FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.249

Report Reference No.....	: **CTA23052500101E**	
FCC ID.....	: **2AYJK-RW2**	
Compiled by (position+printed name+signature)..	: File administrators Kevin Liu	Kevin . Liu
Supervised by (position+printed name+signature)..	: Project Engineer Kevin Liu	Kevin . Liu
Approved by (position+printed name+signature)..	: RF Manager Eric Wang	Eric Wang
Date of issue.....	: May 25, 2023	

Testing Laboratory Name.....	: **Shenzhen CTA Testing Technology Co., Ltd.**
Address.....	: Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China
Applicant's name.....	: **Shenzhen Warsong Technology Co., Ltd.**
Address.....	: Floor 15, Building 1, Nanshan Zhiyuan Chongwen Park, No. 3370 Liuxian Avenue, Nanshan District, Shenzhen
Test specification.....	:
Standard.....	: **FCC CFR Title 47 Part 15 Subpart C Section 15.249** **ANSI C63.10:2013**

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Equipment description.....	: **Wireless Gaming Controller**
Trade Mark.....	: BIGBIG WON
Manufacturer.....	: Shenzhen Warsong Technology Co., Ltd.
Model/Type reference.....	: Rainbow2 Pro
Listed Models	: Rainbow2 lite, Rainbow2
Modulation	: GFSK
Frequency.....	From 2402MHz to 2480MHz
Ratings.....	: DC 3.7V From Battery and DC 5V From External circuit
Result.....	: **PASS**

TEST REPORT

Equipment under Test	:	Wireless Gaming Controller
Model /Type	:	Rainbow2 Pro
Listed Models	:	Rainbow2 lite, Rainbow2
Applicant	:	Shenzhen Warsong Technology Co., Ltd.
Address	:	Floor 15, Building 1, Nanshan Zhiyuan Chongwen Park, No. 3370 Liuxian Avenue, Nanshan District, Shenzhen
Manufacturer	:	Shenzhen Warsong Technology Co., Ltd.
Address	:	Floor 15, Building 1, Nanshan Zhiyuan Chongwen Park, No. 3370 Liuxian Avenue, Nanshan District, Shenzhen

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1 TEST STANDARDS 4

2 SUMMARY 5

2.1 General Remarks 5
2.2 Product Description 5
2.3 Equipment Under Test 5
2.4 Short description of the Equipment under Test (EUT) 5
2.5 EUT operation mode 6
2.6 Block Diagram of Test Setup 7
2.7 Related Submittal(s) / Grant (s) 7
2.8 Modifications 7

3 TEST ENVIRONMENT 8

3.1 Address of the test laboratory 8
3.2 Test Facility 8
3.3 Environmental conditions 8
3.4 Summary of measurement results 9
3.5 Statement of the measurement uncertainty 9
3.6 Equipments Used during the Test 10

4 TEST CONDITIONS AND RESULTS 11

4.1 AC Power Conducted Emission 11
4.2 Radiated Emissions and Band Edge 14
4.3 Bandwidth of Frequncy Band Edge 15
4.4 Channel Bandwidth 22
4.5 Antenna Requirement 25

5 TEST SETUP PHOTOS OF THE EUT 27

6 PHOTOS OF THE EUT 28

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.249: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz and 24.0-24.25 GHz
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	May 05, 2023
Testing commenced on	:	May 05, 2023
Testing concluded on	:	May 23, 2023

2.2 Product Description

Product Description:	Wireless Gaming Controller
Model/Type reference:	Rainbow2 Pro
Listed Models:	Rainbow2 lite, Rainbow2
Model Different.:	PCB board, structure and internal of these model(s) are the same,So no additional models were tested.
Power supply:	DC 3.7V From Battery and DC 5V From External circuit
Adapter information (Auxiliary test supplied by testing Lab):	N/A
Testing sample ID:	CTA23052500101-1# (Engineer sample) CTA23052500101-2# (Normal sample)
2.4G	
Supported type:	2.4G
Modulation:	GFSK
Operation frequency:	2402MHz to 2480MHz
Channel number:	40
Channel separation:	2MHz
Antenna type:	Ceramic antenna
Antenna gain:	1.6 dBi

2.3 Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	120V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

DC 5V From external circuit

2.4 Short description of the Equipment under Test (EUT)

This is a 2.4G Wireless Gaming Controller.
For more details, refer to the user's manual of the EUT.

2.5 EUT operation mode

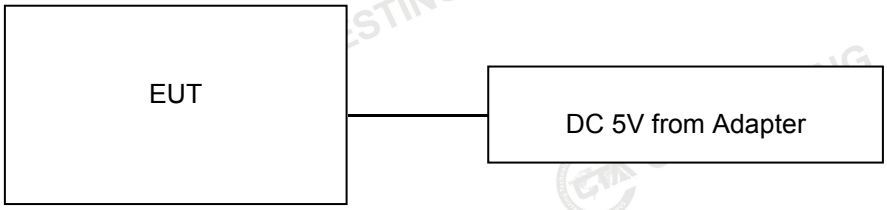
The Applicant provides communication tools software(Engineer mode) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 40 channels provided to the EUT and Channel 1/19/39 were selected to test.

Operation Frequency：

Channel	Frequency (MHz)
00	**2402**
01	2404
02	2406
⋮	⋮
19	**2440**
⋮	⋮
37	2476
38	2478
39	**2480**

Channel	Frequency
The lowest channel	2402 MHz
The middle channel	2440 MHz
The Highest channel	2480 MHz

2.6 Block Diagram of Test Setup



2.7 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for the device filing to comply with Section 15.249 of the FCC Part 15, Subpart C Rules.

2.8 Modifications

No modifications were implemented to meet testing criteria.

3 TEST ENVIRONMENT

3.1 Address of the test laboratory

Shenzhen CTA Testing Technology Co., Ltd.
Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

3.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:
FCC-Registration No.: 517856 Designation Number: CN1318

Shenzhen CTA Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA-Lab Cert. No.: 6534.01

Shenzhen CTA Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

3.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:
Radiated Emission:

Temperature:	23 ° C
Humidity:	44 %
Atmospheric pressure:	950-1050mbar

AC Main Conducted testing：

Temperature:	24 ° C
Humidity:	47 %
Atmospheric pressure:	950-1050mbar

Conducted testing：

Temperature:	24 ° C
Humidity:	46 %
Atmospheric pressure:	950-1050mbar

3.4 Summary of measurement results

FCC Part15 (15.249) , Subpart C			
Standard Section	Test Item	Judgment	Remark
FCC part 15.203	Antenna requirement	PASS	
FCC part 15.207	AC Power Line Conducted Emission	PASS	
FCC part 15.249	Fundamental &Radiated Spurious Emission Measurement	PASS	
FCC part 15.215	20dB Channel Bandwidth	PASS	
FCC part 15.205	Band Edge	PASS	

Remark:
1. The measurement uncertainty is not included in the test result.
2. We tested all test mode and recorded worst case in report
3. " N/A" denotes test is not applicable in this Test Report

3.5 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 TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen CTA 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 Shenzhen CTA Testing Technology Co., Ltd. :

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	9KHz~30MHz	3.82 dB	(1)
Radiated Emission	30~1000MHz	4.06 dB	(1)
Radiated Emission	1~18GHz	5.14 dB	(1)
Radiated Emission	18-40GHz	5.38 dB	(1)
Conducted Disturbance	0.15~30MHz	2.14 dB	(1)
Transmitter power conducted	1~40GHz	0.57 dB	(1)
Conducted spurious emission	1~40GHz	1.60 dB	(1)
OBW	1~40GHz	25 Hz	(1)

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

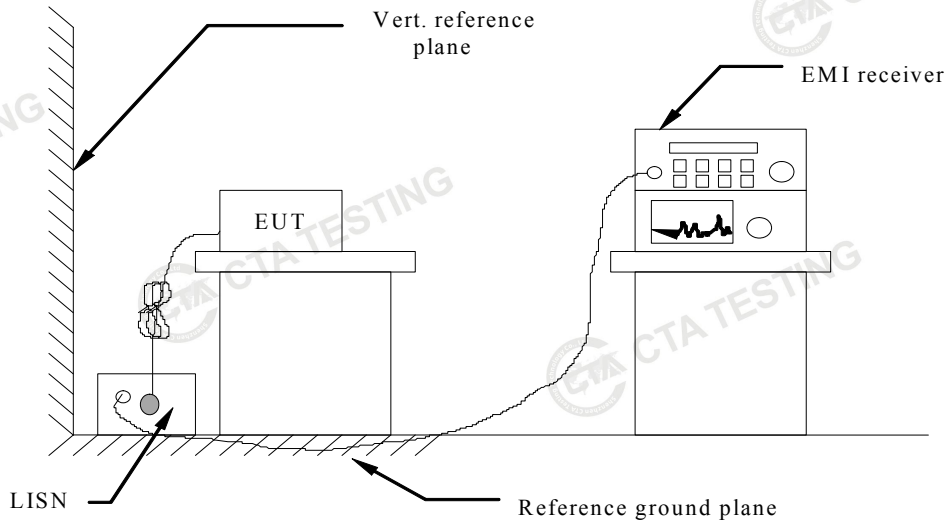
3.6 Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	CTA-308	2022/08/03	2023/08/02
LISN	R&S	ENV216	CTA-314	2022/08/03	2023/08/02
EMI Test Receiver	R&S	ESPI	CTA-307	2022/08/03	2023/08/02
EMI Test Receiver	R&S	ESCI	CTA-306	2022/08/03	2023/08/02
Spectrum Analyzer	Agilent	N9020A	CTA-301	2022/08/03	2023/08/02
Spectrum Analyzer	R&S	FSP	CTA-337	2022/08/03	2023/08/02
Vector Signal generator	Agilent	N5182A	CTA-305	2022/08/03	2023/08/02
Analog Signal Generator	R&S	SML03	CTA-304	2022/08/03	2023/08/02
Universal Radio Communication	CMW500	R&S	CTA-302	2022/08/03	2023/08/02
Temperature and humidity meter	Chigo	ZG-7020	CTA-326	2022/08/03	2023/08/02
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	CTA-310	2022/08/03	2023/08/02
Horn Antenna	Schwarzbeck	BBHA 9120D	CTA-309	2022/08/03	2023/08/02
Loop Antenna	Zhinan	ZN30900C	CTA-311	2022/08/03	2023/08/02
Horn Antenna	Beijing Hangwei Dayang	OBH100400	CTA-336	2022/08/03	2023/08/02
Amplifier	Schwarzbeck	BBV 9745	CTA-312	2022/08/03	2023/08/02
Amplifier	Taiwan chengyi	EMC051845B	CTA-313	2022/08/03	2023/08/02
Directional coupler	NARDA	4226-10	CTA-303	2022/08/03	2023/08/02
High-Pass Filter	XingBo	XBLBQ-GTA18	CTA-402	2022/08/03	2023/08/02
High-Pass Filter	XingBo	XBLBQ-GTA27	CTA-403	2022/08/03	2023/08/02
Automated filter bank	Tonscend	JS0806-F	CTA-404	2022/08/03	2023/08/02
Power Sensor	Agilent	U2021XA	CTA-405	2022/08/03	2023/08/02
Amplifier	Schwarzbeck	BBV9719	CTA-406	2022/08/03	2023/08/02

4 TEST CONDITIONS AND RESULTS

4.1 AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
2 Support equipment, if needed, was placed as per ANSI C63.10-2013
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
4 The EUT received power from adapter, the adapter received AC120V/60Hz and AC 240V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5 All support equipments received AC power from a second LISN, if any.
6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT.The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

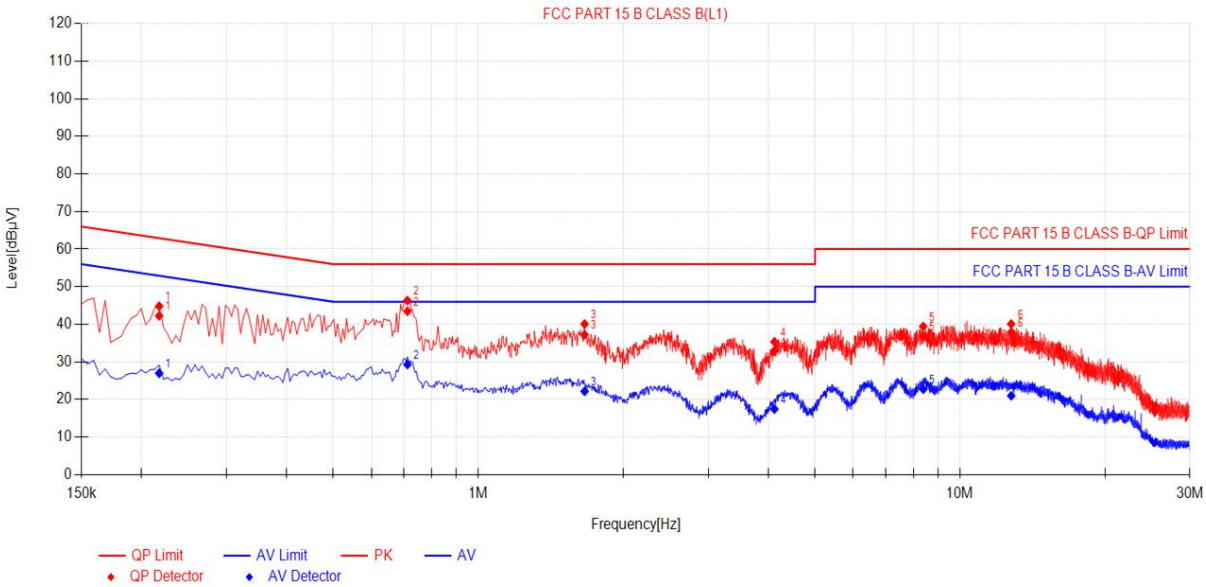
AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

TEST RESULTS

Power supply:	DC 5V from Adapter AC 120V/60Hz	Polarization	L



Suspected List

NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Detector	Type	Verdict
1	0.2175	34.31	44.81	10.50	62.91	18.10	PK	L1	PASS
2	0.7125	35.82	46.32	10.50	56.00	9.68	PK	L1	PASS
3	1.662	29.56	40.06	10.50	56.00	15.94	PK	L1	PASS
4	4.119	24.83	35.33	10.50	56.00	20.67	PK	L1	PASS
5	8.3895	28.92	39.42	10.50	60.00	20.58	PK	L1	PASS
6	12.777	29.58	40.08	10.50	60.00	19.92	PK	L1	PASS

Final Data List

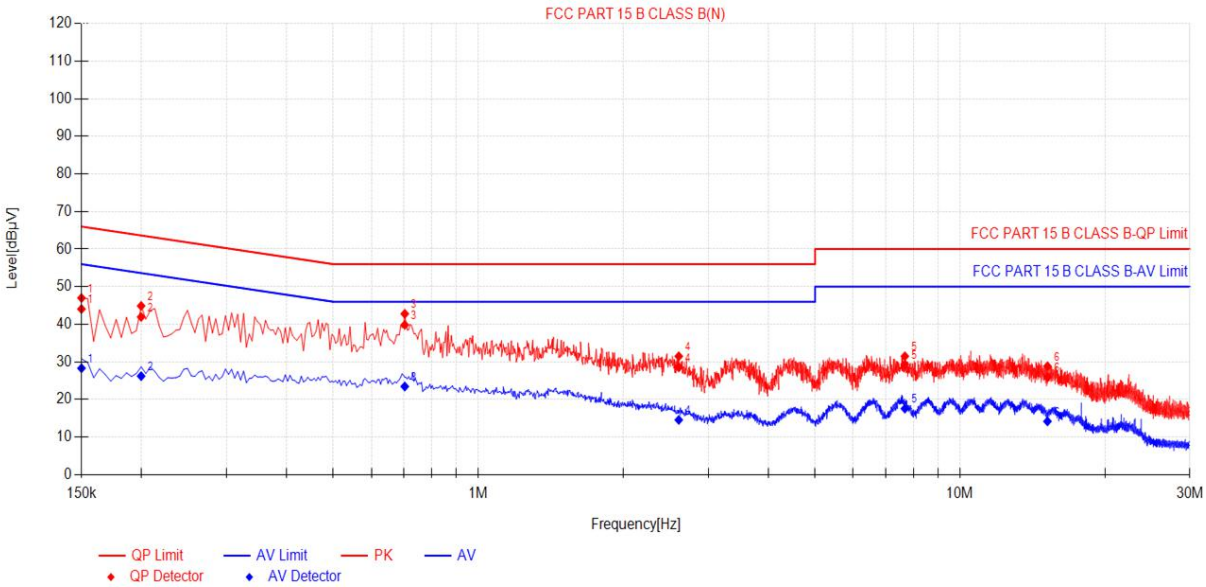
NO.	Freq. [MHz]	Factor [dB]	QP Reading[dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.2175	10.50	31.76	42.26	62.91	20.65	16.48	26.98	52.91	25.93	PASS
2	0.7125	10.50	32.97	43.47	56.00	12.53	18.81	29.31	46.00	16.69	PASS
3	1.662	10.50	26.71	37.21	56.00	18.79	11.67	22.17	46.00	23.83	PASS
4	4.119	10.50	22.38	32.88	56.00	23.12	6.93	17.43	46.00	28.57	PASS
5	8.3895	10.50	26.26	36.76	60.00	23.24	12.22	22.72	50.00	27.28	PASS
6	12.777	10.50	27.40	37.90	60.00	22.10	10.48	20.98	50.00	29.02	PASS

Note:1).Level (dBµV)= Reading (dBµV)+ Factor (dB)

2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)

3). Margin(dB) = Limit (dBµV) - Level (dBµV)

Power supply:	DC 5V from Adapter AC 120V/60Hz	Polarization	N



Suspected List

NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Detector	Type	Verdict
1	0.15	36.49	46.99	10.50	66.00	19.01	PK	N	PASS
2	0.1995	34.39	44.89	10.50	63.63	18.74	PK	N	PASS
3	0.7035	32.28	42.78	10.50	56.00	13.22	PK	N	PASS
4	2.607	20.99	31.49	10.50	56.00	24.51	PK	N	PASS
5	7.683	21.01	31.51	10.50	60.00	28.49	PK	N	PASS
6	15.1935	18.35	28.85	10.50	60.00	31.15	PK	N	PASS

Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Reading[dBµV]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Reading [dBµV]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Verdict
1	0.15	10.50	33.56	44.06	66.00	21.94	17.82	28.32	56.00	27.68	PASS
2	0.1995	10.50	31.46	41.96	63.63	21.67	15.71	26.21	53.63	27.42	PASS
3	0.7035	10.50	29.35	39.85	56.00	16.15	12.96	23.46	46.00	22.54	PASS
4	2.607	10.50	18.06	28.56	56.00	27.44	4.08	14.58	46.00	31.42	PASS
5	7.683	10.50	18.87	29.37	60.00	30.63	7.06	17.56	50.00	32.44	PASS
6	15.1935	10.50	15.41	25.91	60.00	34.09	3.69	14.19	50.00	35.81	PASS

Note:1).Level (dBµV)= Reading (dBµV)+ Factor (dB)

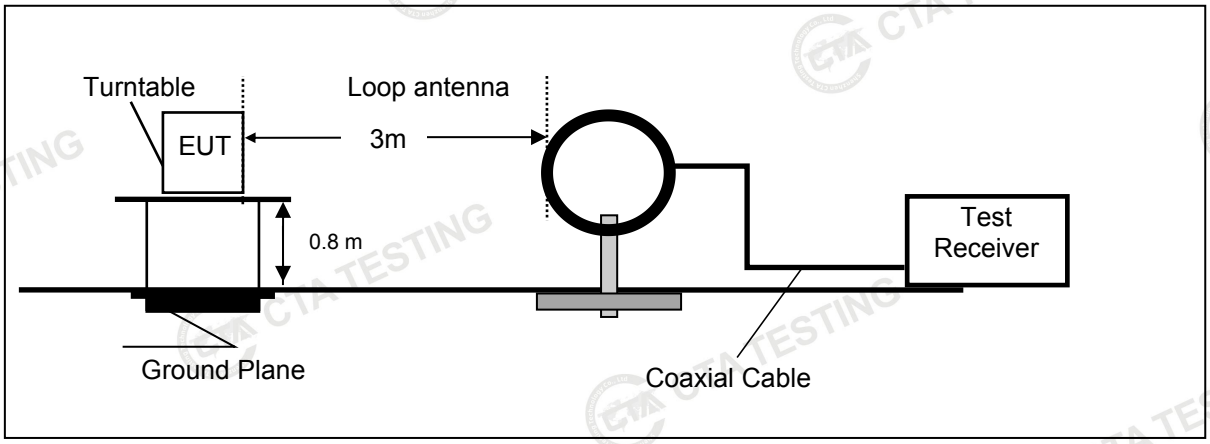
2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)

3). Margin(dB) = Limit (dBµV) - Level (dBµV)

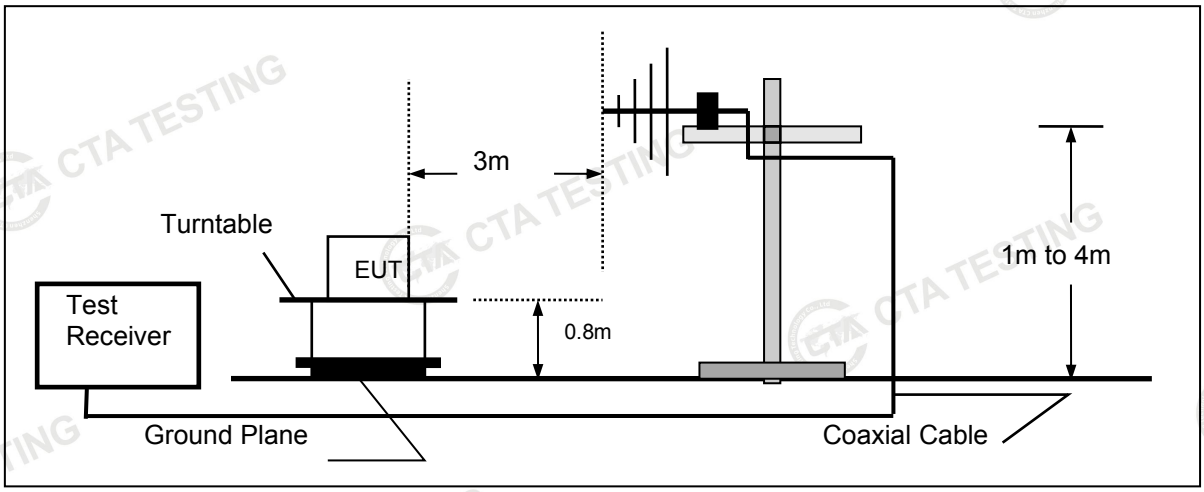
4.2 Radiated Emissions and Band Edge

TEST CONFIGURATION

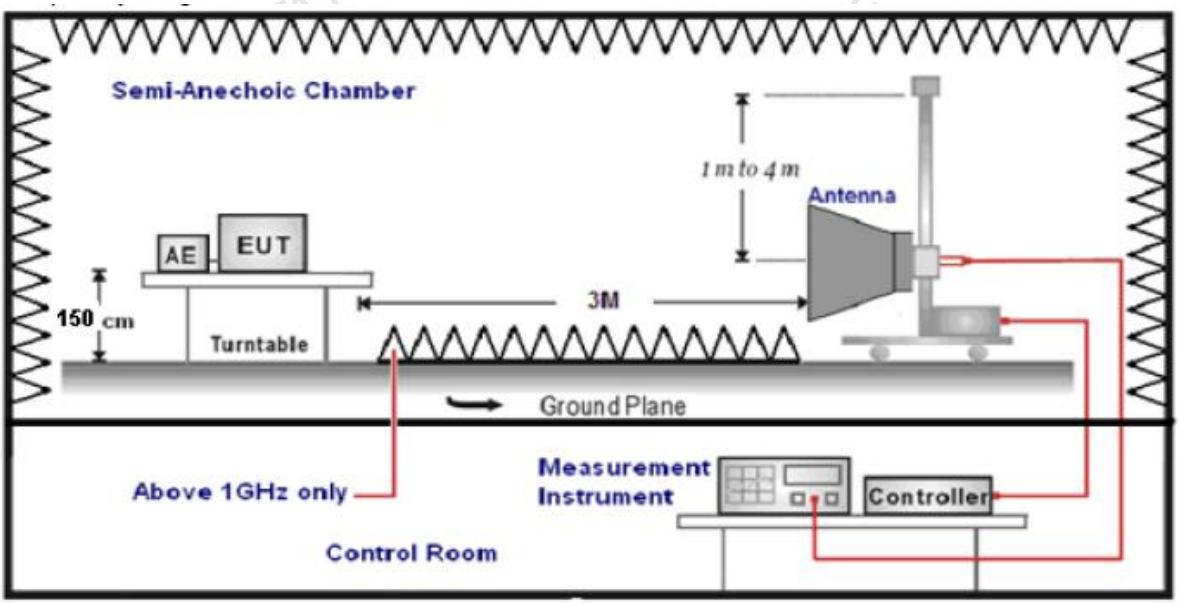
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz;the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz – 25GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 32.768KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

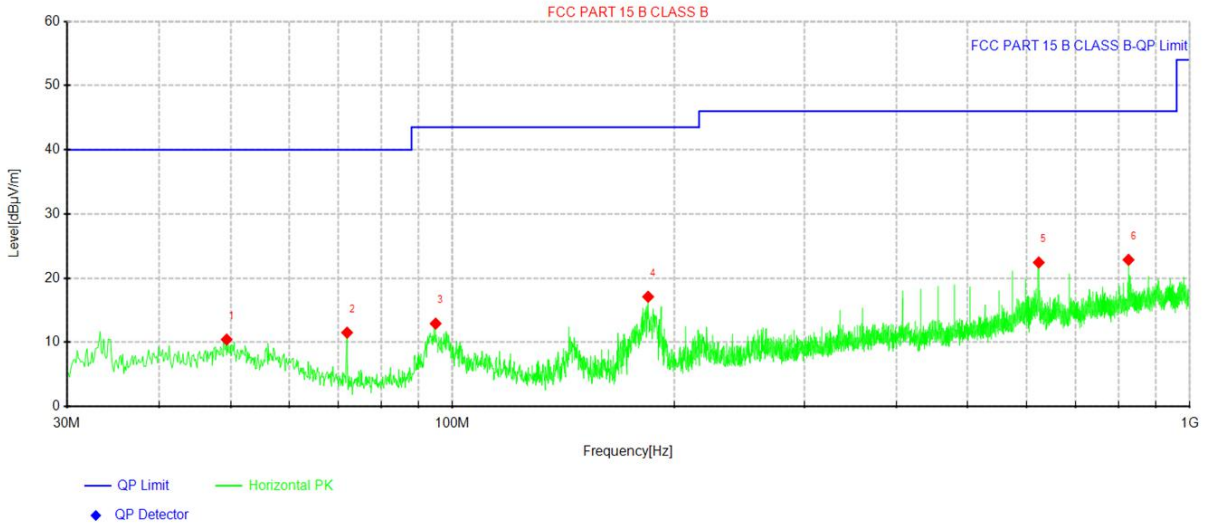
TEST RESULTS

Remark:

1. This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
2. 2.4G were tested at Low, Middle, and High channel and recorded worst mode at 2.4G 1Mpbs.
3. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

For 30MHz-1GHz

Horizontal



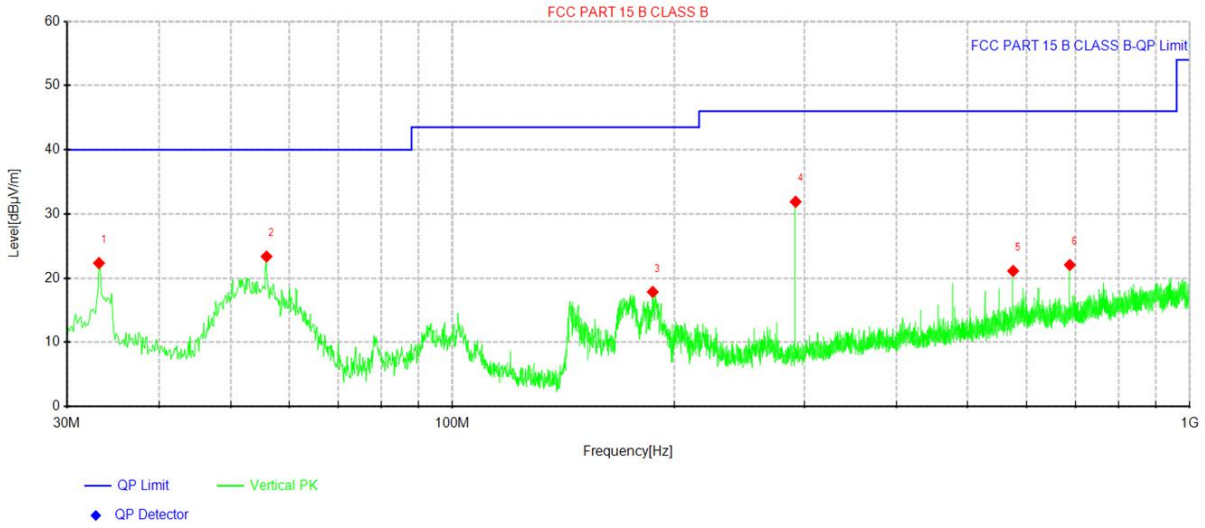
Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	49.4	26.55	10.44	-16.11	40.00	29.56	100	360	Horizontal
2	71.9525	32.49	11.52	-20.97	40.00	28.48	100	199	Horizontal
3	94.8688	32.09	12.92	-19.17	43.50	30.58	100	360	Horizontal
4	184.23	37.38	17.10	-20.28	43.50	26.40	100	88	Horizontal
5	624.003	34.62	22.44	-12.18	46.00	23.56	100	63	Horizontal
6	825.885	33.18	22.86	-10.32	46.00	23.14	100	260	Horizontal

Note:1).Level (dBµV/m)= Reading (dBµV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBµV/m) - Level (dBµV/m)

Vertical



Suspected Data List

NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	33.1525	40.52	22.34	-18.18	40.00	17.66	100	112	Vertical
2	55.9475	40.71	23.37	-17.34	40.00	16.63	100	355	Vertical
3	186.897	37.95	17.85	-20.10	43.50	25.65	100	18	Vertical
4	292.021	49.36	31.90	-17.46	46.00	14.10	100	69	Vertical
5	575.988	34.00	21.13	-12.87	46.00	24.87	100	337	Vertical
6	687.538	33.80	22.06	-11.74	46.00	23.94	100	103	Vertical

Note:1).Level (dBµV/m)= Reading (dBµV)+ Factor (dB/m)

2). Factor(dB/m)=Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB)

3). Margin(dB) = Limit (dBµV/m) - Level (dBµV/m)

For 1GHz to 25GHz

GFSK (above 1GHz)

Frequency(MHz):			2402			Peak value		
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4804.00	55.26	21.52	3.52	33.12	47.18	74	-26.82	Vertical
4804.00	57.25	23.65	4.56	33.08	52.38	74	-21.62	Horizontal
7206.00	48.53	25.58	6.15	33.57	46.69	74	-27.31	Vertical
7206.00	43.16	27.68	6.98	33.26	44.56	74	-29.44	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4804.00	43.65	21.52	3.52	33.12	35.57	54	-18.43	Vertical
4804.00	41.45	23.65	4.56	33.08	36.58	54	-17.42	Horizontal
7206.00	37.53	25.58	6.15	33.57	35.69	54	-18.31	Vertical
7206.00	31.25	27.68	6.98	33.26	32.65	54	-21.35	Horizontal

Frequency(MHz):			2440			Peak value		
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4880.00	54.67	21.78	3.58	33.27	46.76	74	-27.24	Vertical
4880.00	52.25	24.15	4.57	33.87	47.1	74	-26.9	Horizontal
7320.00	43.66	26.04	6.24	33.19	42.75	74	-31.25	Vertical
7320.00	42.05	27.98	7.18	33.68	43.53	74	-30.47	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4880.00	46.64	21.78	3.58	33.27	38.73	54	-15.27	Vertical
4880.00	41.59	24.15	4.57	33.87	36.44	54	-17.56	Horizontal
7320.00	36.53	26.04	6.24	33.19	35.62	54	-18.38	Vertical
7320.00	31.46	27.98	7.18	33.68	32.94	54	-21.06	Horizontal

Frequency(MHz):			2480			Peak value		
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	56.73	22.56	4.17	33.75	49.71	74	-24.29	Vertical
4960.00	54.67	24.78	5.36	33.17	51.64	74	-22.36	Horizontal
7440.00	47.24	27.14	6.97	33.62	47.73	74	-26.27	Vertical
7440.00	43.17	28.16	7.65	33.58	45.4	74	-28.6	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	46.83	22.56	4.17	33.75	39.81	54	-14.19	Vertical
4960.00	42.64	24.78	5.36	33.17	39.61	54	-14.39	Horizontal
7440.00	37.49	27.14	6.97	33.62	37.98	54	-16.02	Vertical
7440.00	31.27	28.16	7.65	33.58	33.5	54	-20.5	Horizontal

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

4.3 BANDWIDTH OF FREQUENCY BAND EDGE

4.3.1 Test Requirement:

<table>
<tr><td>Test Requirement:</td><td colspan="5">FCC Part15 C Section 15.209 and 15.205</td></tr>
<tr><td>Test Method:</td><td colspan="5">ANSI C63.10: 2013</td></tr>
<tr><td>Test Frequency Range:</td><td colspan="5">All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.</td></tr>
<tr><td>Test site:</td><td colspan="5">Measurement Distance: 3m</td></tr>
<tr><td rowspan="3">Receiver setup:</td><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr>
<tr><td>Average</td><td>1MHz</td><td>3MHz</td><td>Average</td></tr>
</table>

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation

4.3.2 TEST PROCEDURE

Above 1GHz test procedure as below:

a. 1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
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 and the rota 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 Highest channel

Note:

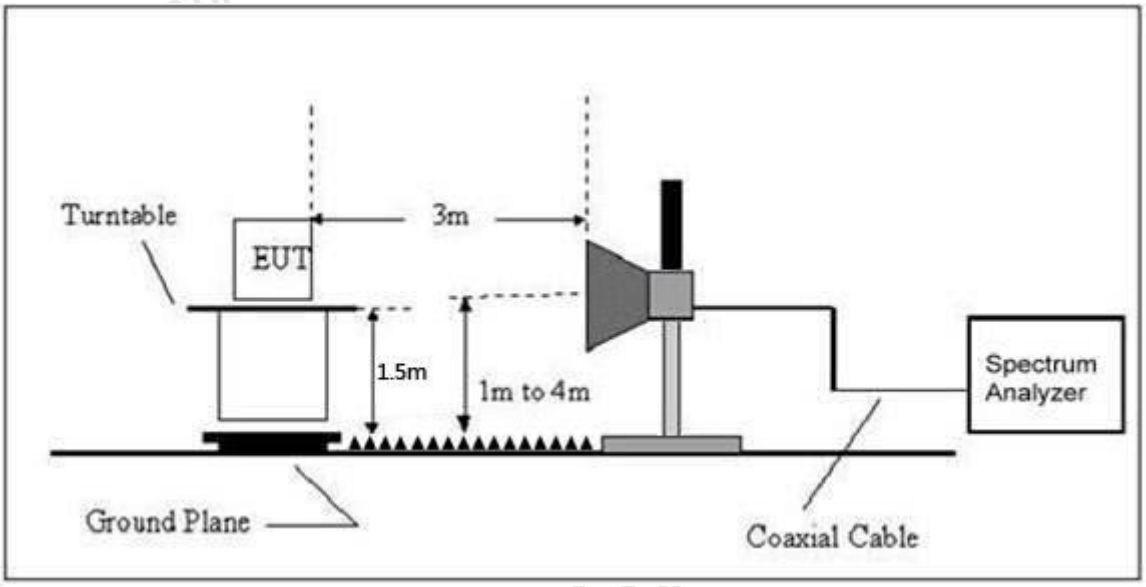
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

4.3.3 DEVIATION FROM TEST STANDARD

No deviation

4.3.4 TEST SETUP

Radiated Emission Test-Up Frequency Above 1GHz



4.3.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

4.3.6 TEST RESULT

2402MHz
Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310	53.84	21.25	3.26	33.14	45.21	74	-28.79	Horizontal
2400	55.27	21.75	3.54	33.42	47.14	74	-26.86	Horizontal
2310	53.16	21.25	3.26	33.14	44.53	74	-29.47	Vertical
2400	52.15	21.75	3.54	33.42	44.02	74	-29.98	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310	51.17	21.25	3.26	33.14	42.54	54	-11.46	Horizontal
2400	45.34	21.75	3.54	33.42	37.21	54	-16.79	Horizontal
2310	43.19	21.25	3.26	33.14	34.56	54	-19.44	Vertical
2400	37.63	21.75	3.54	33.42	29.5	54	-24.5	Vertical

2480MHz
Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.5	57.47	22.12	3.65	33.54	49.7	74	-24.3	Horizontal
2500	55.19	22.35	3.98	33.27	48.25	74	-25.75	Horizontal
2483.5	53.17	22.12	3.65	33.54	45.4	74	-28.6	Vertical
2500	57.36	22.35	3.98	33.27	50.42	74	-23.58	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.5	51.07	22.12	3.65	33.54	43.3	54	-10.7	Horizontal
2500	43.36	22.35	3.98	33.27	36.42	54	-17.58	Horizontal
2483.5	45.33	22.12	3.65	33.54	37.56	54	-16.44	Vertical
2500	34.64	22.35	3.98	33.27	27.7	54	-26.3	Vertical

Remark: Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
All of the restriction bands were tested, and only the data of worst case was exhibited.

Measurement data:
Field Strength of The Fundamental Signal

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
2402	104.15	22.55	3.25	33.45	96.50	114	-17.5	Vertical
2402	103.65	22.55	3.25	33.45	96.00	114	-18	Horizontal
2440	102.54	23.05	3.36	33.15	95.80	114	-18.2	Vertical
2440	97.33	23.05	3.36	33.15	90.59	114	-23.41	Horizontal
2480	96.27	23.57	3.67	33.68	89.83	114	-24.17	Vertical
2480	94.15	23.57	3.67	33.68	87.71	114	-26.29	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
2402	90.33	22.55	3.25	33.45	82.68	94	-11.32	Vertical
2402	83.42	22.55	3.25	33.45	75.77	94	-18.23	Horizontal
2440	87.14	23.05	3.36	33.15	80.4	94	-13.6	Vertical
2440	85.35	23.05	3.36	33.15	78.61	94	-15.39	Horizontal
2480	83.15	23.57	3.67	33.68	76.71	94	-17.29	Vertical
2480	83.65	23.57	3.67	33.68	77.21	94	-16.79	Horizontal

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*

4.4 Channel Bandwidth

Test Requirement:	FCC Part15 C Section 15.215
Test Method:	ANSI C63.10: 2013

4.4.1 Applied procedures / limit

FCC Part15 (15.215) , Subpart C			
Section	Test Item	Frequency Range (MHz)	Result
15.215	Bandwidth	2400-2483.5	PASS

4.4.2 TEST PROCEDURE

1. Set resolution bandwidth (RBW) = 1-5% or DTS BW, not to exceed 100 kHz.
2. Set the video bandwidth (VBW) ⩾ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

4.4.3 DEVIATION FROM STANDARD

No deviation.

4.4.4 TEST SETUP

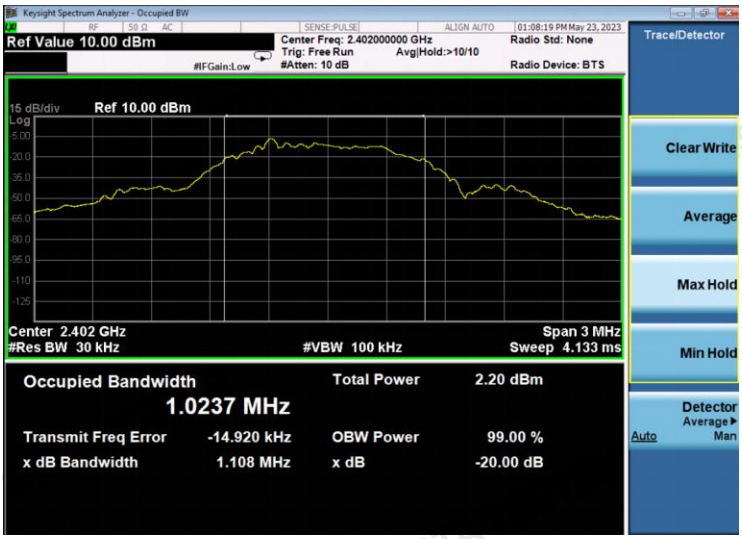
4.4.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

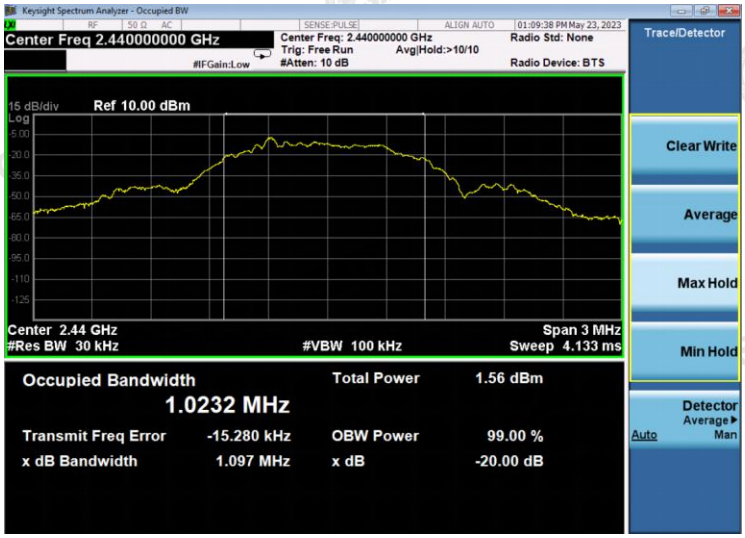
4.4.6 TEST RESULTS

Temperature：	26℃	Relative Humidity：	54%
Test Mode ：	GFSK	Test Voltage ：	DC 5V

Test channel	Channel Bandwidth (MHz)	Result
Lowest	1.108	Pass
Middle	1.097	
Highest	1.106	



Lowest channel



Middle channel

Highest channel

4.5 Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203:

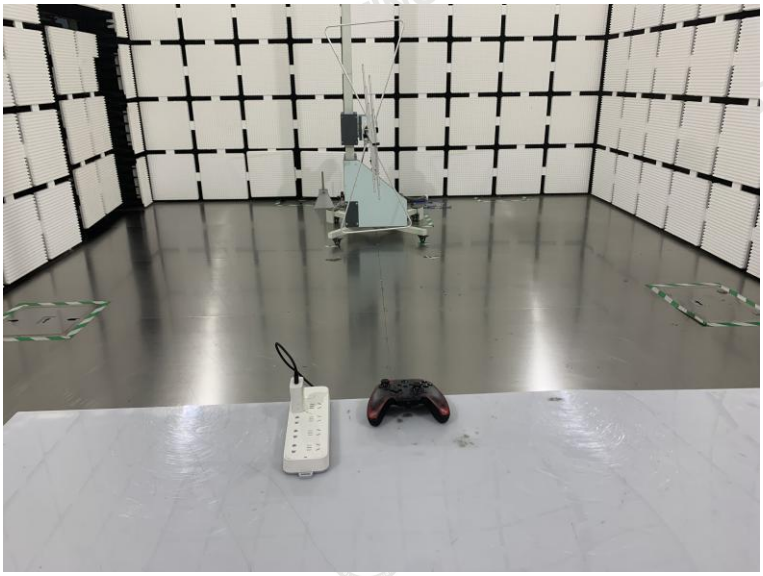
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit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

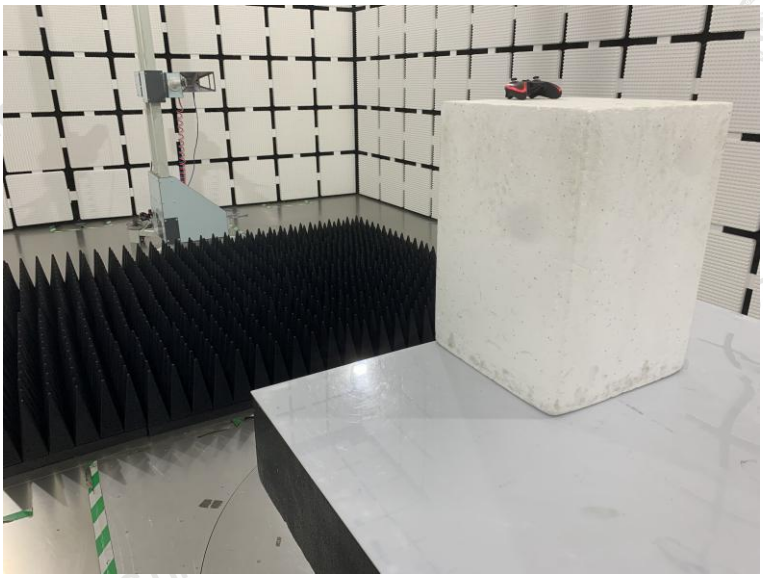
Antenna Connected Construction

The maximum gain of antenna was 1.6 dBi.

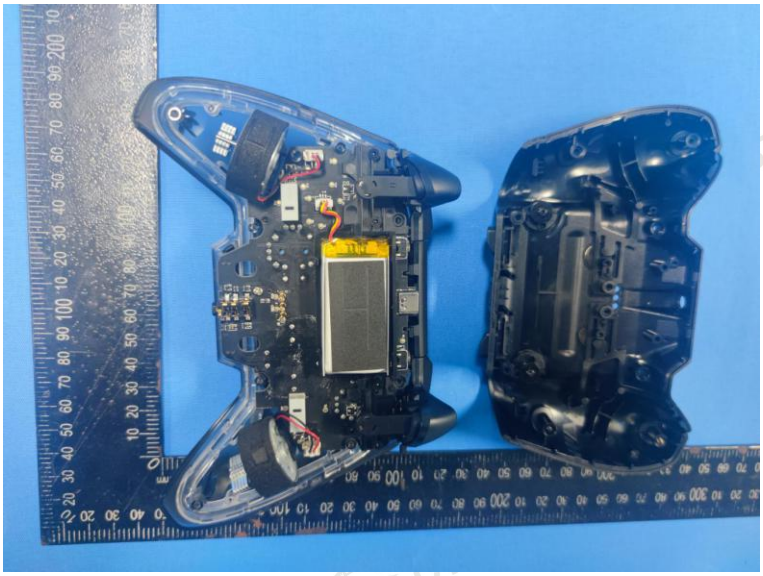
Remark:The antenna gain is provided by the customer , if the data provided by the customer is not accurate, Shenzhen CTA Testing Technology Co., Ltd. does not assume any responsibility.

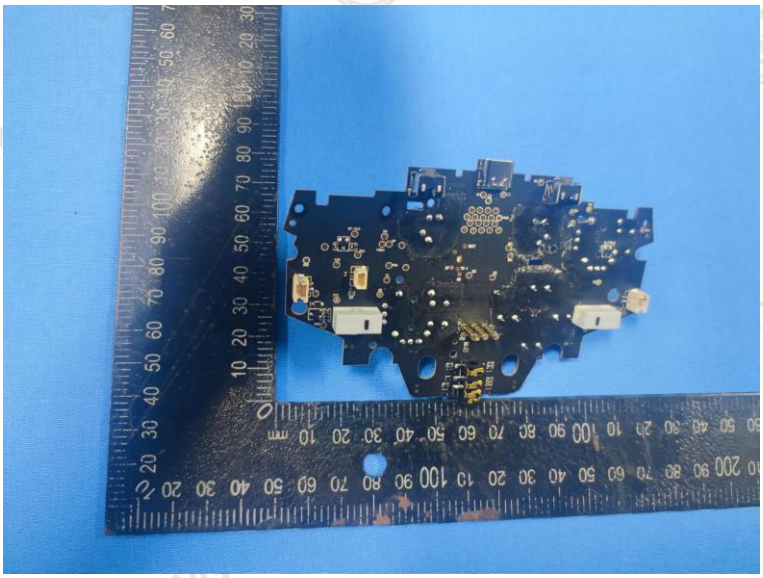
5 Test Setup Photos of the EUT

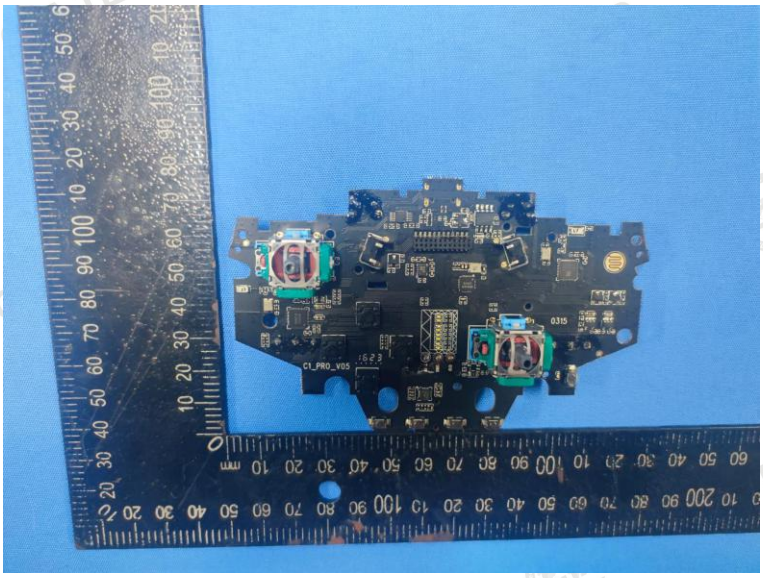


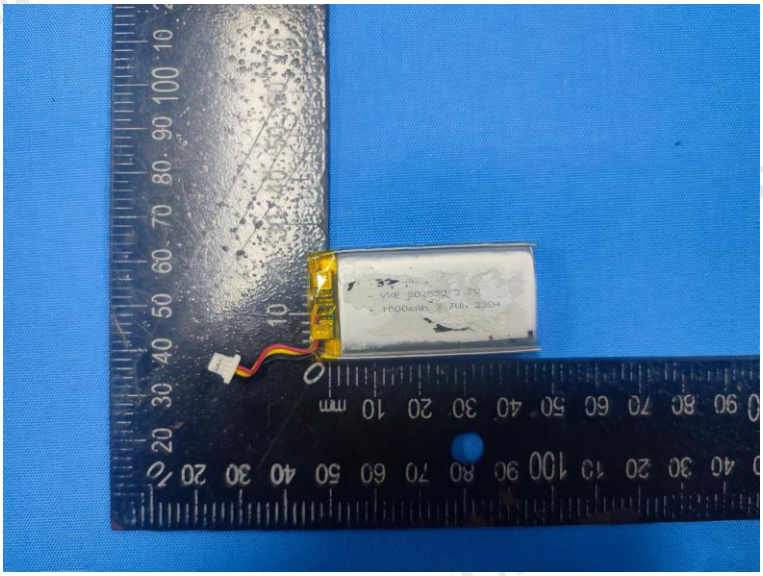


6 Photos of the EUT









********** End of Report **********