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RF Exposure Evaluation Report

Report No. : CQASZ20200500350E-05
Applicant: RuiXingHengFang Network (Shenzhen) Co., Ltd
Address of Applicant: Room 601, Building 10, Software Park 2, Keji Mid 2nd Road, NanShan District, Shenzhen, Guangdong, China 518057
Equipment Under Test (EUT):
Product: LoRa Gateway
Model No.: RHF2S208
Brand Name: N/A
FCC ID: 2AJUZ-RHF2S208
Standards: 47 CFR Part 1.1307
47 CFR Part 1.1310
KDB447498D01 General RF Exposure Guidance v06
Date of Receipt: 2020-05-08
Date of Test: 2020-05-08 to 2020-06-05
Date of Issue: 2020-06-08
Test Result : PASS*

Tested By:

Tom Chen

(Tom Chen)

Reviewed By:

Sheek, Luo

(Sheek Luo)

Approved By:

Jack Ai

(Jack Ai)



* In the configuration tested, the EUT complied with the standards specified above.

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CQA, this report can't be reproduced except in full.

1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20200500350E-05	Rev.01	Initial report	2020-06-08

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3 General Information

3.1 Client Information

Applicant:	RuiXingHengFang Network (Shenzhen) Co., Ltd
Address of Applicant:	Room 601, Building 10, Software Park 2, Keji Mid 2 nd Road, NanShan District, Shenzhen, Guangdong, China 518057
Manufacturer:	RuiXingHengFang Network (Shenzhen) Co., Ltd
Address of Manufacturer:	Room 601, Building 10, Software Park 2, Keji Mid 2 nd Road, NanShan District, Shenzhen, Guangdong, China 518057
Factory:	SHENZHEN EDADOC TECHNOLOGY CO.,LTD
Address of Factory:	NO.3 Bldg., Zhongyuntai industrial Park, Shiyan, Shenzhen, PRC

3.2 General Description of EUT

Product Name:	LoRa Gateway
Model No.:	RHF2S208
Trade Mark:	N/A
EUT Supports Radios application:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz LoRa: 902.3MHz~914.9MHz LTE Band2: 1850-1910 MHz
Hardware version:	RHF2S208_V3.0
Software version:	V_1.2.3
Product Type:	☐ Mobile ☐ Portable ☒ Fix Location
Power Supply:	lithium battery: DC 9.6V, 3200mAh, Charge by Adapter
Adapter:	Model: RCL-X190150C Input: 100~240V 50/60Hz 1A Output: DC 19V 1.5A

4 RF Exposure Evaluation

4.1 RF Exposure Compliance Requirement

4.1.1 Limits

According to FCC Part1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in part1.1307(b)

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

F= Frequency in MHz

Friis Formula

Friis transmission formula: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

4.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

4.2 1.1.3 EUT RF Exposure Evaluation

1) For WIFI

Antenna Gain: 2dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.58 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

802.11b mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	11.63	11±1	12	15.849
Middle(2437MHz)	11.4	11±1	12	15.849
Highest(2462MHz)	11.3	11±1	12	15.849
802.11g mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	13.45	13±1	14	25.119
Middle(2437MHz)	13.25	13±1	14	25.119
Highest(2462MHz)	12.93	13±1	14	25.119
802.11n(HT20) mode				
Test channel	Average Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2412MHz)	13.54	13±1	14	25.119
Middle(2437MHz)	13.3	13±1	14	25.119
Highest(2462MHz)	13.08	13±1	14	25.119

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
25.119	2	0.00792	1.0	PASS

Note: 1) Refer to report No.CQASZ20200500350E-01 for EUT test Max Conducted Average Output Power value.

$$2) P_d = (P_{out} * G) / (4 * \pi * R^2) = (25.119 * 1.58) / (4 * 3.1416 * 20^2) = 0.00792$$

2) For LoRa

Antenna Gain: 2dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.58 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

LoRa(DSS) mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest	10.190	10±1	11	12.589
Middle	10.360	10±1	11	12.589
Highest	10.210	10±1	11	12.589
LoRa(DTS) mode				
Test channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest	10.37	10±1	11	12.589
Middle	10.63	10±1	11	12.589
Highest	10.41	10±1	11	12.589

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
12.589	2	0.00397	0.6	PASS

Note: 1) Refer to report No.CQASZ20200500350E-03 and CQASZ20200500350E-04 for EUT test Max Conducted Peak Output Power value.

$$2) P_d = (P_{out} * G) / (4 * \pi * R^2) = (12.589 * 1.58) / (4 * 3.1416 * 20^2) = 0.00397$$

3) For LTE

Antenna Gain: 2dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.58 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

Channel Bandwidth: 1.4 MHz							
Modulation	Channel	RB Configuration		Average Power [dBm]	Tune up tolerance (dBm)	Maximum tune-up Power	
		Size	Offset			(dBm)	(mW)
QPSK	LCH	1	0	20.7	20.5±1.5	22	158.489
		1	3	20.74	20.5±1.5	22	158.489
		1	5	20.71	20.5±1.5	22	158.489
		3	0	20.37	20.5±1.5	22	158.489
		3	2	20.38	20.5±1.5	22	158.489
		3	3	20.38	20.5±1.5	22	158.489
		6	0	19.65	20.5±1.5	22	158.489
	MCH	1	0	21.01	20.5±1.5	22	158.489
		1	3	21.07	20.5±1.5	22	158.489
		1	5	21	20.5±1.5	22	158.489
		3	0	20.41	20.5±1.5	22	158.489
		3	2	20.41	20.5±1.5	22	158.489
		3	3	20.41	20.5±1.5	22	158.489
		6	0	19.98	20.5±1.5	22	158.489
	HCH	1	0	21.13	20.5±1.5	22	158.489
		1	3	21.09	20.5±1.5	22	158.489
		1	5	21.13	20.5±1.5	22	158.489
		3	0	20.36	20.5±1.5	22	158.489
		3	2	20.36	20.5±1.5	22	158.489
		3	3	20.39	20.5±1.5	22	158.489
		6	0	20.1	20.5±1.5	22	158.489
16QAM	LCH	1	0	19.78	19.5±1.5	21	125.893
		1	3	19.77	19.5±1.5	21	125.893
		1	5	19.73	19.5±1.5	21	125.893
		3	0	19.4	19.5±1.5	21	125.893
		3	2	19.37	19.5±1.5	21	125.893
		3	3	19.35	19.5±1.5	21	125.893
		6	0	18.69	19.5±1.5	21	125.893
	MCH	1	0	20.23	19.5±1.5	21	125.893

		1	3	20.16	19.5±1.5	21	125.893
		1	5	20.14	19.5±1.5	21	125.893
		3	0	19.89	19.5±1.5	21	125.893
		3	2	19.89	19.5±1.5	21	125.893
		3	3	19.8	19.5±1.5	21	125.893
		6	0	19.06	19.5±1.5	21	125.893
	HCH	1	0	20.21	19.5±1.5	21	125.893
		1	3	20.14	19.5±1.5	21	125.893
		1	5	20.12	19.5±1.5	21	125.893
		3	0	19.9	19.5±1.5	21	125.893
		3	2	19.9	19.5±1.5	21	125.893
		3	3	19.81	19.5±1.5	21	125.893
		6	0	19.03	19.5±1.5	21	125.893

Channel Bandwidth: 3 MHz							
Modulation	Channel	RB Configuration		Average Power [dBm]	Tune up tolerance (dBm)	Maximum tune-up Power	
		Size	Offset			(dBm)	(mW)
QPSK	LCH	1	0	20.61	20.5±1.5	22	158.489
		1	3	20.72	20.5±1.5	22	158.489
		1	5	20.58	20.5±1.5	22	158.489
		3	0	19.62	20.5±1.5	22	158.489
		3	2	19.63	20.5±1.5	22	158.489
		3	3	19.7	20.5±1.5	22	158.489
		6	0	19.67	20.5±1.5	22	158.489
	MCH	1	0	21.1	20.5±1.5	22	158.489
		1	3	21.06	20.5±1.5	22	158.489
		1	5	20.92	20.5±1.5	22	158.489
		3	0	20.11	20.5±1.5	22	158.489
		3	2	20.16	20.5±1.5	22	158.489
		3	3	20.08	20.5±1.5	22	158.489
		6	0	20.04	20.5±1.5	22	158.489
	HCH	1	0	21.11	20.5±1.5	22	158.489
		1	3	21.12	20.5±1.5	22	158.489
		1	5	21.09	20.5±1.5	22	158.489
		3	0	20.09	20.5±1.5	22	158.489
		3	2	20.06	20.5±1.5	22	158.489
		3	3	20.08	20.5±1.5	22	158.489

		6	0	20.08	20.5±1.5	22	158.489
16QAM	LCH	1	0	20.21	19.5±1.5	21	125.893
		1	3	20.19	19.5±1.5	21	125.893
		1	5	20.14	19.5±1.5	21	125.893
		3	0	19.48	19.5±1.5	21	125.893
		3	2	19.49	19.5±1.5	21	125.893
		3	3	19.44	19.5±1.5	21	125.893
		6	0	18.69	19.5±1.5	21	125.893
	MCH	1	0	20.17	19.5±1.5	21	125.893
		1	3	20.12	19.5±1.5	21	125.893
		1	5	20.11	19.5±1.5	21	125.893
		3	0	19.45	19.5±1.5	21	125.893
		3	2	19.49	19.5±1.5	21	125.893
		3	3	19.5	19.5±1.5	21	125.893
		6	0	19	19.5±1.5	21	125.893
	HCH	1	0	20.27	19.5±1.5	21	125.893
		1	3	20.21	19.5±1.5	21	125.893
		1	5	20.19	19.5±1.5	21	125.893
		3	0	19.52	19.5±1.5	21	125.893
		3	2	19.54	19.5±1.5	21	125.893
		3	3	19.45	19.5±1.5	21	125.893
		6	0	19.46	19.5±1.5	21	125.893

Channel Bandwidth: 5 MHz							
Modulation	Channel	RB Configuration		Average Power [dBm]	Tune up tolerance (dBm)	Maximum tune-up Power	
		Size	Offset			(dBm)	(mW)
QPSK	LCH	1	0	20.71	20.5±1.5	22	158.489
		1	3	20.69	20.5±1.5	22	158.489
		1	5	20.61	20.5±1.5	22	158.489
		3	0	19.69	20.5±1.5	22	158.489
		3	2	19.68	20.5±1.5	22	158.489
		3	3	19.65	20.5±1.5	22	158.489
		6	0	19.63	20.5±1.5	22	158.489
	MCH	1	0	21.14	20.5±1.5	22	158.489
		1	3	21.1	20.5±1.5	22	158.489
		1	5	21.11	20.5±1.5	22	158.489
		3	0	20.07	20.5±1.5	22	158.489

		3	2	20.12	20.5±1.5	22	158.489
		3	3	20.04	20.5±1.5	22	158.489
		6	0	20.02	20.5±1.5	22	158.489
	HCH	1	0	21.25	20.5±1.5	22	158.489
		1	3	21.22	20.5±1.5	22	158.489
		1	5	21.22	20.5±1.5	22	158.489
		3	0	20.16	20.5±1.5	22	158.489
		3	2	20.14	20.5±1.5	22	158.489
		3	3	20.12	20.5±1.5	22	158.489
		6	0	20.11	20.5±1.5	22	158.489
16QAM	LCH	1	0	19.95	19.5±1.5	21	125.893
		1	3	19.91	19.5±1.5	21	125.893
		1	5	19.97	19.5±1.5	21	125.893
		3	0	19.46	19.5±1.5	21	125.893
		3	2	19.48	19.5±1.5	21	125.893
		3	3	19.39	19.5±1.5	21	125.893
		6	0	18.79	19.5±1.5	21	125.893
	MCH	1	0	20.47	19.5±1.5	21	125.893
		1	3	20.45	19.5±1.5	21	125.893
		1	5	20.36	19.5±1.5	21	125.893
		3	0	19.5	19.5±1.5	21	125.893
		3	2	19.52	19.5±1.5	21	125.893
		3	3	19.48	19.5±1.5	21	125.893
		6	0	18.98	19.5±1.5	21	125.893
	HCH	1	0	20.31	19.5±1.5	21	125.893
		1	3	20.25	19.5±1.5	21	125.893
		1	5	20.18	19.5±1.5	21	125.893
		3	0	19.52	19.5±1.5	21	125.893
		3	2	19.52	19.5±1.5	21	125.893
		3	3	19.45	19.5±1.5	21	125.893
		6	0	19.35	19.5±1.5	21	125.893

Channel Bandwidth: 10 MHz							
Modulation	Channel	RB Configuration		Average Power [dBm]	Tune up tolerance (dBm)	Maximum tune-up Power	
		Size	Offset			(dBm)	(mW)
QPSK	LCH	1	0	20.73	20.5±1.5	22	158.489
		1	3	20.66	20.5±1.5	22	158.489

		1	5	20.55	20.5±1.5	22	158.489
		3	0	19.7	20.5±1.5	22	158.489
		3	2	19.7	20.5±1.5	22	158.489
		3	3	19.71	20.5±1.5	22	158.489
		6	0	19.76	20.5±1.5	22	158.489
	MCH	1	0	21.16	20.5±1.5	22	158.489
		1	3	21.16	20.5±1.5	22	158.489
		1	5	21.08	20.5±1.5	22	158.489
		3	0	20.05	20.5±1.5	22	158.489
		3	2	20	20.5±1.5	22	158.489
		3	3	20.07	20.5±1.5	22	158.489
		6	0	20.11	20.5±1.5	22	158.489
	HCH	1	0	21.24	20.5±1.5	22	158.489
		1	3	21.23	20.5±1.5	22	158.489
		1	5	21.15	20.5±1.5	22	158.489
		3	0	20.06	20.5±1.5	22	158.489
		3	2	20.09	20.5±1.5	22	158.489
		3	3	20.14	20.5±1.5	22	158.489
		6	0	20.09	20.5±1.5	22	158.489
16QAM	LCH	1	0	20.29	19.5±1.5	21	125.893
		1	3	20.31	19.5±1.5	21	125.893
		1	5	20.21	19.5±1.5	21	125.893
		3	0	19.47	19.5±1.5	21	125.893
		3	2	19.47	19.5±1.5	21	125.893
		3	3	19.52	19.5±1.5	21	125.893
		6	0	18.79	19.5±1.5	21	125.893
	MCH	1	0	20.17	19.5±1.5	21	125.893
		1	3	20.13	19.5±1.5	21	125.893
		1	5	20.09	19.5±1.5	21	125.893
		3	0	19.52	19.5±1.5	21	125.893
		3	2	19.5	19.5±1.5	21	125.893
		3	3	19.42	19.5±1.5	21	125.893
		6	0	19.13	19.5±1.5	21	125.893
	HCH	1	0	20.37	19.5±1.5	21	125.893
		1	3	20.35	19.5±1.5	21	125.893
		1	5	20.28	19.5±1.5	21	125.893
		3	0	19.47	19.5±1.5	21	125.893

		3	2	19.5	19.5±1.5	21	125.893
		3	3	19.47	19.5±1.5	21	125.893
		6	0	19.45	19.5±1.5	21	125.893

Channel Bandwidth: 15 MHz							
Modulation	Channel	RB Configuration		Average Power [dBm]	Tune up tolerance (dBm)	Maximum tune-up Power	
		Size	Offset			(dBm)	(mW)
QPSK	LCH	1	0	20.74	20.5±1.5	22	158.489
		1	3	20.7	20.5±1.5	22	158.489
		1	5	20.56	20.5±1.5	22	158.489
		3	0	19.82	20.5±1.5	22	158.489
		3	2	19.93	20.5±1.5	22	158.489
		3	3	19.85	20.5±1.5	22	158.489
		6	0	19.85	20.5±1.5	22	158.489
	MCH	1	0	21.16	20.5±1.5	22	158.489
		1	3	21.18	20.5±1.5	22	158.489
		1	5	21.08	20.5±1.5	22	158.489
		3	0	20.07	20.5±1.5	22	158.489
		3	2	20.16	20.5±1.5	22	158.489
		3	3	20.13	20.5±1.5	22	158.489
		6	0	20.17	20.5±1.5	22	158.489
	HCH	1	0	21.24	20.5±1.5	22	158.489
		1	3	21.22	20.5±1.5	22	158.489
		1	5	21.18	20.5±1.5	22	158.489
		3	0	20.22	20.5±1.5	22	158.489
		3	2	20.25	20.5±1.5	22	158.489
		3	3	20.29	20.5±1.5	22	158.489
		6	0	20.23	20.5±1.5	22	158.489
16QAM	LCH	1	0	20.39	19.5±1.5	21	125.893
		1	3	20.38	19.5±1.5	21	125.893
		1	5	20.28	19.5±1.5	21	125.893
		3	0	19.47	19.5±1.5	21	125.893
		3	2	19.51	19.5±1.5	21	125.893
		3	3	19.53	19.5±1.5	21	125.893
		6	0	18.83	19.5±1.5	21	125.893
	MCH	1	0	20.18	19.5±1.5	21	125.893
		1	3	20.14	19.5±1.5	21	125.893

		1	5	20.22	19.5±1.5	21	125.893
		3	0	19.43	19.5±1.5	21	125.893
		3	2	19.46	19.5±1.5	21	125.893
		3	3	19.43	19.5±1.5	21	125.893
		6	0	19.09	19.5±1.5	21	125.893
		1	0	20.47	19.5±1.5	21	125.893
	HCH	1	3	20.5	19.5±1.5	21	125.893
		1	5	20.52	19.5±1.5	21	125.893
		3	0	19.36	19.5±1.5	21	125.893
		3	2	19.49	19.5±1.5	21	125.893
		3	3	19.47	19.5±1.5	21	125.893
		6	0	19.19	19.5±1.5	21	125.893

Channel Bandwidth: 20 MHz							
Modulation	Channel	RB Configuration		Average Power [dBm]	Tune up tolerance (dBm)	Maximum tune-up Power	
		Size	Offset			(dBm)	(mW)
QPSK	LCH	1	0	21.17	20.5±1.5	22	158.489
		1	3	20.8	20.5±1.5	22	158.489
		1	5	20.69	20.5±1.5	22	158.489
		3	0	20.18	20.5±1.5	22	158.489
		3	2	20.13	20.5±1.5	22	158.489
		3	3	19.83	20.5±1.5	22	158.489
		6	0	19.84	20.5±1.5	22	158.489
	MCH	1	0	21.28	20.5±1.5	22	158.489
		1	3	21.17	20.5±1.5	22	158.489
		1	5	21.13	20.5±1.5	22	158.489
		3	0	20.45	20.5±1.5	22	158.489
		3	2	20.1	20.5±1.5	22	158.489
		3	3	20.07	20.5±1.5	22	158.489
		6	0	20.27	20.5±1.5	22	158.489
	HCH	1	0	21.23	20.5±1.5	22	158.489
		1	3	21.21	20.5±1.5	22	158.489
		1	5	21.1	20.5±1.5	22	158.489
		3	0	20.16	20.5±1.5	22	158.489
		3	2	20.11	20.5±1.5	22	158.489
		3	3	20.11	20.5±1.5	22	158.489
		6	0	20.15	20.5±1.5	22	158.489

16QAM	LCH	1	0	20.15	19.5±1.5	21	125.893
		1	3	20.22	19.5±1.5	21	125.893
		1	5	20.1	19.5±1.5	21	125.893
		3	0	19.5	19.5±1.5	21	125.893
		3	2	19.51	19.5±1.5	21	125.893
		3	3	19.41	19.5±1.5	21	125.893
		6	0	18.88	19.5±1.5	21	125.893
	MCH	1	0	20.31	19.5±1.5	21	125.893
		1	3	20.29	19.5±1.5	21	125.893
		1	5	20.18	19.5±1.5	21	125.893
		3	0	19.47	19.5±1.5	21	125.893
		3	2	19.45	19.5±1.5	21	125.893
		3	3	19.48	19.5±1.5	21	125.893
		6	0	19.1	19.5±1.5	21	125.893
	HCH	1	0	20.49	19.5±1.5	21	125.893
		1	3	20.47	19.5±1.5	21	125.893
		1	5	20.48	19.5±1.5	21	125.893
		3	0	19.52	19.5±1.5	21	125.893
		3	2	19.48	19.5±1.5	21	125.893
		3	3	19.45	19.5±1.5	21	125.893
		6	0	19.4	19.5±1.5	21	125.893

The worst case:

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
158.489	2	0.04997	1.0	PASS

Note: 1) Refer to report No.CQASZ20200500350E-02 for EUT test Max Conducted Peak Output Power value.

2) $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2) = (158.489 \cdot 1.58) / (4 \cdot 3.1416 \cdot 20^2) = 0.04997$

SUM PD(P_d /limit) = WIFI + LoRa + LTE = $0.00792/1 + 0.00397/0.6 + 0.04997/1 = 0.06409$

$0.06409 < 1.0$