

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

Telephone: +86-755-26648640 Fax: +86-755-26648637 Website:

www.cqa-cert.com Report Template Revision Date: Mar.1st, 2017

Report Template Version: V03

# **Test Report**

Report No.: CQASZ20210100001EX-01

**Applicant:** Dongguan Lingije Electronics & Technology Co., Ltd

Address of Applicant: Building A(Floor 1-4) and B(Floor 1-5), No. 16 Zhenxing North Road, Taiyuan

Community, Xiegang Town, Dongguan City, Guangdong Province, 523590,

P.R.C

Dongguan Lingije Electronics & Technology Co., Ltd Manufacturer:

Address of Building A(Floor 1-4) and B(Floor 1-5), No. 16 Zhenxing North Road, Taiyuan Manufacturer:

Community, Xiegang Town, Dongguan City, Guangdong Province, 523590,

**Equipment Under Test (EUT):** 

**Product:** Wireless Keyboard

All Model No.: K913, K901, K902, K903, K911, K912, K921, K922, K923, K931, K932, K933

**Test Model No.:** K913 **Brand Name:** N/A

FCC ID: 2ANBU-K913922901933

Standards: 47 CFR Part 15, Subpart C Section 15.247

Date of Test: 2020-12-21 to 2021-1-19

Date of Issue: 2021-1-19 Test Result: PASS\*

JUH Li Tested By:

(Jun Li)

Ans lin Reviewed By:

( Ares Liu )

Approved By:

(Sheek Luo)



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.

<sup>\*</sup> In the configuration tested, the EUT complied with the standards specified above.



Report No.: CQASZ20210100001EX-01

# 1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20210100001EX-01	Rev.01	Initial report	2021-1-19



# 2 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203/15.247 (c)	ANSI C63.10 2013	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10 2013	N/A
Conducted Peak Output Power	47 CFR Part 15, Subpart C Section 15.247 (b)(3)	ANSI C63.10 2013	PASS
6dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.247 (a)(2)	ANSI C63.10 2013	PASS
Power Spectral Density	47 CFR Part 15, Subpart C Section 15.247 (e)	ANSI C63.10 2013	PASS
Band-edge for RF Conducted Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10 2013	PASS
RF Conducted Spurious Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10 2013	PASS
Radiated Spurious Emissions	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 2013	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 2013	PASS

N/A: Because this test EUT Power by the 2\*AAA battery. Not Applicable





# 3 Contents

			Page
1	VE	ERSION	2
2	TE	EST SUMMARY	3
3	C	ONTENTS	4
4		ENERAL INFORMATION	
	4.1	CLIENT INFORMATION	5
	4.2	GENERAL DESCRIPTION OF EUT	
	4.3	TEST ENVIRONMENT	
	4.4	DESCRIPTION OF SUPPORT UNITS	
	4.5	STATEMENT OF THE MEASUREMENT UNCERTAINTY	
	4.6	TEST LOCATION	9
	4.7	TEST FACILITY	9
	4.8	DEVIATION FROM STANDARDS	
	4.9	OTHER INFORMATION REQUESTED BY THE CUSTOMER	
	4.10	EQUIPMENT LIST	10
5	TE	EST RESULTS AND MEASUREMENT DATA	11
	5.1	Antenna Requirement	11
	5.2	CONDUCTED PEAK OUTPUT POWER	
	5.3	6DB OCCUPY BANDWIDTH	14
	5.4	POWER SPECTRAL DENSITY	16
	5.5	BAND-EDGE FOR RF CONDUCTED EMISSIONS	
	5.6	SPURIOUS RF CONDUCTED EMISSIONS	
	5.7	RADIATED SPURIOUS EMISSION & RESTRICTED BANDS	
	5.7	7.1 Spurious Emissions	25
6	Pŀ	HOTOGRAPHS - EUT TEST SETUP	31
7	Pŀ	HOTOGRAPHS - EUT CONSTRUCTIONAL DETAILS	33



Report No.: CQASZ20210100001EX-01

# 4 General Information

#### 4.1 Client Information

Applicant:	Dongguan Lingjie Electronics & Technology Co., Ltd	
Address of Applicant:	Building A(Floor 1-4) and B(Floor 1-5), No. 16 Zhenxing North Road, Taiyuan Community, Xiegang Town, Dongguan City, Guangdong Province, 523590, P.R.C	
Manufacturer:	Dongguan Lingjie Electronics & Technology Co., Ltd	
Address of Manufacturer:	Building A(Floor 1-4) and B(Floor 1-5), No. 16 Zhenxing North Road, Taiyuan Community, Xiegang Town, Dongguan City, Guangdong Province, 523590, P.R.C	

## 4.2 General Description of EUT

Product Name:	Wireless Keyboard
Test Model No.:	K913
Trade Mark:	N/A
Hardware Version:	V1.0
Software Version:	V1.0
Operation Frequency:	2403.85-2479.85MHz
Modulation Type:	GFSK
Transfer Rate:	1Mbps
Number of Channel:	16
Fixed frequency mode	Combine buttons to enter engineering mode
Product Type:	☐ Mobile ☐ Portable ☐ Fix Location
Antenna Type:	PCB antenna
Antenna Gain:	0dBi
EUT Power Supply:	battery: 3V(1.5V*2)



Report No.: CQASZ20210100001EX-01

Operation Frequency each of channel				
Channel	Frequency	Channel	Frequency	
0	2403.85 MHz	8	2441.85 MHz	
1	2407.85 MHz	9	2445.85MHz	
2	2414.85 MHz	10	2453.85 MHz	
3	2419.85 MHz	11	2459.85 MHz	
4	2422.85 MHz	12	2463.85 MHz	
5	2426.85 MHz	13	2466.85 MHz	
6	2436.85 MHz	14	2473.85 MHz	
7	2439.85 MHz	15	2479.85 MHz	

#### Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency	
The lowest channel (CH0)	2403.85MHz	
The middle channel (CH8)	2441.85MHz	
The highest channel (CH15)	2479.85MHz	



Report No.: CQASZ20210100001EX-01

#### 4.3 Test Environment

Operating Environment	Operating Environment:		
Radiated Emission			
Temperature:	25.1 °C		
Humidity:	53 % RH		
Atmospheric Pressure:	1001mbar		
RF item test (RF test ro	oom)		
Temperature:	27.5 °C		
Humidity:	59 % RH		
Atmospheric Pressure:	1001mbar		
Test Mode:	Use test software to set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT.  Note: In the process of transmitting of EUT, the duty cycle >98%.		

## 4.4 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.	Remark	FCC certification
PC	Lenovo	ThinkPad E450C	Provide by lab	FCC ID
AC/DC A apter	Lenovo	ADLX65NLC3A	Provide by lab	FCC SDOC



Report No.: CQASZ20210100001EX-01

#### 4.5 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.** guality 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:

No.	Item	Uncertainty	Notes
1	Radiated Emission (Below 1GHz)	5.12dB	(1)
2	Radiated Emission (Above 1GHz)	4.60dB	(1)
3	Conducted Disturbance (0.15~30MHz)	3.34dB	(1)
4	Radio Frequency	3×10 <sup>-8</sup>	(1)
5	Duty cycle	0.6 %.	(1)
6	Occupied Bandwidth	1.1%	(1)
7	RF conducted power	0.86dB	(1)
8	RF power density	0.74	(1)
9	Conducted Spurious emissions	0.86dB	(1)
10	Temperature test	0.8℃	(1)
11	Humidity test	2.0%	(1)
12	Supply voltages	0.5 %.	(1)
13	time	0.6 %.	(1)
14	Frequency Error	5.5 Hz	(1)

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



Report No.: CQASZ20210100001EX-01

#### 4.6 Test Location

#### Shenzhen Huaxia Testing Technology Co., Ltd,

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

#### 4.7 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

IC Registration No.: 22984-1

The 3m Semi-anechoic chamber of Shenzhen Huaxia Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

#### • 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

#### 4.8 Deviation from Standards

None.

#### 4.9 Other Information Requested by the Customer

None.



Report No.: CQASZ20210100001EX-01

## 4.10 Equipment List

			Instrument	Calibration	Calibration
Test Equipment	Manufacturer	Model No.	No.	Date	Due Date
EMI Test Receiver	R&S	ESR7	CQA-005	2020/09/22	2021/09/21
Spectrum analyzer	R&S	FSU26	CQA-038	2020/10/24	2021/10/23
Spectrum analyzer	keysight	N9020A	CQA-105	2020/10/24	2021/10/23
Preamplifier	MITEQ	AFS4-00010300-18-10P- 4	CQA-035	2020/09/22	2021/09/21
Preamplifier	MITEQ	AMF-6D-02001800-29- 20P	CQA-036	2020/10/29	2021/10/28
Loop antenna	Schwarzbeck	FMZB1516	CQA-087	2020/10/24	2021/10/23
Bilog Antenna	R&S	HL562	CQA-011	2020/09/22	2021/09/21
Horn Antenna	R&S	HF906	CQA-012	2020/09/22	2021/09/21
Horn Antenna	Schwarzbeck	BBHA 9170	CQA-088	2020/09/22	2021/09/21
Coaxial Cable (Above 1GHz)	CQA	N/A	C019	2020/09/22	2021/09/21
Coaxial Cable (Below 1GHz)	CQA	N/A	C020	2020/09/22	2021/09/21
Antenna Connector	CQA	RFC-01	CQA-080	2020/09/22	2021/09/21
RF cable(9KHz~40GHz)	CQA	RF-01	CQA-079	2020/09/22	2021/09/21
Power divider	MIDWEST	PWD-2533-02-SMA-79	CQA-067	2020/09/22	2021/09/21
EMI Test Receiver	R&S	ESPI3	CQA-013	2020/09/22	2021/09/21
LISN	R&S	ENV216	CQA-003	2020/11/01	2021/10/30
Coaxial cable	CQA	N/A	CQA-C009	2020/09/22	2021/09/21

#### Note:

The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.



#### 5 Test results and Measurement Data

#### 5.1 Antenna Requirement

Standard requirement: 47 CFR Part 15C Section 15.203 /247(c)

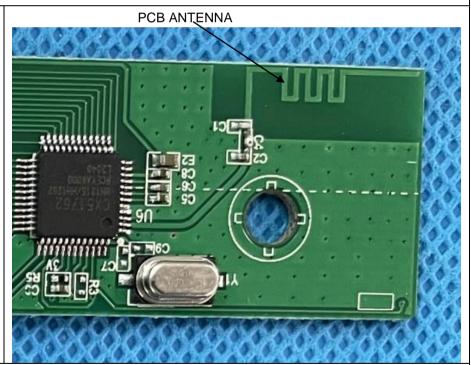
15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**EUT Antenna:** 

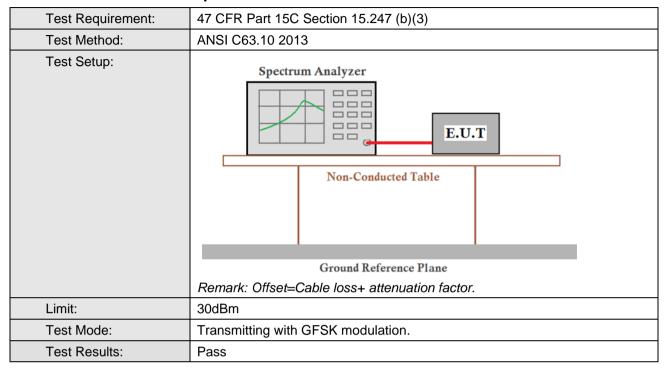


The antenna is integral antenna. The best case gain of the antenna is 0dBi.



Report No.: CQASZ20210100001EX-01

#### 5.2 Conducted Peak Output Power



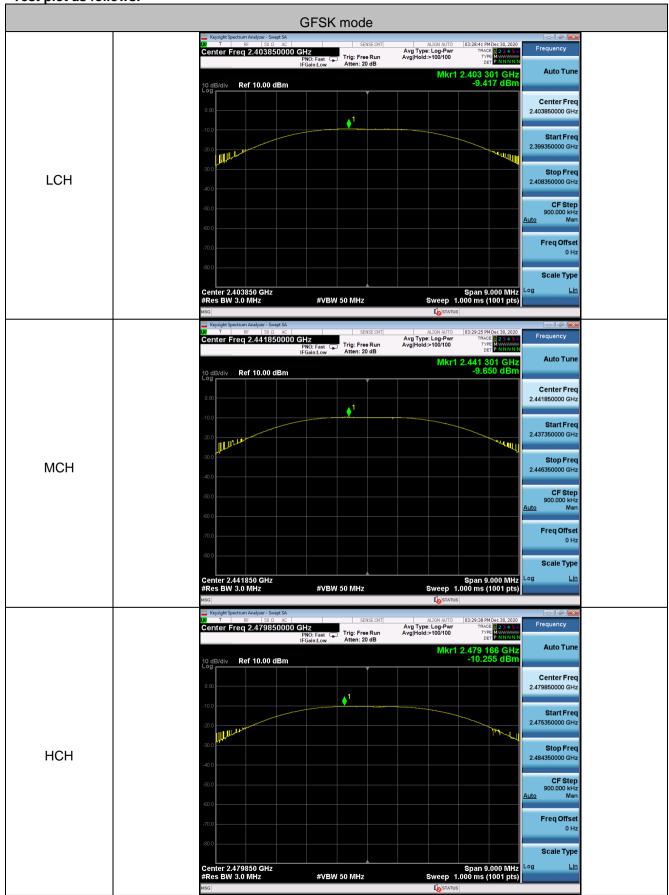
#### **Measurement Data**

GFSK mode (1Mbps)				
Test channel	Peak Output Power (dBm) Limit (dBm) Result			
Lowest	-9.417	30.00	Pass	
Middle	-9.650	30.00	Pass	
Highest	-10.255	30.00	Pass	



Report No.: CQASZ20210100001EX-01

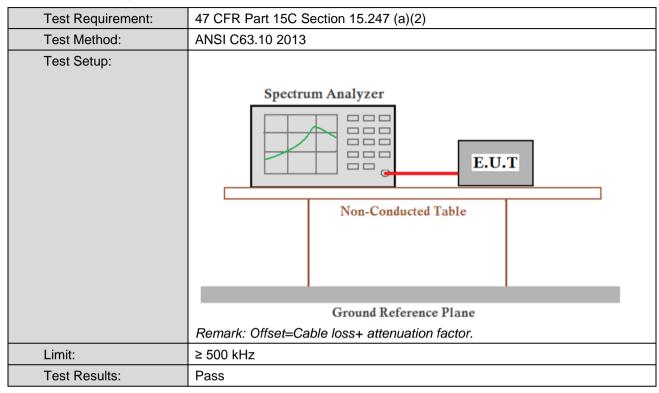
#### Test plot as follows:







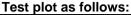
## 5.3 6dB Occupy Bandwidth

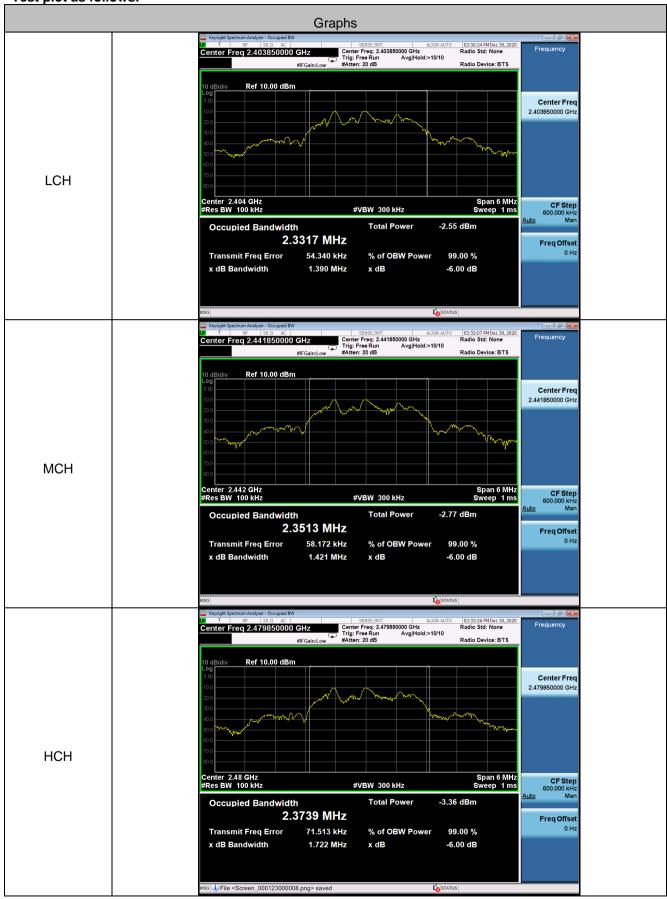


#### **Measurement Data**

	GFSK mode						
Test channel	6dB Occupy Bandwidth (MHz)	Limit (kHz)	Result				
Lowest	1.390	N/A	Pass				
Middle	1.421	N/A	Pass				
Highest	1.722	N/A	Pass				



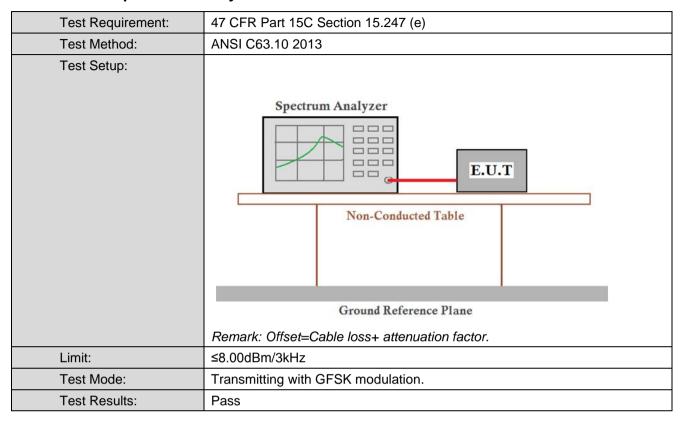






Report No.: CQASZ20210100001EX-01

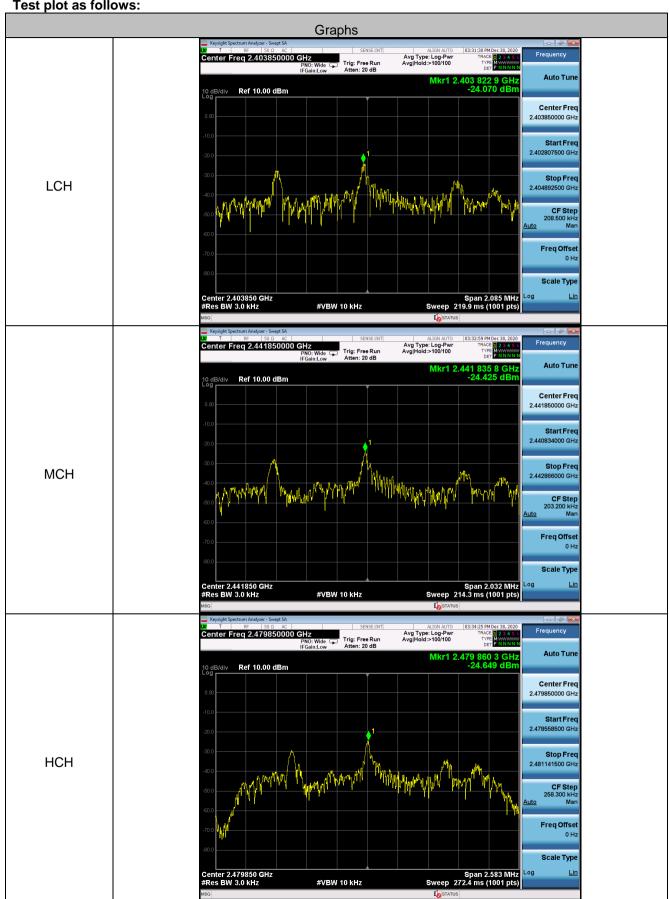
## 5.4 Power Spectral Density



#### **Measurement Data**

	GFSK mode								
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result						
Lowest	-24.070	≤8.00	Pass						
Middle	-24.425	≤8.00	Pass						
Highest	-24.649	≤8.00	Pass						

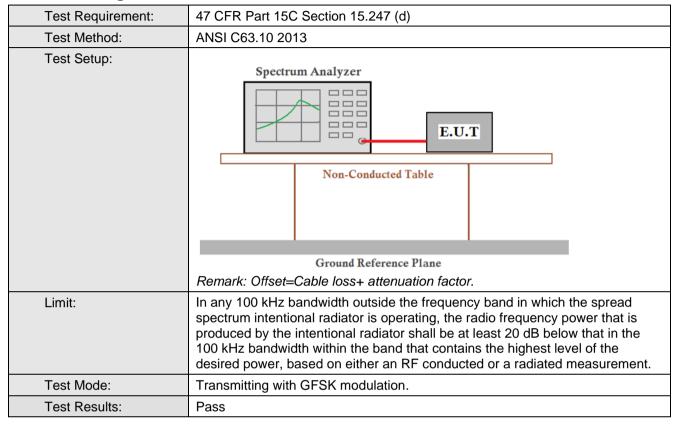
#### Test plot as follows:







### 5.5 Band-edge for RF Conducted Emissions



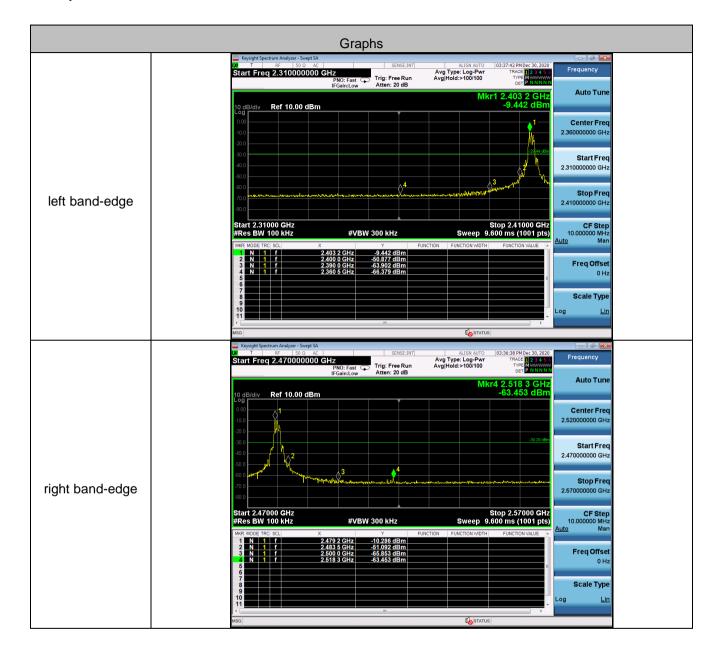
left band-edge						
Frequency(MHz)	Emission Level(dBm)	Limit(dBm)	Result			
2390	-63.902	-29.44	Pass			
2400	-50.877	-29.44	Pass			

right band-edge							
Frequency(MHz)	Emission Level(dBm)	Limit(dBm)	Result				
2483.5	-51.092	-30.29	Pass				
2500	65.853	-30.29	Pass				



Report No.: CQASZ20210100001EX-01

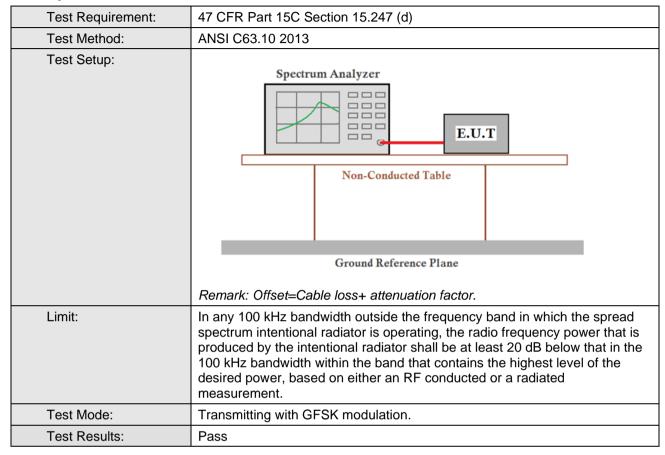
#### Test plot as follows:



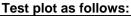




#### 5.6 Spurious RF Conducted Emissions

















Report No.: CQASZ20210100001EX-01

#### Remark:

Pretest 9kHz to 25GHz, find the highest point when testing, so only the worst data were shown in the test report. Per FCC Part 15.33 (a) and 15.31 (o) ,The amplitude of spurious emissions from intentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.



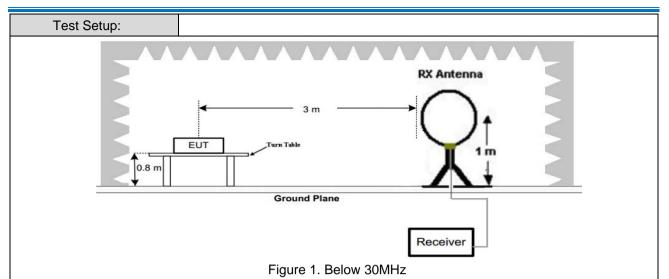
Report No.: CQASZ20210100001EX-01

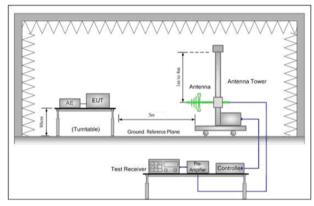
## 5.7 Radiated Spurious Emission & Restricted bands

5.7.1 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 Dete			RBW	VBW	Remark			
	0.009MHz-0.090MH	z	Peak	10kHz	30kHz	Peak			
	0.009MHz-0.090MH	Z	Average	10kHz	30kHz	Average			
	0.090MHz-0.110MH	Z	Quasi-peak	10kHz	30kHz	Quasi-peak			
	0.110MHz-0.490MH	z	Peak	10kHz	30kHz	Peak			
	0.110MHz-0.490MH	z	Average	10kHz	30kHz	Average			
	0.490MHz -30MHz Quasi-peak				30kHz	Quasi-peak			
	30MHz-1GHz		Quasi-peak	100 kH	lz 300kHz	Quasi-peak			
	Above 1CI I-		Peak	1MHz	3MHz	Peak			
	Above 1GHz		Peak	1MHz	10Hz	Average			
Limit:	Frequency		eld strength crovolt/meter)	Limit (dBuV/m)	Remark	Measuremen distance (m)			
	0.009MHz-0.490MHz	2	400/F(kHz)	-	-	300			
	0.490MHz-1.705MHz	24	1000/F(kHz)	ı	1	30			
	1.705MHz-30MHz		30	ı	1	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), frequency emissions is limit applicable to the epeak emission level race	20c quip	IB above the oment under t	maximum est. This p	permitted ave	erage emission			



Report No.: CQASZ20210100001EX-01





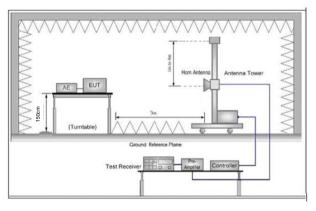


Figure 2. 30MHz to 1GHz

Figure 3. Above 1 GHz

#### Test Procedure:

- 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 camber. 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 camber. 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.

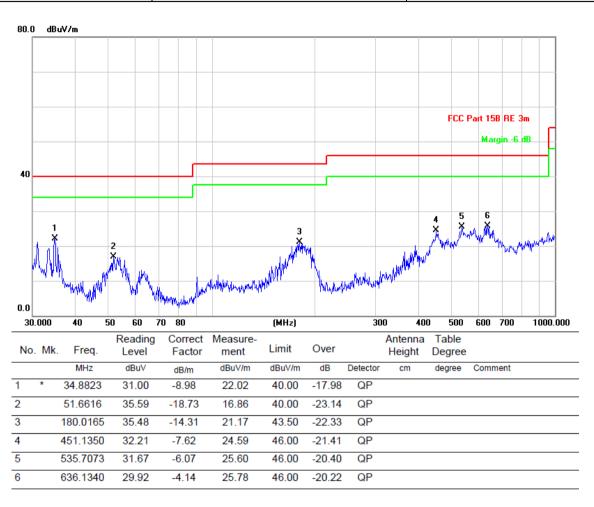
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the



	measurement.
	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.
	<ul> <li>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.</li> <li>g. Test the EUT in the lowest channel, the middle channel, the Highest channel</li> </ul>
	h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
	i. Repeat above procedures until all frequencies measured was complete.
Exploratory Test	Transmitting with GFSK modulation.
Mode:	Transmitting mode, Transmitting mode.
Final Test Mode:	Transmitting with GFSK modulation.
	For below 1GHz part, through pre-scan, the worst case is the lowest channel.
	Only the worst case is recorded in the report.
Test Results:	Pass

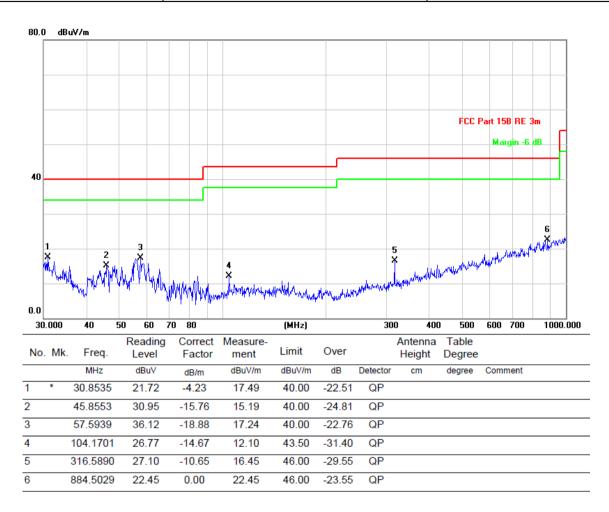


Radiated Emission below 1GHz						
30MHz~1GHz, the worst case						
Test mode: Transmitting mode Vertical						





30MHz~1GHz, the worst case			
Test mode:	Transmitting mode	Horizontal	







#### Transmitter Emission above 1GHz

Worse case mode: GFSK		Test channel:		Lowest			
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	H/V
2390	57.54	-9.2	48.34	74	-25.66	Peak	н
2400	58.86	-9.39	49.47	74	-24.53	Peak	Н
4807.7	55.75	-4.33	51.42	74	-22.58	Peak	Н
7211.55	53.33	1.01	54.34	74	-19.66	Peak	Н
2390	58.34	-9.2	49.14	74	-24.86	Peak	V
2400	59.66	-9.39	50.27	74	-23.73	Peak	V
4807.7	56.25	-4.33	51.92	74	-22.08	Peak	V
7211.55	52.00	1.01	53.01	74	-20.99	Peak	V

Worse case mode:		GFSK		Test channel:		Middle	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	H/V
4883.7	55.05	-4.11	50.94	74	-23.06	Peak	Н
7325.55	49.70	1.51	51.21	74	-22.79	Peak	Н
4883.7	55.02	-4.11	50.91	74	-23.09	Peak	V
7325.55	48.39	1.51	49.90	74	-24.10	Peak	V

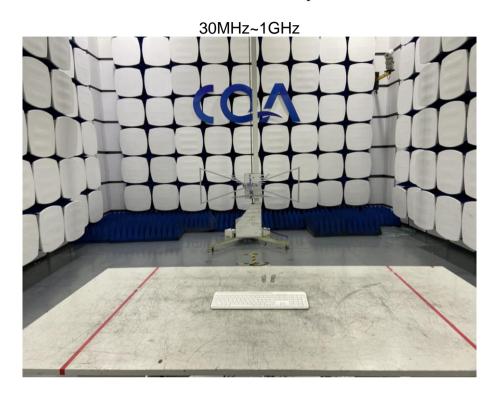
Worse case mode:		GFSK		Test channel:		Highest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	H/V
2483.5	54.58	-9.29	45.29	74	-28.71	Peak	Н
4959.7	53.87	-4.04	49.83	74	-24.17	Peak	Н
7439.55	50.34	1.57	51.91	74	-22.09	Peak	Н
2483.5	53.82	-9.29	44.53	74	-29.47	Peak	V
4959.7	53.16	-4.04	49.12	74	-24.88	Peak	V
7439.55	49.82	1.57	51.39	74	-22.61	Peak	V

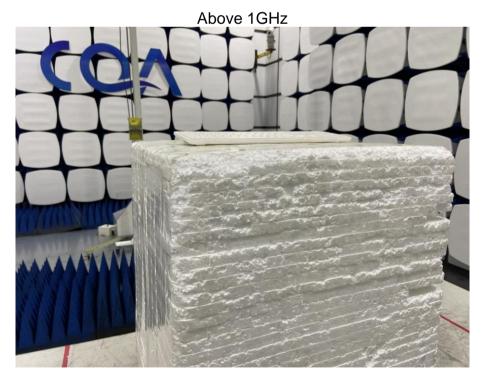
#### Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
  - Final Test Level = Receiver Reading + Antenna Factor + Cable Factor 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.

# 6 Photographs - EUT Test Setup

Please refer to test setup file











# 7 Photographs - EUT Constructional Details





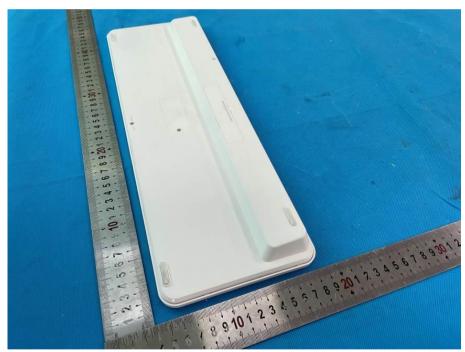






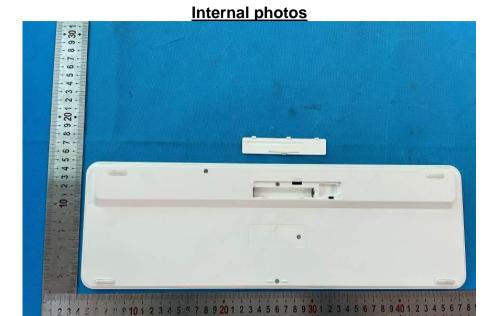


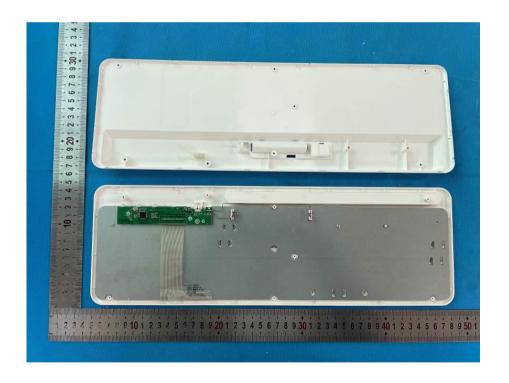






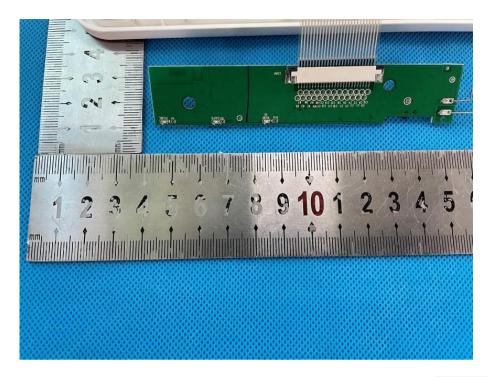


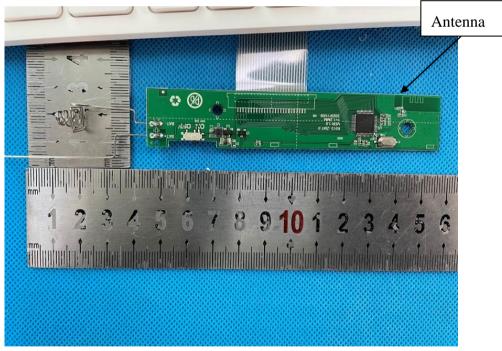












The End