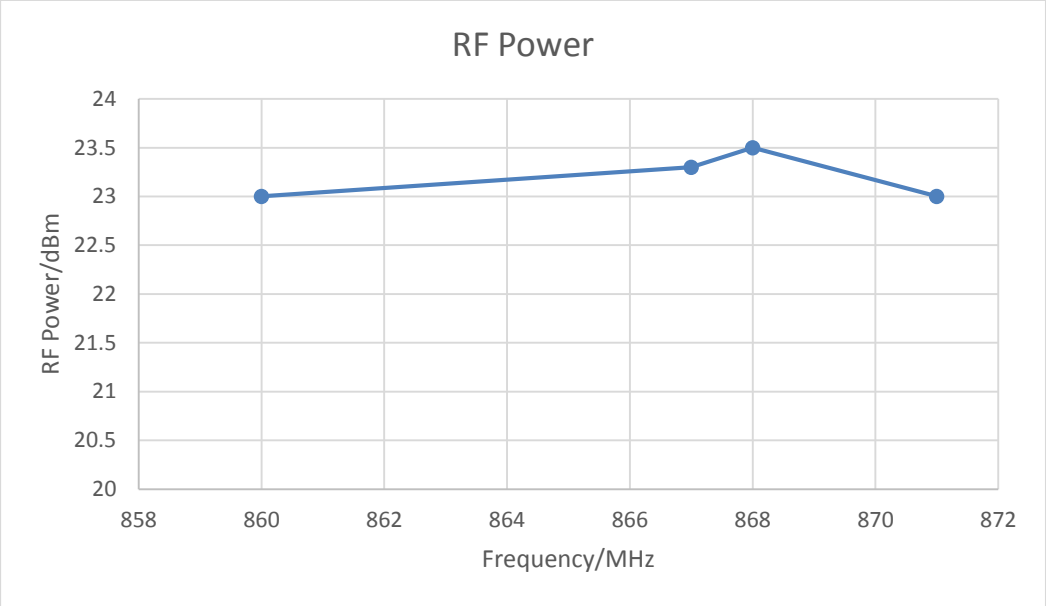

Figure 5 Txop vs Freq for RHF0M302-SPI-868B

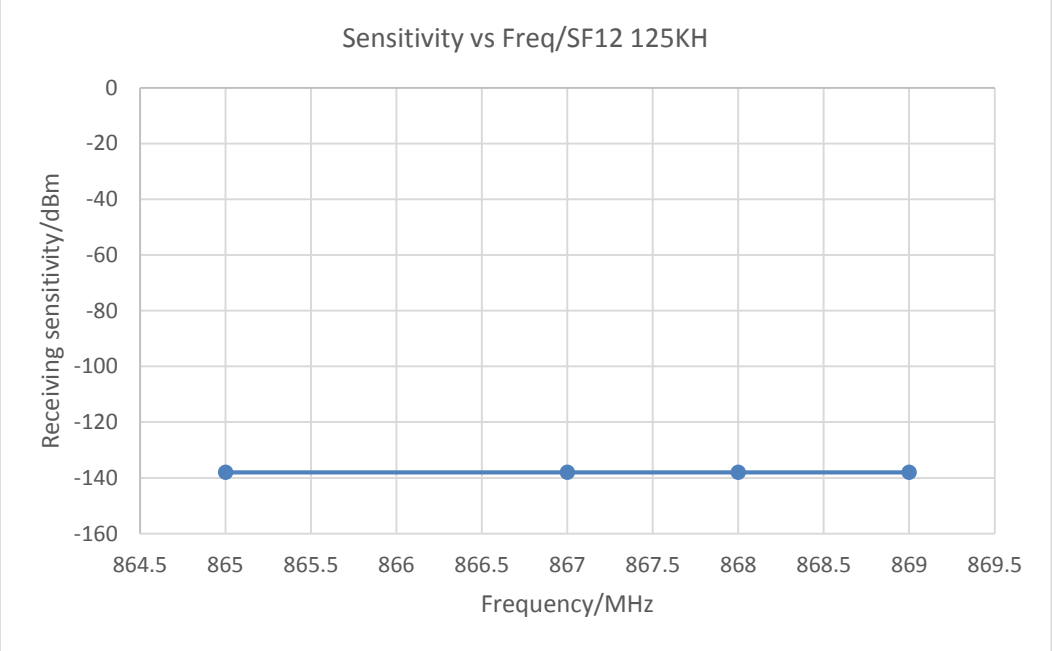

Figure 6 Sensitivity vs Freq for RHF0M302-SPI-868B

3.3.3 RHF0M302-SPI-915B

Available band: 900MHz to 927.9MHz

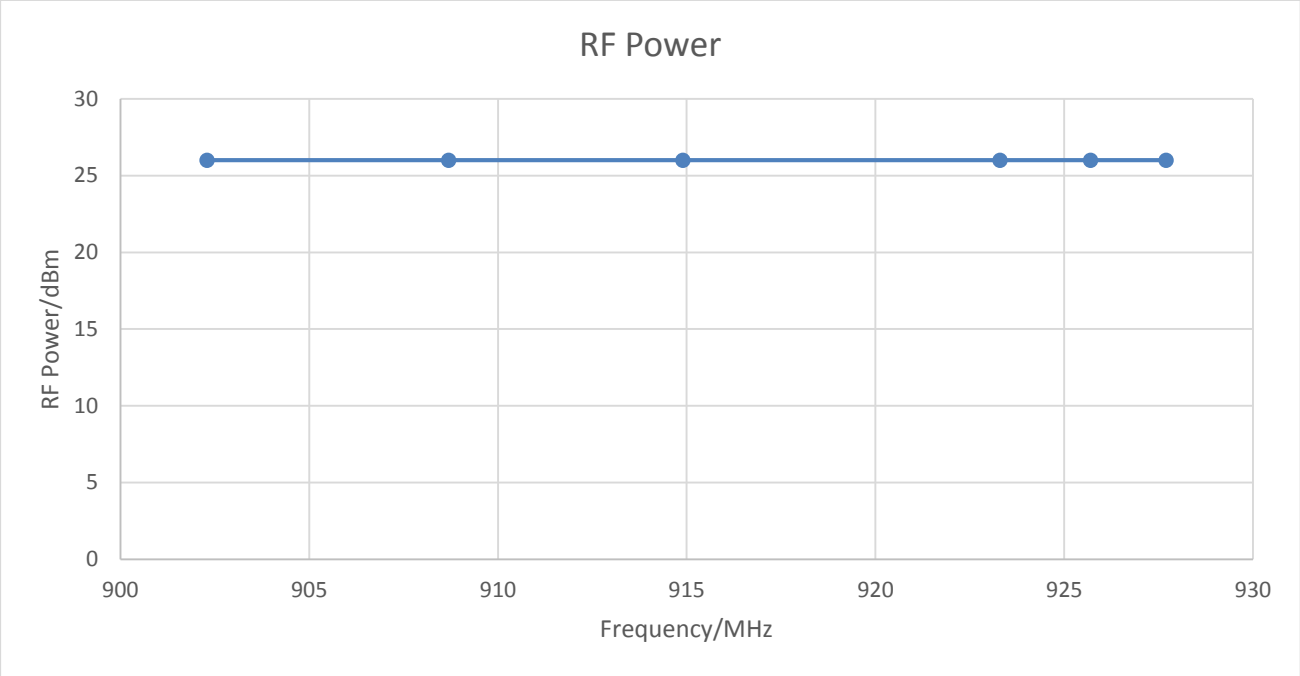

Figure 7 Txop vs Freq for RHF0M302-SPI-915B

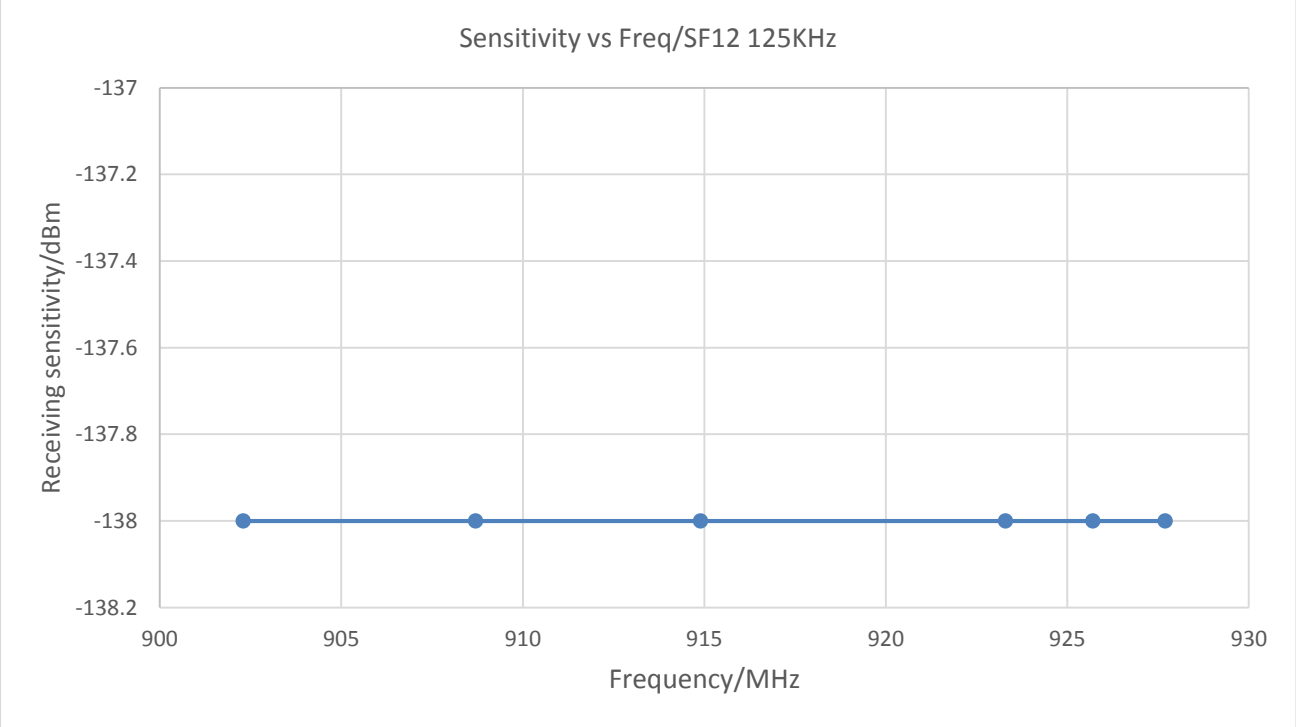

Figure 8 Sensitivity vs Freq for RHF0M302-SPI-915B

4 Appliction

4.1 Semtech HAL

This part will give the output power table for each band. Users should refer to these ta
GW on server side.

Power level: LoRaWAN protocol power level; RF power: module actual output power

Table 9 RHF0M302-SPI-470B TX Power Table

PA	Pwid	RF Power/dBm		
		490MHz	868MHz	915MHz
1	1	13.502	9.509	18.971
1	2	14.646	10.467	20.117
1	3	15.343	11.046	20.786
1	4	16.585	12.078	21.951
1	5	17.371	12.741	22.649
1	6	18.388	13.569	23.5
1	7	19.516	14.483	24.317
1	8	20.518	15.266	24.962
1	9	21.52	16.044	25.514
1	10	22.318	16.713	25.84
1	11	22.971	17.353	26.002
1	12	23.537	18.039	26.061
1	13	24.08	18.79	26.082
1	14	24.498	19.482	26.064
1	15	24.859	20.254	26.051
1	16	25.183	21.146	26.016
1	17	25.415	21.996	25.978
1	18	25.514	22.853	25.926
1	19	25.467	23.561	25.849
1	20	25.34	23.916	25.767
1	21	25.222	23.966	25.658
1	22	25.159	23.98	25.545

4.2 Reset sequence

Each time when powering up the RHF0M302 Mini-PCIE module, reset operation is required. The timing of reset signal should be more than 1ms delay after VCC+3.3V stable and last more than 100ns.

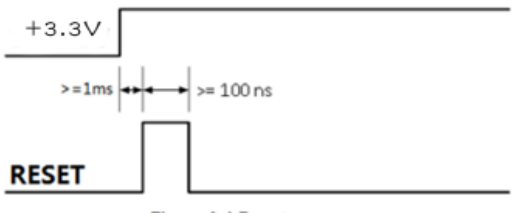

Figure 9 Reset sequence

5 Reference Design

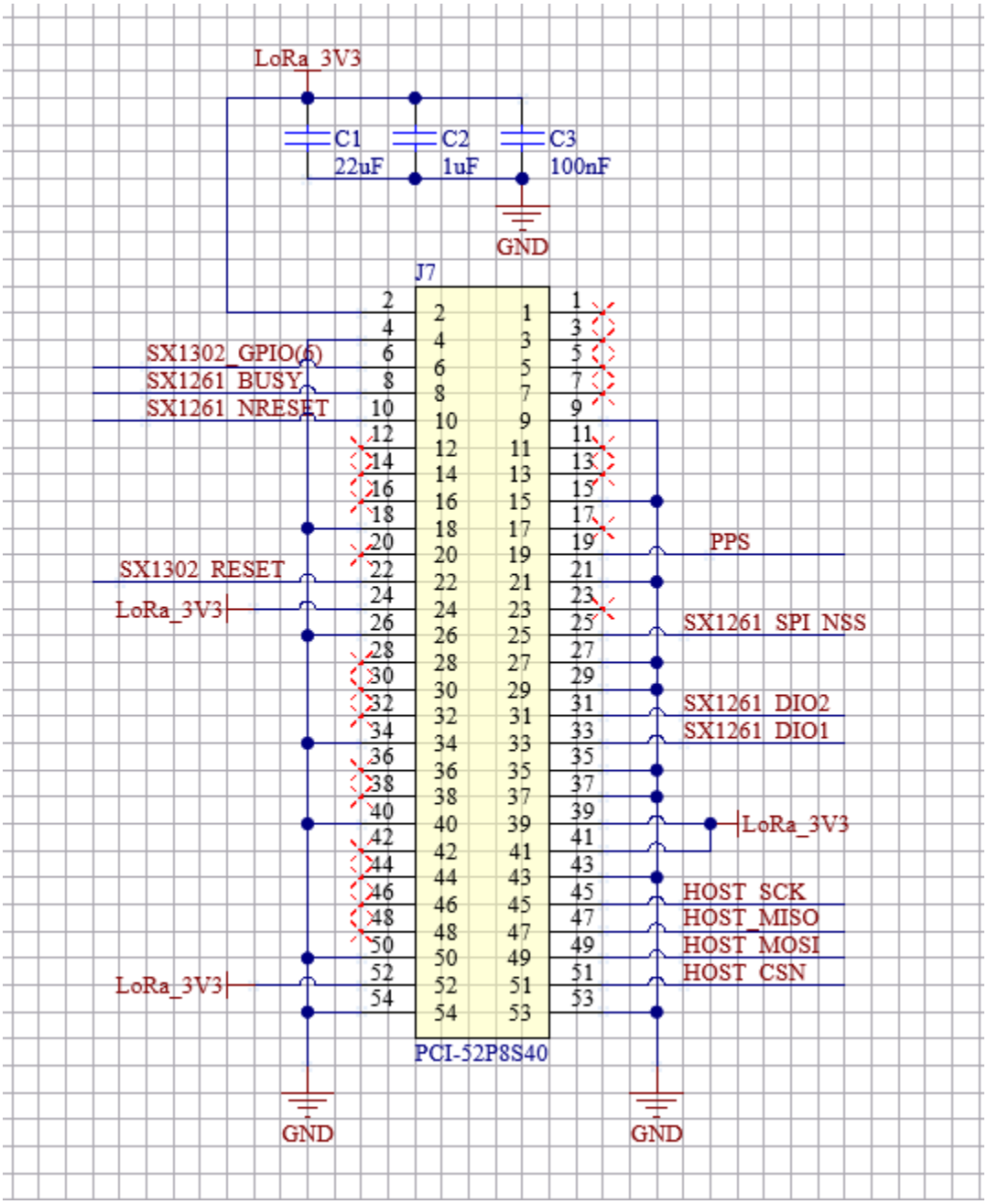

Figure 10 Recommended Connection

Note:

1) 220uF//220uF//100nF//100pF is strongly suggested to put as close as to the input pin (Pin1 and Pin2) of the module when you layout!

2) A RC filter (R=22R, C=10nF) is strongly suggested to be added for Reset connection。

5.1 PCB Package information

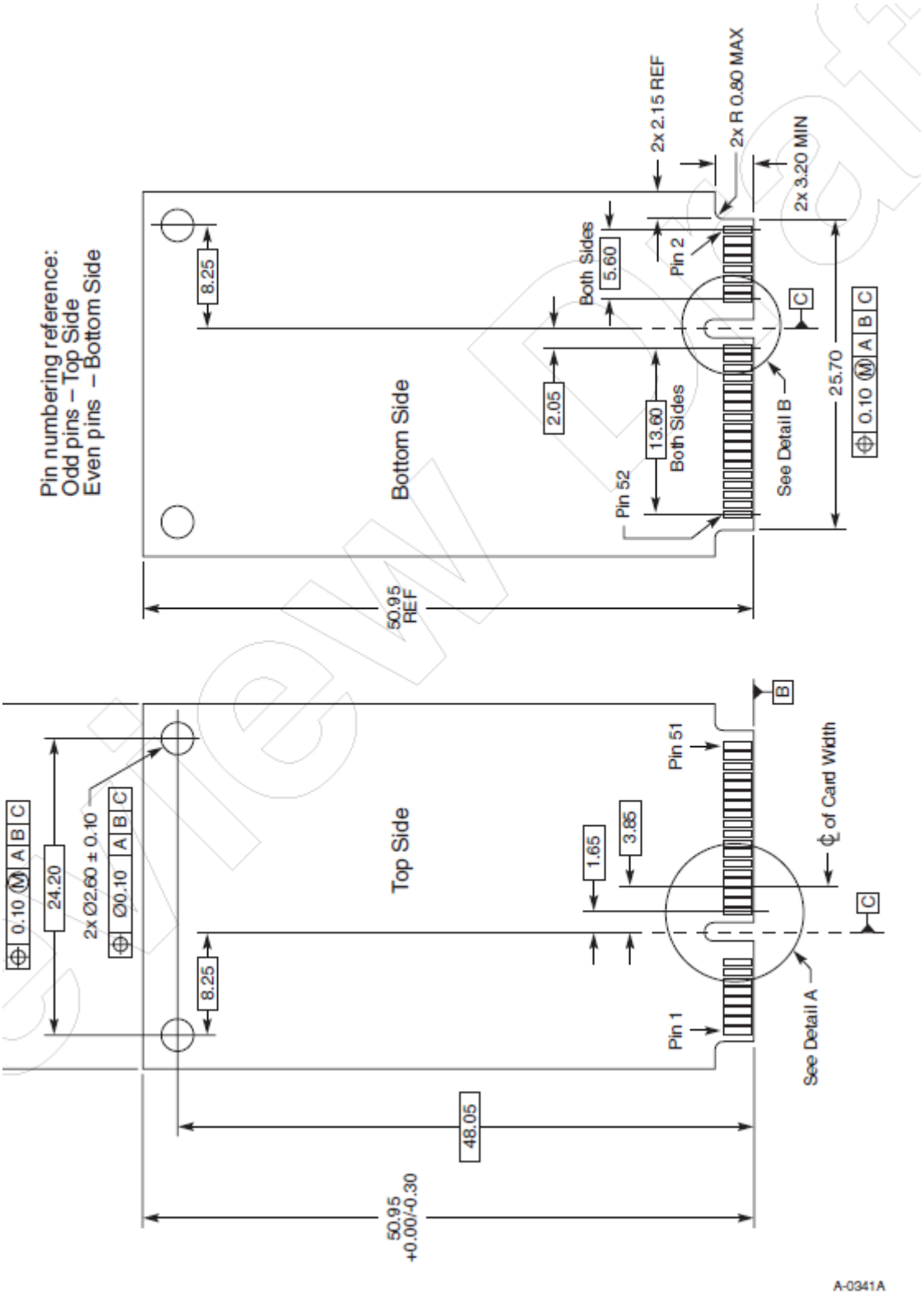

Figure 11 Mechanical size of RHF0M302B Mini-PCIE Interface gateway module 1

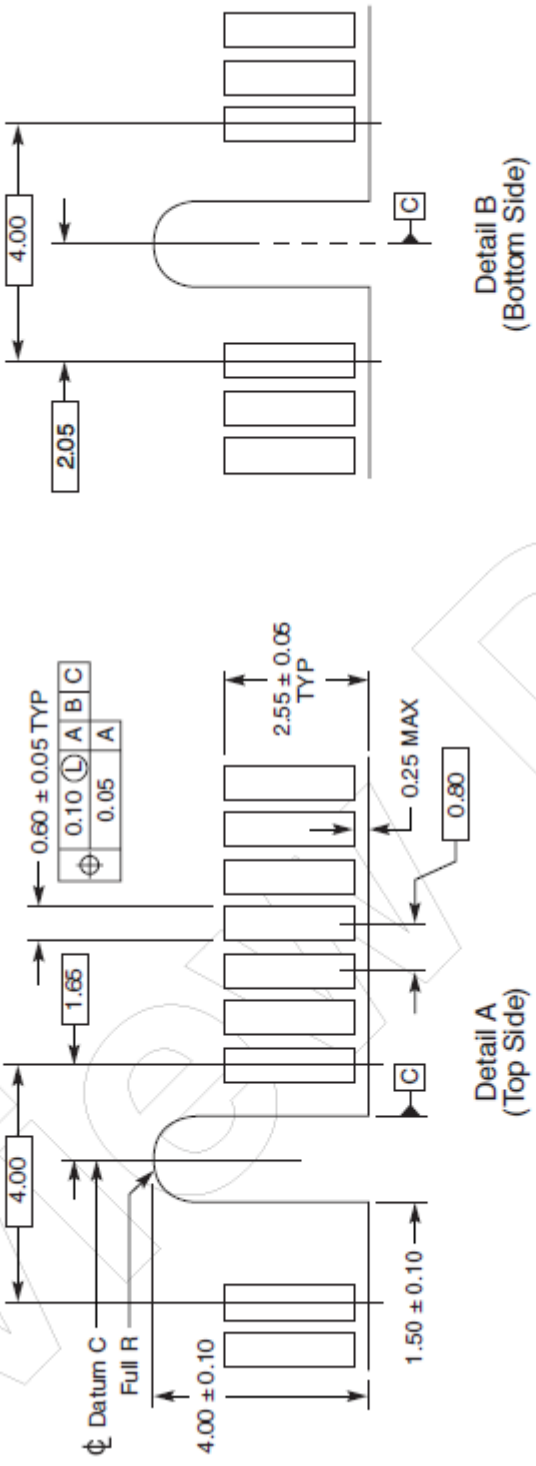

Figure 12 Mechanical size of Mechanical size of RHF0M302B Mini-PCIE Interface gateway module 2

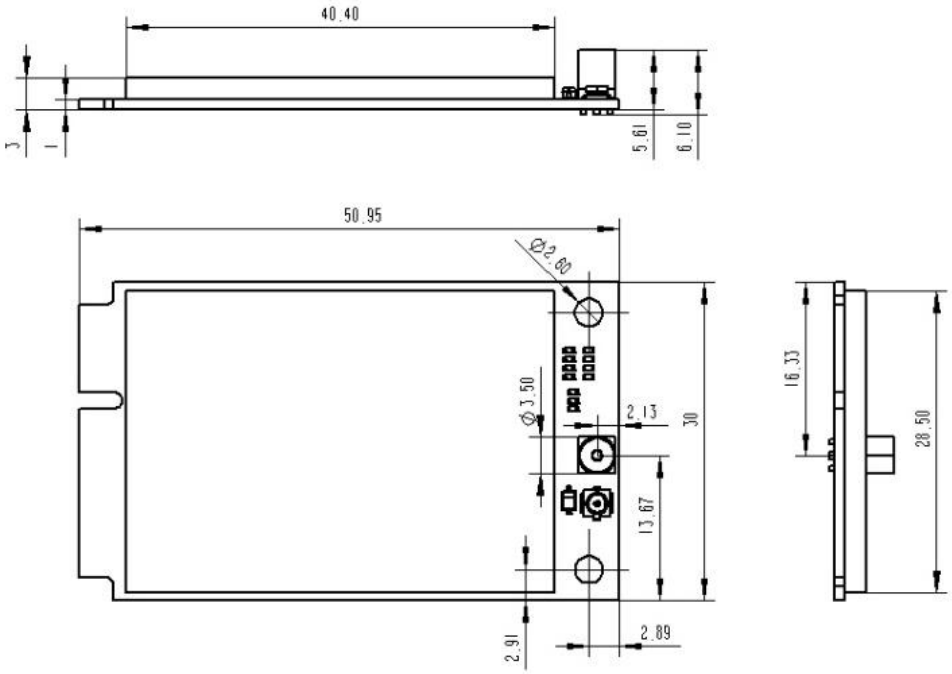

Figure 13 Mechanical size of enclosure on board

5.2 Label

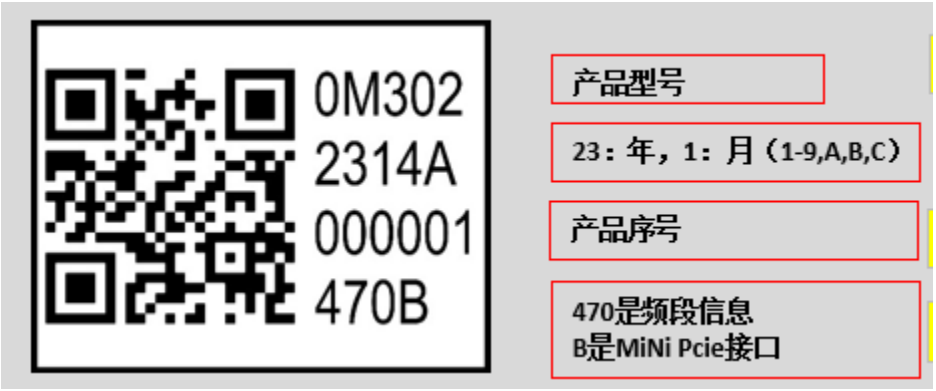

Figure 14 Label

5.3 Outer packaging information

There will be a label with “RHF0M302-xxx” on the top side of the box. Box size is 150x90x42mm.
--RHF0M302-470B is the 470MHz band production.
--RHF0M302-868B is the 868MHz band production.
--RHF0M302-915B is the 915MHz band (902MHz to 928MHz) production。

Figure 15 Box for packaging

Figure 16 Package of the module (2 pcs in one box)

6 Ordering Information

Technical Support:： support@risinghf.com

Sales:

China：salescn@risnghf.com

Other：salesww@risinghf.com

Table 10 Ordering Information

Part number	Band	Tx power
RHF0M302-SPI-470B	470-490 MHz	26dBm
RHF0M302-SPI-868B	859-871 MHz	24dBm
RHF0M302-SPI-915B	900-930 MHz	26dBm

7 Revision

V1.0 2023-1-31
+ first draft

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