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Report Template Version: V04
Report Template Revision Date: 2018-07-06

Test Report

Report No. : CQASZ20200500350E-06

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 15, Subpart C,
47 CFR Part 2,
47 CFR Part 24 subpart E

Date of Receipt: 2020-05-08

Date of Test: 2020-05-08 to 2020-07-01

Date of Issue: 2020-07-01

Test Result : PASS*

Tested By:

Tom Chen.

(Tom Chen)

Reviewed By:

Sheek Luo

(Sheek Luo)

Approved By:

Jack Ai

(Jack Ai)



1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20200500350E-06	Rev.01	Initial report	2020-07-01

2 Test Summary

Test Item	Test Requirement	Test method	Result
Radiated Spurious Emissions	47 CFR Part 15, Subpart C Section 15.205/15.209, RSS-Gen Issue 5	ANSI C63.10 2013	PASS
Spurious emissions at antenna terminals	47 CFR Part 2.1051, 47 CFR Part 24.238	ANSI C63.4 2014	PASS

Note: The simultaneously transmission mode

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4 General Information

4.1 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, Shenzhen, PRC

4.2 General Description of EUT

Product Name:	LoRa Gateway
Model No.:	RHF2S208
Trade Mark:	N/A
Hardware version:	RHF2S208_V3.0
Software version:	V_1.2.3
EUT Supports Radios application:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz LoRa: 902.3MHz~914.9MHz LTE Band2: 1850-1910 MHz
Product Type:	<input type="checkbox"/> Mobile <input type="checkbox"/> Portable <input checked="" type="checkbox"/> 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

4.3 Test Environment and Mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	52 % RH
Atmospheric Pressure:	1009 mbar
The following test modes were adjusted during the tests:	
Operation mode	Description of the operation mode
a: LTE(Data) + WLAN(Data) + LoRa(Data)	LTE Band 2 QPSK Channel Bandwidth 20 MHz MCH 1RB0
	802.11n(HT20)mode CH1
	LoRa mode CH4

4.4 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.	Remark	FCC certification
-	-	-	-	-

4.5 Test Location

All tests were performed at:

Shenzhen Huaxia Testing Technology Co., Ltd.,

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua New District, Shenzhen, Guangdong, China

4.6 Test Facility

- **A2LA (Certificate No. 4742.01)**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4742.01.

- **FCC Registration No.: 522263**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.:522263

4.7 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate.

The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities.

The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the **Shenzhen Huaxia Testing Technology Co., Ltd.** quality system acc. to DIN EN ISO/IEC 17025.

Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CQA laboratory is reported:

Test	Range	Uncertainty	Notes
Radiated Emission	Below 1GHz	5.12dB	(1)
Radiated Emission	Above 1GHz	4.60dB	(1)
Conducted Disturbance	0.15~30MHz	3.34dB	(1)

(1)This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

4.8 Deviation from Standards

None.

4.9 Abnormalities from Standard Conditions

None.

4.10 Other Information Requested by the Customer

None.

4.11 Equipment List

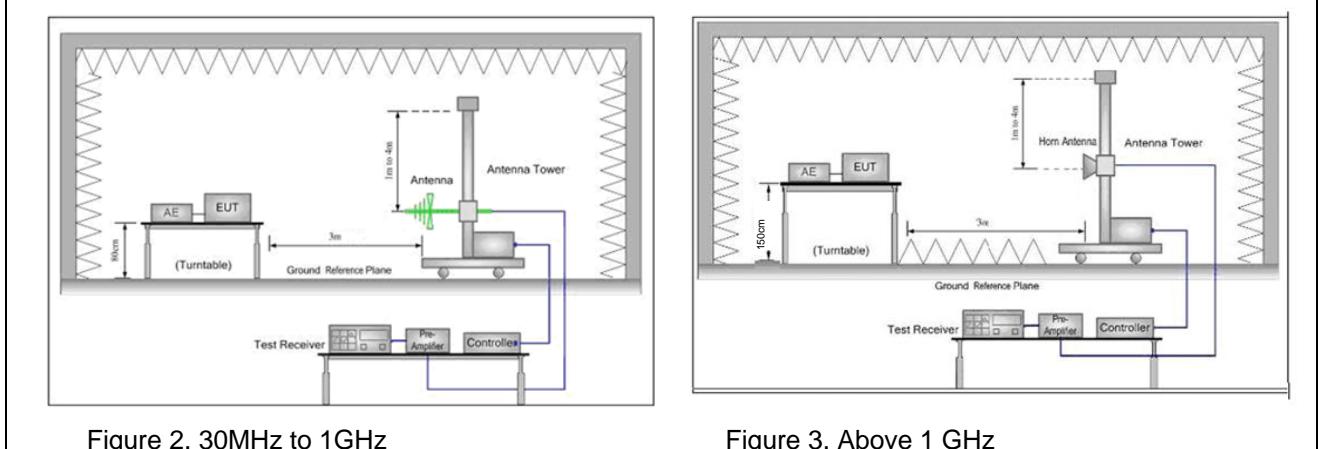
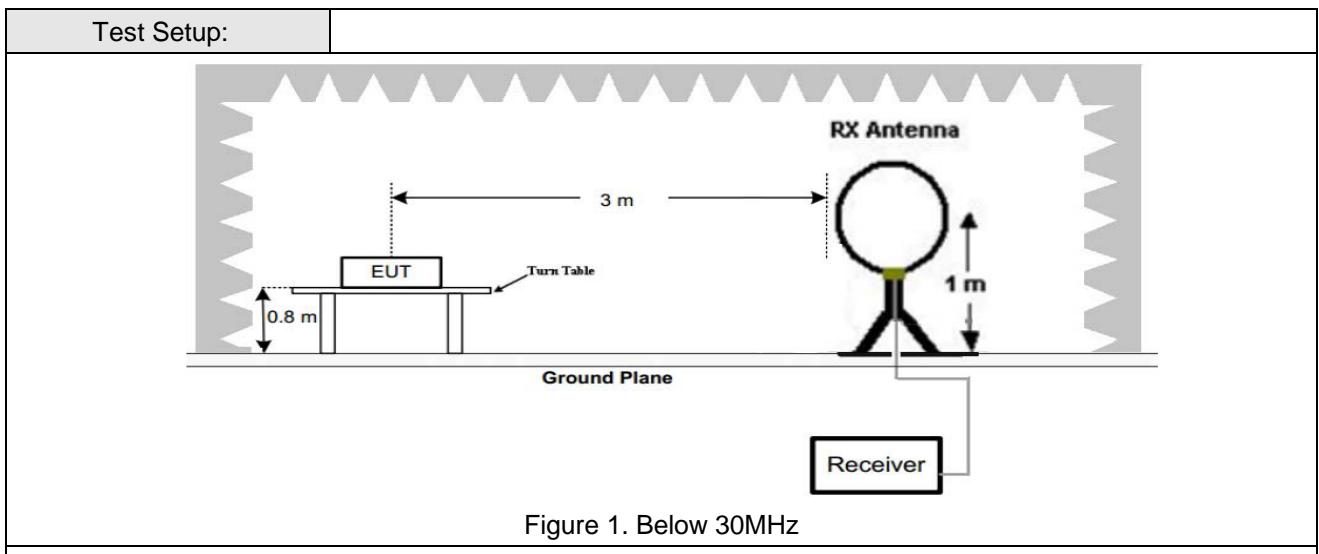
Test Equipment	Manufacturer	Model No.	Instrument No.	Calibration Date	Calibration Due Date
EMI Test Receiver	R&S	ESR7	CQA-005	2019/10/25	2020/10/24
Spectrum analyzer	R&S	FSU26	CQA-038	2019/10/25	2020/10/24
Preamplifier	MITEQ	AMF-6D-02001800-29-20P	CQA-036	2019/10/25	2020/10/24
Loop antenna	Schwarzbeck	FMZB1516	CQA-060	2019/10/21	2020/10/20
Bilog Antenna	R&S	HL562	CQA-011	2019/9/26	2020/9/25
Horn Antenna	R&S	HF906	CQA-012	2019/9/26	2020/9/25
Horn Antenna	Schwarzbeck	BBHA 9170	CQA-088	2019/9/25	2020/9/24
Coaxial Cable (Above 1GHz)	CQA	N/A	C007	2019/9/26	2020/9/25
Coaxial Cable (Below 1GHz)	CQA	N/A	C013	2019/9/26	2020/9/25
Antenna Connector	CQA	RFC-01	CQA-080	2019/9/26	2020/9/25
RF cable(9KHz~40GHz)	CQA	RF-01	CQA-079	2019/9/26	2020/9/25
Power divider	MIDWEST	PWD-2533-02-SMA-79	CQA-067	2019/9/26	2020/9/25

5 Test results and Measurement Data

5.1 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205,				
Test Method:	ANSI C63.10 2013				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

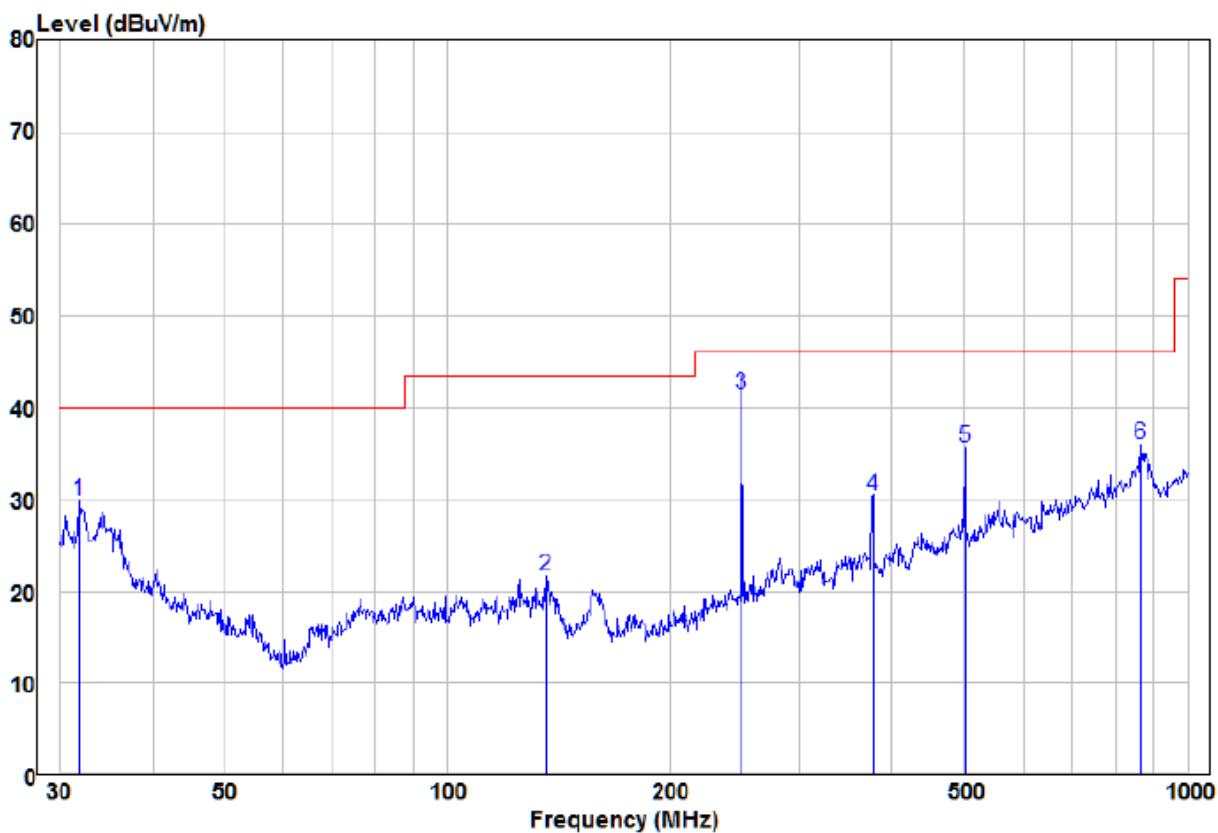


Test Procedure:	<p>a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. Note: For the radiated emission test above 1GHz: Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.</p> <p>b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</p> <p>c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</p>
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	<ul style="list-style-type: none">d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters(for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.g. Test the EUT in the lowest channel ,the middle channel ,the Highest channelh. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Mode a: LTE(Data) + WLAN(Data) + LoRa(Data)
Test Results:	Pass

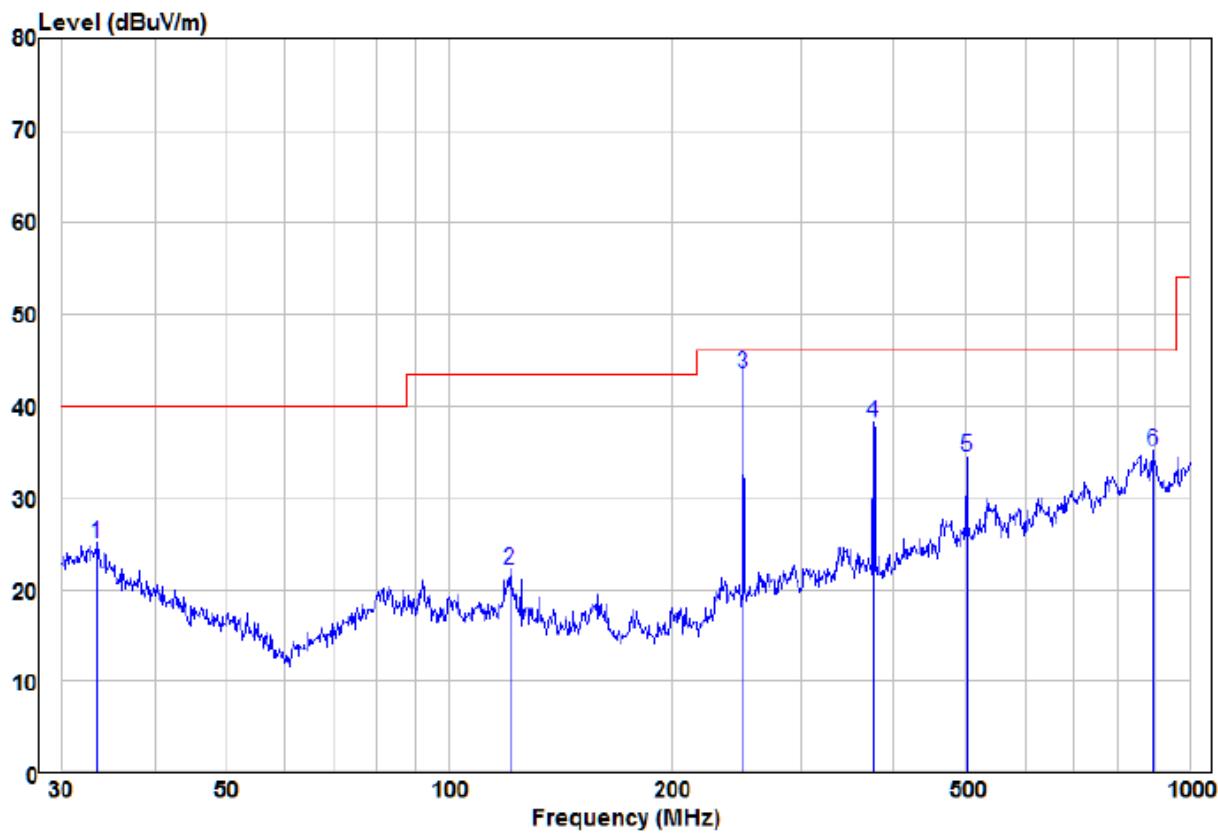
5.1.1 Radiated emission below 1GHz

30MHz~1GHz		
Test mode:	mode a	Vertical



Freq	Read		Limit	Over	Remark	Pol/Phase	
	Freq	Level					
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	31.84	14.40	15.43	29.83	40.00	-10.17	Peak VERTICAL
2	135.98	12.77	8.96	21.73	43.50	-21.77	Peak VERTICAL
3 pp	250.30	29.40	12.09	41.49	46.00	-4.51	QP VERTICAL
4	375.90	15.79	14.58	30.37	46.00	-15.63	Peak VERTICAL
5	501.18	17.35	18.29	35.64	46.00	-10.36	Peak VERTICAL
6 pk	866.09	12.01	23.98	35.99	46.00	-10.01	Peak VERTICAL

Test mode:	mode a	Horizontal
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Freq	Read		Limit		Over		Pol/Phase
	Level	Factor	Level	Line	Limit	Remark	
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	33.44	10.00	15.01	25.01	40.00	-14.99 Peak	HORIZONTAL
2	121.12	11.46	10.66	22.12	43.50	-21.38 Peak	HORIZONTAL
3 pp	250.40	31.38	12.09	43.47	46.00	-2.53 QP	HORIZONTAL
4 pk	374.62	23.52	14.62	38.14	46.00	-7.86 Peak	HORIZONTAL
5	501.28	16.12	18.29	34.41	46.00	-11.59 Peak	HORIZONTAL
6	893.86	11.20	23.87	35.07	46.00	-10.93 Peak	HORIZONTAL

5.1.2 Transmitter emission above 1GHz

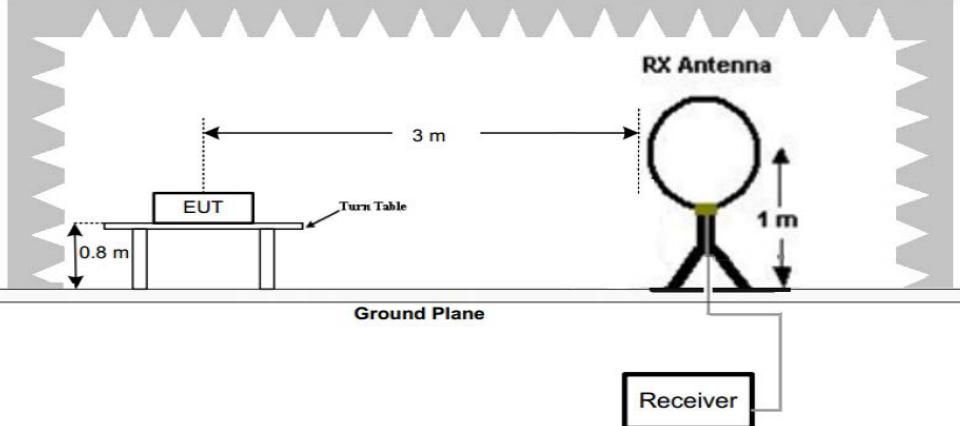
Test mode: mode a		Transmitting		Test Frequency:		2412MHz+909.4MHz+1880 MHz	
Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits		Over (dB)	Ant. Pol. Detector Type
				(dB μ V/m)	(dB)		
1818.8	54.96	-9.61	45.35	74	-28.65	Peak	H
2728.2	54.52	-8.06	46.46	74	-27.54	Peak	H
2390	53.91	-9.2	44.71	74	-29.29	Peak	H
2400	51.22	-9.39	41.83	74	-32.17	Peak	H
2483.5	52.32	-9.29	43.03	74	-30.97	Peak	H
4824	51.96	-4.26	47.70	74	-26.30	Peak	H
7236	53.85	1.18	55.03	74	-18.97	Peak	H
1818.8	53.86	-9.61	44.25	74	-29.75	Peak	V
2728.2	55.69	-8.06	47.63	74	-26.37	Peak	V
2390	54.11	-9.2	44.91	74	-29.09	Peak	V
2400	49.34	-9.39	39.95	74	-34.05	Peak	V
2483.5	54.20	-9.29	44.91	74	-29.09	Peak	V
4824	52.68	-4.26	48.42	74	-25.58	Peak	V
7236	54.89	1.18	56.07	74	-17.93	Peak	V

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

$$\text{Final Test Level} = \text{Receiver Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Preamplifier Factor}$$
- 2) Scan from 9kHz to 25GHz, the disturbance above 10GHz and below 30MHz was very low. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

5.2 Spurious emissions at antenna terminals

Test Requirement:	47 CFR Part 2.1051, 47 CFR Part 24.238				
Test Method:	ANSI C63.4 2014				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.490MHz -30MHz	Peak	10kHz	30kHz	Peak
	30MHz-1GHz	Peak	100 kHz	300kHz	Peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
Limit:	$\leq -13\text{dBm}$				
Test Setup:					
Figure 1. Below 30MHz					

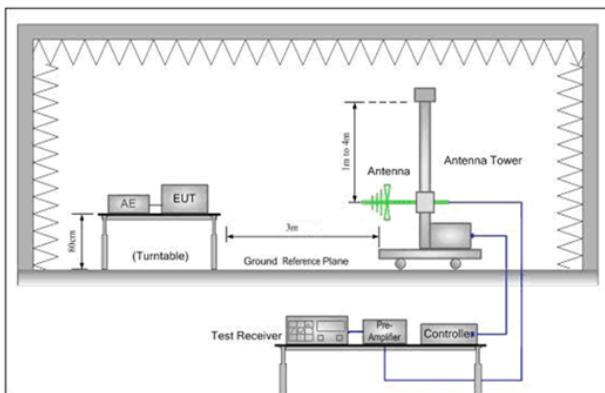


Figure 2. 30MHz to 1GHz

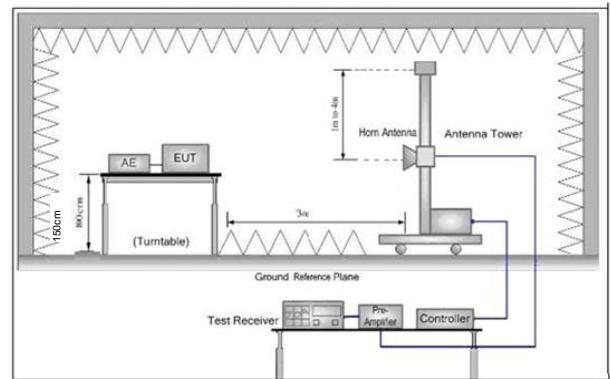


Figure 3. Above 1 GHz

Test Procedure:	<ol style="list-style-type: none"> i. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. <p>Note: For the radiated emission test above 1GHz:</p>
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	<p>Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.</p> <ul style="list-style-type: none"> j. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. k. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. l. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters(for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. m. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. n. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. o. Test the EUT in the lowest channel ,the middle channel ,the Highest channel p. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Mode a: LTE(Data) + WLAN(Data) + LoRa(Data)
Test Results:	Pass

5.2.1 Measurement Data

Test mode: mode a	Transmitting	Test Frequency:	2412MHz+909.4MHz+1880 MHz
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Frequency (MHz)	Level (dBm)	Limit Line (dBm)	Over Limit (dB)	Polarization
425.15	-41.96	-13	-28.96	Vertical
604.41	-41.57	-13	-28.57	Vertical
3760.000	-43.47	-13	-30.47	Vertical
4824.000	-42.53	-13	-29.53	Vertical
5640.000	-43.04	-13	-30.04	Vertical
7236.000	-43.30	-13	-30.30	Vertical
7520.000	-43.45	-13	-30.45	Vertical
438.92	-42.51	-13	-29.51	Horizontal
698.09	-40.88	-13	-27.88	Horizontal
3760.000	-43.51	-13	-30.51	Horizontal
4824.000	-42.56	-13	-29.56	Horizontal
5640.000	-41.88	-13	-28.88	Horizontal
7236.000	-42.72	-13	-29.72	Horizontal
7520.000	-42.09	-13	-29.09	Horizontal

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

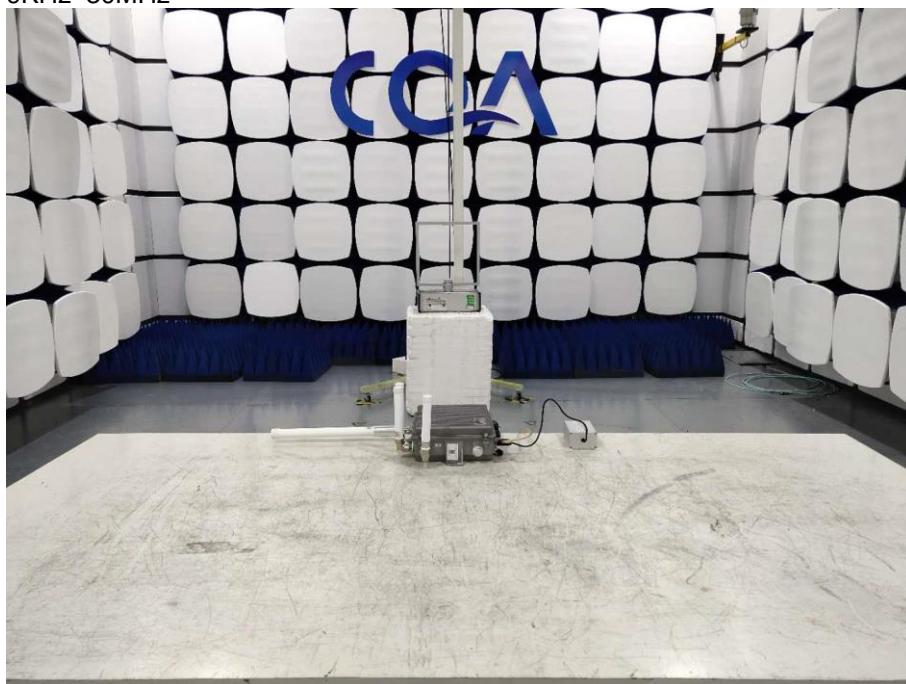
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

3) Scan from 9kHz to 25GHz, the disturbance above 10GHz and below 30MHz was very low. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

6 Photographs - EUT Test Setup

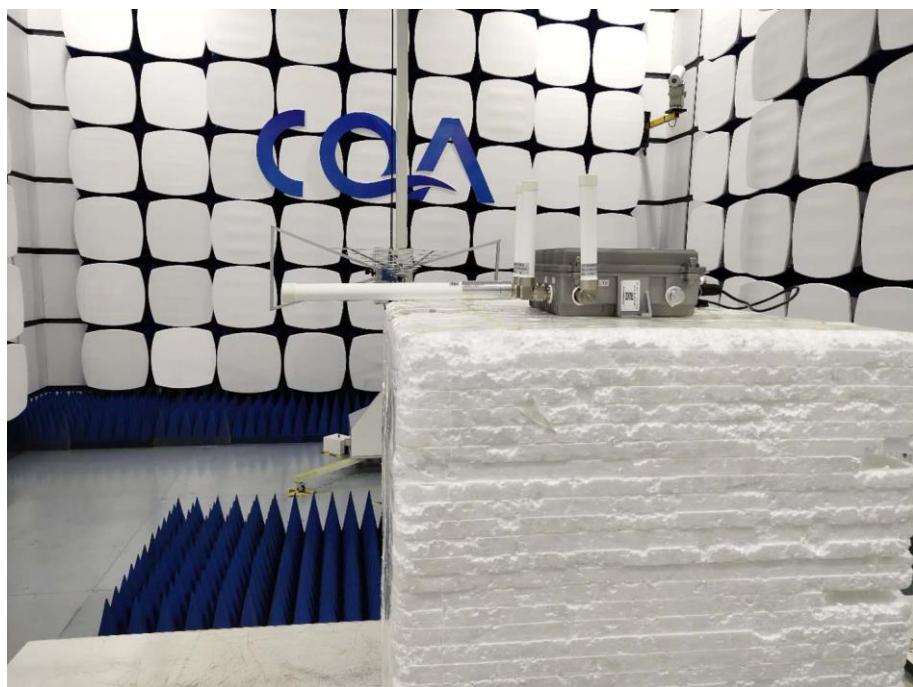
6.1 Radiated Spurious Emission

9KHz~30MHz

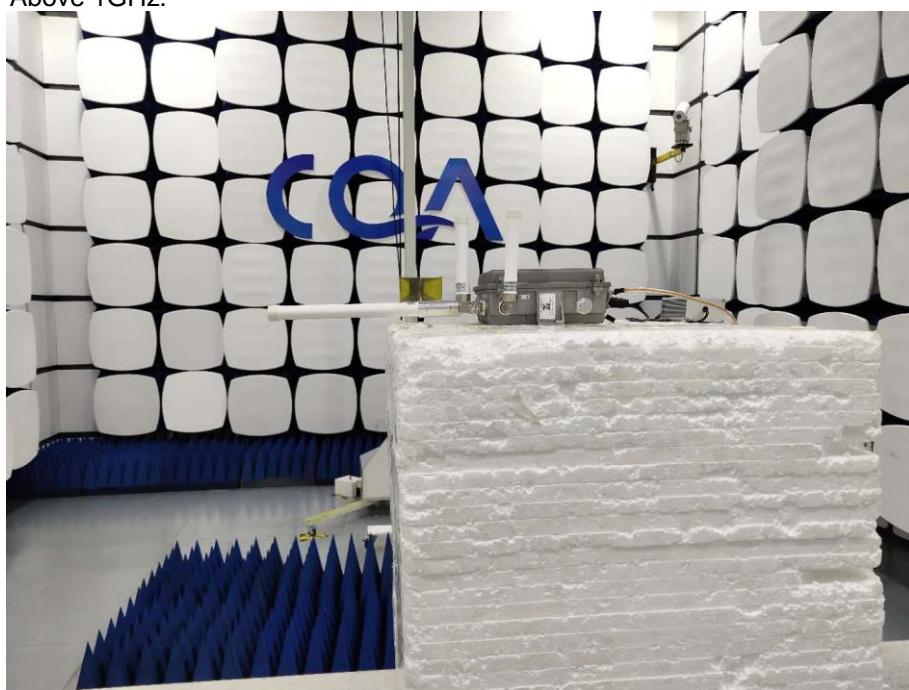


30MHz~1GHz:





Above 1GHz:



THE END