Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.249

Report Reference No.....	**CTA22022800701**
FCC ID.....	**BOOKP-81061SM**
Compiled by (position+printed name+signature)..	File administrators Kevin Liu
Supervised by (position+printed name+signature)..	Project Engineer Kevin Liu
Approved by (position+printed name+signature)..	RF Manager Eric Wang
Date of issue.....	Feb. 28, 2022
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.....	**Unisen Limited**
Address.....	Room 907, Fook Hong Industrial Bldg.,19 Sheung Yuet Road, Kowloon Bay, Kowloon, Hong Kong
Test specification.....	:
Standard.....	**FCC CFR Title 47 Part 15 Subpart C Section 15.249** **ANSI C63.10:2013**

Equipment description.....	**wireless Keyboard**
Trade Mark.....	iPazzPort
Manufacturer.....	Unisen Limited
Model/Type reference.....	KP-810-61SM
Listed Models	KP-810-61, KP-810-61SM, KP-810-61BT, KP-810-61D
Modulation	GFSK
Frequency.....	From 2405MHz to 2470MHz
Ratings.....	DC 5.0V from USB Port
Result.....	**PASS**

TEST REPORT

Equipment under Test	:	wireless Keyboard
Model /Type	:	KP-810-61SM
Listed Models	:	KP-810-61, KP-810-61SM, KP-810-61BT, KP-810-61D
Applicant	:	Unisen Limited
Address	:	Room 907, Fook Hong Industrial Bldg.,19 Sheung Yuet Road, Kowloon Bay, Kowloon, Hong Kong
Manufacturer	:	Unisen Limited
Address	:	NO.1, Wuwu Road, BanShi Wuwu Village, Changping Town, Dongguan City Guangdong Prov. China

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

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
KDB558074 D01 V05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.249

2 SUMMARY

2.1 General Remarks

Date of receipt of test sample	:	Feb. 18, 2022
Testing commenced on	:	Feb. 19, 2022
Testing concluded on	:	Feb. 25, 2022

2.2 Product Description

Product Description:	wireless Keyboard
Model/Type reference:	KP-810-61SM
Listed Models:	KP-810-61, KP-810-61SM, KP-810-61BT, KP-810-61D
Model Different.:	Only for different model name.
Power supply:	DC 5.0V from USB Port
Adapter information (Auxiliary test supplied by testing Lab):	Model: EP-TA20CBC Input:AC 100-240V 50/60Hz Output:DC 5V 2A
Testing sample ID：	CTA22022800701
2.4G	
Supported type:	2.4G
Modulation:	GFSK
Operation frequency:	2405MHz to 2470MHz
Channel number:	66
Channel separation:	1 MHz
Antenna type:	PCB antenna
Antenna gain:	0.00 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 3.7V From Battery and DC 5V From external circuit

2.4 Short description of the Equipment under Test (EUT)

This is a 2.4G wireless Keyboard.
For more details, refer to the user's manual of the EUT.

2.5 EUT operation mode

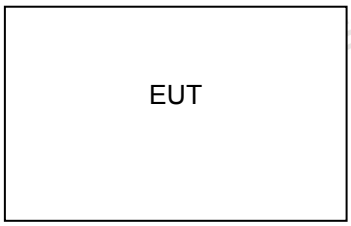
The Applicant provides communication tools software(Engineer mode) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 66 channels provided to the EUT and Channel 1/26/66 were selected to test.

Operation Frequency：

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	**2405MHz**	21	2425 MHz	41	2445 MHz	61	2465 MHz
2	2406 MHz	22	2426 MHz	42	2446 MHz	62	2466 MHz
3	2407 MHz	23	2427 MHz	43	2447 MHz	63	2467 MHz
4	2408 MHz	24	2428 MHz	44	2448 MHz	64	2468 MHz
5	2409 MHz	25	2429 MHz	45	2449 MHz	65	2469 MHz
6	2410 MHz	**26**	**2430 MHz**	46	2450 MHz	**66**	**2470 MHz**
7	2411 MHz	27	2431MHz	47	2451 MHz		
8	2412 MHz	28	2432 MHz	48	2452 MHz		
9	2413 MHz	29	2433 MHz	49	2453 MHz		
10	2414 MHz	30	2434 MHz	50	2454 MHz		
11	2415 MHz	31	2435 MHz	51	2455 MHz		
12	2416 MHz	32	2436 MHz	52	2456 MHz		
13	2417 MHz	33	2437 MHz	53	2457 MHz		
14	2418 MHz	34	2438 MHz	54	2458 MHz		
15	2419 MHz	35	2439 MHz	55	2459 MHz		
16	2420 MHz	36	2440 MHz	56	2460 MHz		
17	2421 MHz	37	2441MHz	57	2461 MHz		
18	2422 MHz	38	2442 MHz	58	2462 MHz		
19	2423 MHz	39	2443 MHz	59	2463 MHz		
20	2424 MHz	40	2444 MHz	60	2464 MHz		

Channel	Frequency
The lowest channel	2405MHz
The middle channel	2430MHz
The Highest channel	2470MHz

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 15.249 (a)(2)	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	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)

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

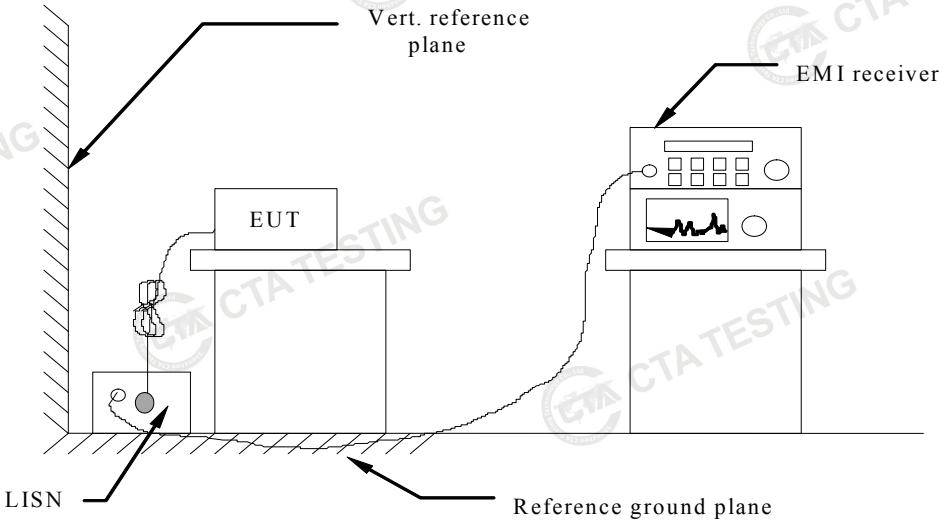
3.6 Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Equipment No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	CTA-308	2021/08/06	2022/08/05
LISN	R&S	ENV216	CTA-314	2021/08/06	2022/08/05
EMI Test Receiver	R&S	ESPI	CTA-307	2021/08/06	2022/08/05
EMI Test Receiver	R&S	ESCI	CTA-306	2021/08/06	2022/08/05
Spectrum Analyzer	Agilent	N9020A	CTA-301	2021/08/06	2022/08/05
Spectrum Analyzer	R&S	FSP	CTA-337	2021/08/06	2022/08/05
Vector Signal generator	Agilent	N5182A	CTA-305	2021/08/06	2022/08/05
Analog Signal Generator	R&S	SML03	CTA-304	2021/08/06	2022/08/05
Universal Radio Communication	CMW500	R&S	CTA-302	2021/08/06	2022/08/05
Temperature and humidity meter	Chigo	ZG-7020	CTA-326	2021/08/06	2022/08/05
Ultra-Broadband Antenna	Schwarzbeck	VULB9163	CTA-310	2021/08/07	2022/08/06
Horn Antenna	Schwarzbeck	BBHA 9120D	CTA-309	2021/08/07	2022/08/06
Loop Antenna	Zhinan	ZN30900C	CTA-311	2021/08/07	2022/08/06
Horn Antenna	Beijing Hangwei Dayang	OBH100400	CTA-336	2021/08/06	2022/08/05
Amplifier	Schwarzbeck	BBV 9745	CTA-312	2021/08/06	2022/08/05
Amplifier	Taiwan chengyi	EMC051845B	CTA-313	2021/08/06	2022/08/05
Directional coupler	NARDA	4226-10	CTA-303	2021/08/06	2022/08/05
High-Pass Filter	XingBo	XBLBQ-GTA18	CTA-402	2021/08/06	2022/08/05
High-Pass Filter	XingBo	XBLBQ-GTA27	CTA-403	2021/08/06	2022/08/05
Automated filter bank	Tonscend	JS0806-F	CTA-404	2021/08/06	2022/08/05
Power Sensor	Agilent	U2021XA	CTA-405	2021/08/06	2022/08/05
Amplifier	Schwarzbeck	BBV9719	CTA-406	2021/08/06	2022/08/05

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.

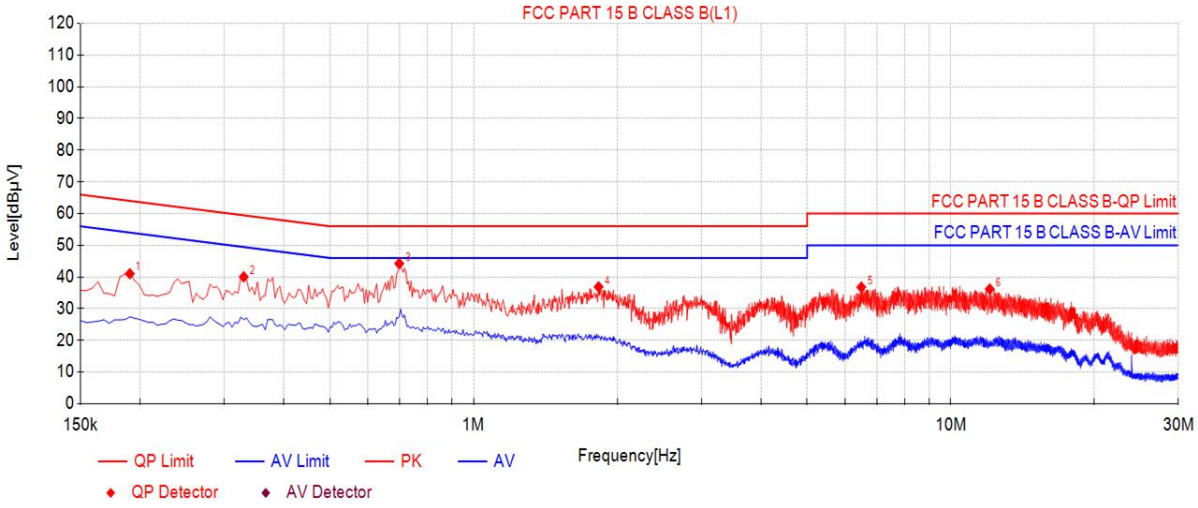
AC Power Conducted Emission Limit

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

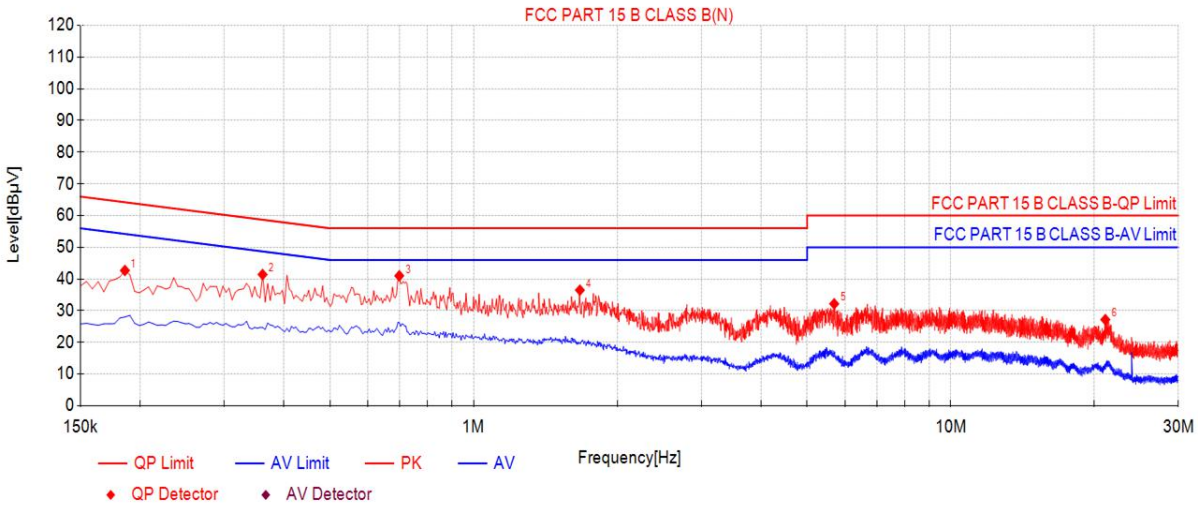
NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Detector	Type	Verdict
1	0.1905	30.53	41.03	10.50	64.01	22.98	PK	L1	PASS
2	0.33	29.55	40.05	10.50	59.45	19.40	PK	L1	PASS
3	0.699	33.73	44.23	10.50	56.00	11.77	PK	L1	PASS
4	1.8285	26.37	36.87	10.50	56.00	19.13	PK	L1	PASS
5	6.495	26.29	36.79	10.50	60.00	23.21	PK	L1	PASS
6	12.075	25.68	36.18	10.50	60.00	23.82	PK	L1	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	0.186	32.19	42.69	10.50	64.21	21.52	PK	N	PASS
2	0.3615	30.91	41.41	10.50	58.69	17.28	PK	N	PASS
3	0.699	30.51	41.01	10.50	56.00	14.99	PK	N	PASS
4	1.671	25.99	36.49	10.50	56.00	19.51	PK	N	PASS
5	5.6985	21.67	32.17	10.50	60.00	27.83	PK	N	PASS
6	21.084	16.67	27.17	10.50	60.00	32.83	PK	N	PASS

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

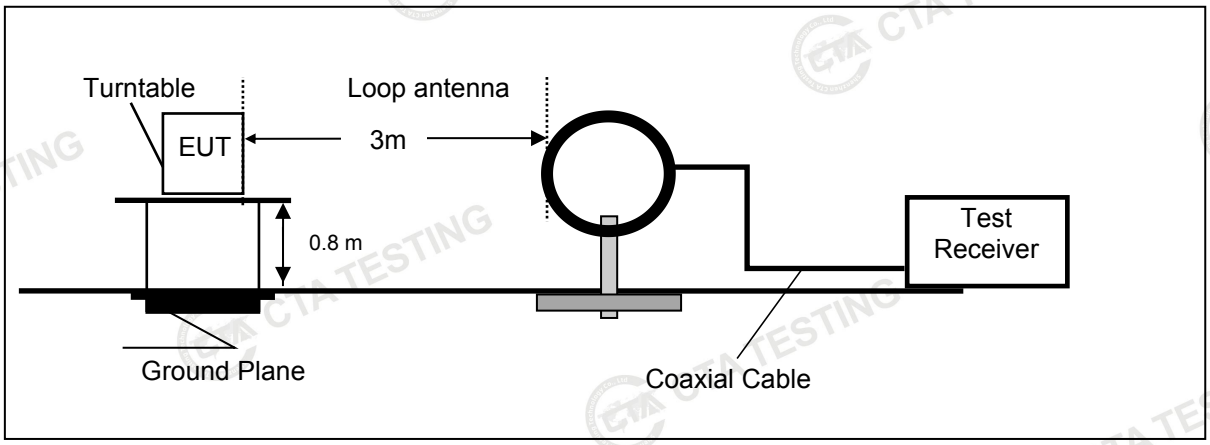
2). Factor (dB)=insertion loss of LISN (dB) + Cable loss (dB)

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

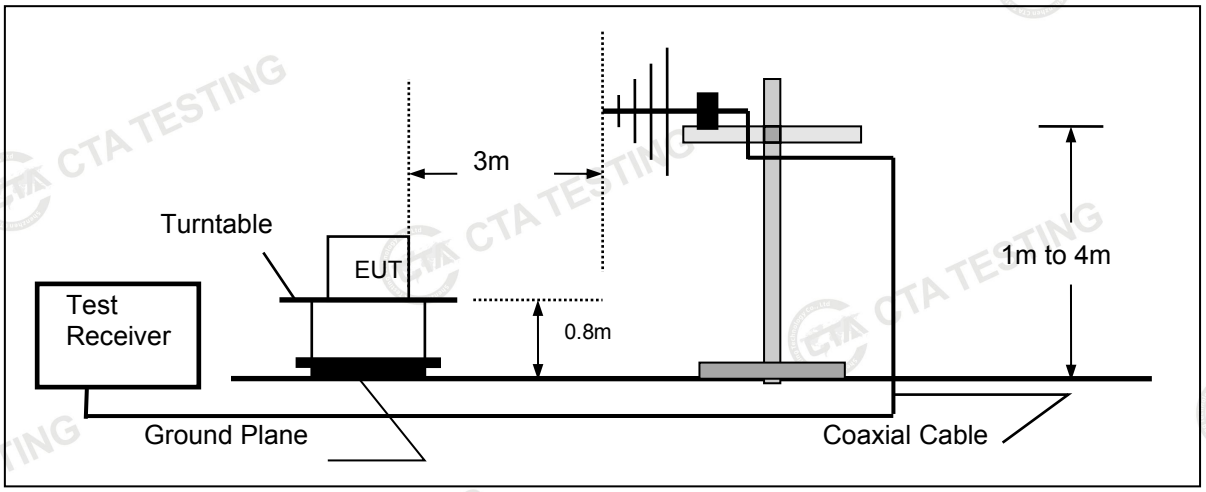
4.2 Radiated Emissions and Band Edge

TEST CONFIGURATION

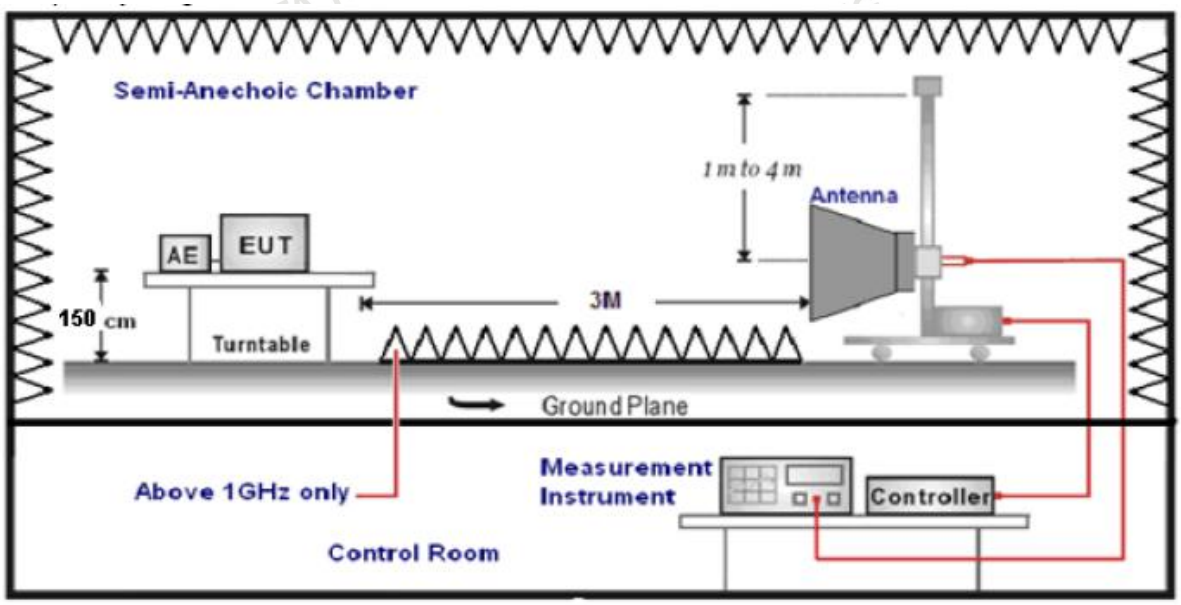
Frequency range 9 KHz – 30MHz



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

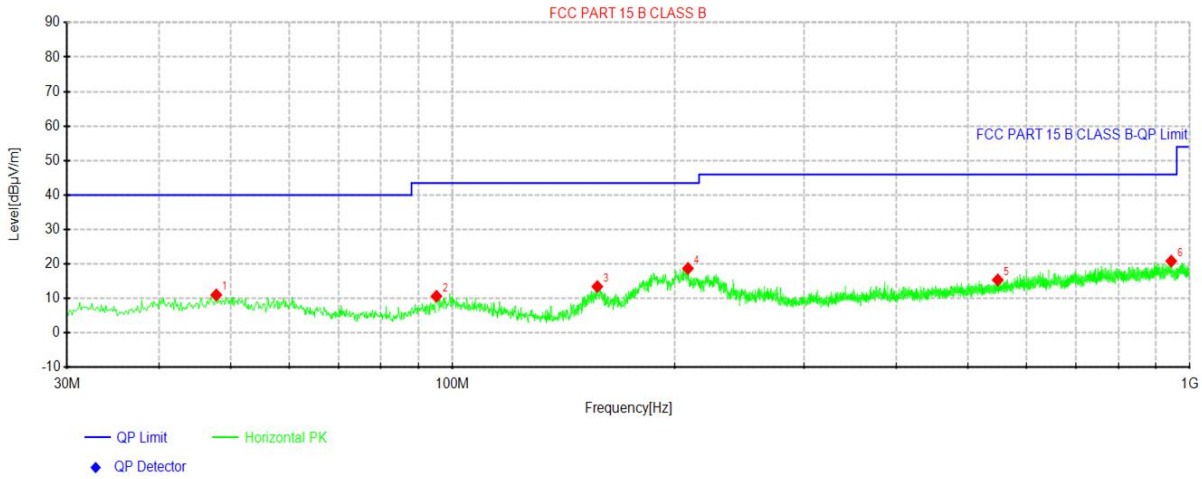
TEST RESULTS

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

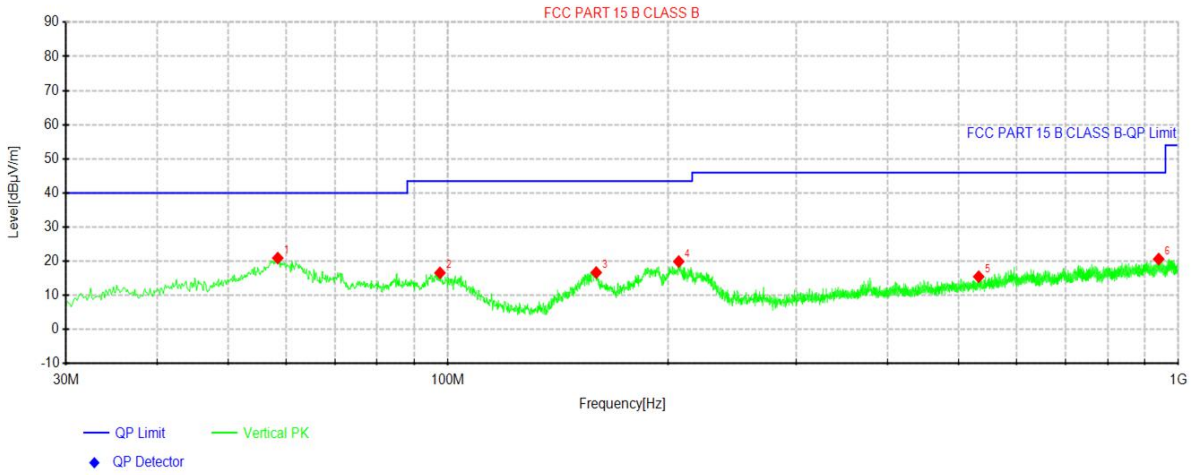
NO.	Freq. [MHz]	Reading [dBµV]	Level [dBµV/m]	Factor [dB/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	47.8237	27.27	11.04	-16.23	40.00	28.96	100	257	Horizontal
2	95.1112	29.78	10.65	-19.13	43.50	32.85	100	0	Horizontal
3	157.191	35.12	13.46	-21.66	43.50	30.04	100	16	Horizontal
4	208.601	37.84	18.71	-19.13	43.50	24.79	100	46	Horizontal
5	548.95	29.08	15.39	-13.69	46.00	30.61	100	210	Horizontal
6	943.861	29.84	20.85	-8.99	46.00	25.15	100	351	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	58.4938	38.82	20.93	-17.89	40.00	19.07	100	244	Vertical
2	97.5362	35.35	16.60	-18.75	43.50	26.90	100	315	Vertical
3	159.616	38.34	16.71	-21.63	43.50	26.79	100	252	Vertical
4	207.025	39.10	19.94	-19.16	43.50	23.56	100	350	Vertical
5	532.945	29.29	15.48	-13.81	46.00	30.52	100	360	Vertical
6	939.86	29.57	20.65	-8.92	46.00	25.35	100	221	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):			2405			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
4810.00	58.54	21.52	3.52	33.12	50.46	74	-23.54	Vertical
4810.00	54.26	23.65	4.56	33.08	49.39	74	-24.61	Vertical
7215.00	57.24	21.52	3.52	33.12	49.16	74	-24.84	Horizontal
7215.00	53.58	23.65	4.56	33.08	48.71	74	-25.29	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
4810.00	48.25	21.52	3.52	33.12	40.17	54	-13.83	Vertical
4810.00	44.26	23.65	4.56	33.08	39.39	54	-14.61	Vertical
7215.00	47.76	21.52	3.52	33.12	39.68	54	-14.32	Horizontal
7215.00	42.35	23.65	4.56	33.08	37.48	54	-16.52	Horizontal

Frequency(MHz):			2430			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
4860.00	58.88	21.78	3.58	33.27	50.97	74	-23.03	Vertical
4860.00	53.19	24.15	4.57	33.87	48.04	74	-25.96	Vertical
7290.00	57.64	21.78	3.58	33.27	49.73	74	-24.27	Horizontal
7290.00	52.26	24.15	4.57	33.87	47.11	74	-26.89	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
4860.00	48.75	21.78	3.58	33.27	40.84	54	-13.16	Vertical
4860.00	43.25	24.15	4.57	33.87	38.10	54	-15.90	Vertical
7290.00	47.73	21.78	3.58	33.27	39.82	54	-14.18	Horizontal
7290.00	42.26	24.15	4.57	33.87	37.11	54	-16.89	Horizontal

Frequency(MHz):			2470			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
4940.00	57.55	22.56	4.17	33.75	50.53	74	-23.47	Vertical
4940.00	53.16	24.78	5.36	33.17	50.13	74	-23.87	Vertical
7410.00	57.74	22.56	4.17	33.75	50.72	74	-23.28	Horizontal
7410.00	52.24	24.78	5.36	33.17	49.21	74	-24.79	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
4940.00	47.56	22.56	4.17	33.75	40.54	54	-13.46	Vertical
4940.00	42.38	24.78	5.36	33.17	39.35	54	-14.65	Vertical
7410.00	47.55	22.56	4.17	33.75	40.53	54	-13.47	Horizontal
7410.00	41.96	24.78	5.36	33.17	38.93	54	-15.07	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>Receiver setup:</td><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Value</td></tr>
<tr><td></td><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr>
<tr><td></td><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:

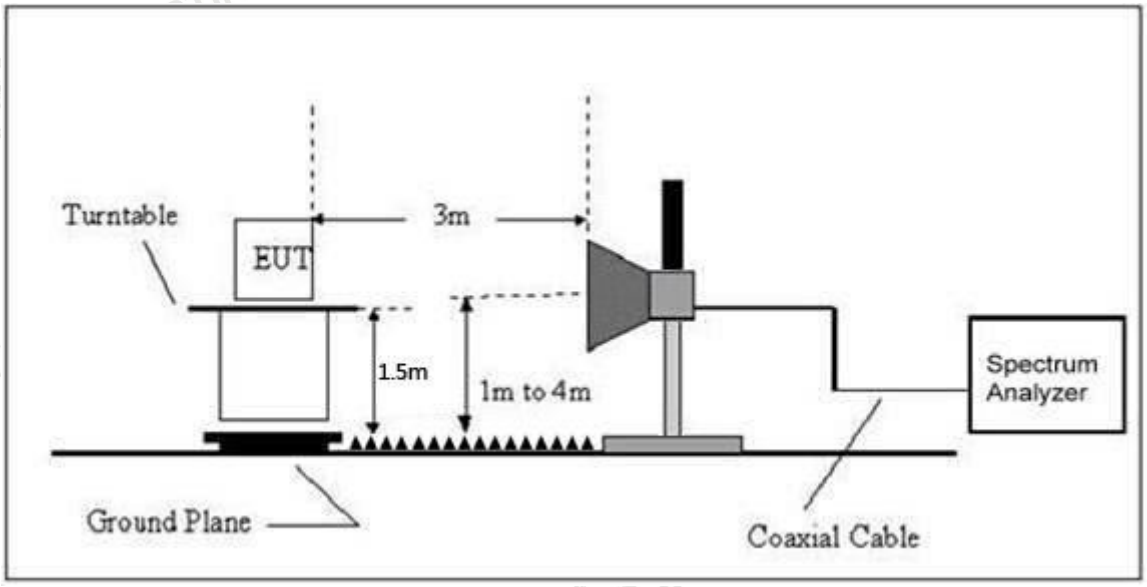
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

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

2405MHz
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	53.65	21.25	3.26	33.14	45.02	74	-28.98	Horizontal
2400	51.28	21.75	3.54	33.42	43.15	74	-30.85	Horizontal
2310	52.47	21.25	3.26	33.14	43.84	74	-30.16	Vertical
2400	50.26	21.75	3.54	33.42	42.13	74	-31.87	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	38.46	21.25	3.26	33.14	29.83	54	-24.17	Horizontal
2400	36.31	21.75	3.54	33.42	28.18	54	-25.82	Horizontal
2310	36.43	21.25	3.26	33.14	27.80	54	-26.20	Vertical
2400	34.26	21.75	3.54	33.42	26.13	54	-27.87	Vertical

2470MHz
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	51.28	22.12	3.65	33.54	43.51	74	-30.49	Horizontal
2500	48.36	22.35	3.98	33.27	41.42	74	-32.58	Horizontal
2483.5	50.46	22.12	3.65	33.54	42.69	74	-31.31	Vertical
2500	48.18	22.35	3.98	33.27	41.24	74	-32.76	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	38.14	22.12	3.65	33.54	30.37	54	-23.63	Horizontal
2500	35.69	22.35	3.98	33.27	28.75	54	-25.25	Horizontal
2483.5	37.88	22.12	3.65	33.54	30.11	54	-23.89	Vertical
2500	35.15	22.35	3.98	33.27	28.21	54	-25.79	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
2405	102.18	22.55	3.25	33.45	94.53	114	-19.47	Vertical
2405	101.21	22.55	3.25	33.45	93.56	114	-20.44	Horizontal
2430	100.15	23.05	3.36	33.15	93.41	114	-20.59	Vertical
2430	99.85	23.05	3.36	33.15	93.11	114	-20.89	Horizontal
2470	98.76	23.57	3.67	33.68	92.32	114	-21.68	Vertical
2470	97.65	23.57	3.67	33.68	91.21	114	-22.79	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
2405	89.69	22.55	3.25	33.45	82.04	94	-11.96	Vertical
2405	88.44	22.55	3.25	33.45	80.79	94	-13.21	Horizontal
2430	87.62	23.05	3.36	33.15	80.88	94	-13.12	Vertical
2430	85.42	23.05	3.36	33.15	78.68	94	-15.32	Horizontal
2470	84.25	23.57	3.67	33.68	77.81	94	-16.19	Vertical
2470	83.43	23.57	3.67	33.68	76.99	94	-17.01	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	0.932	Pass
Middle	0.933	
Highest	0.931	

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

FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1) (I):

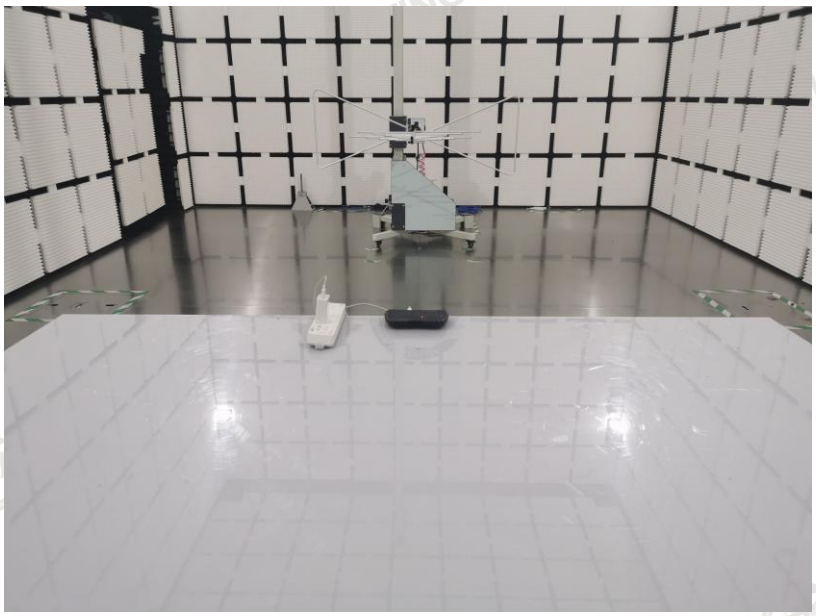
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

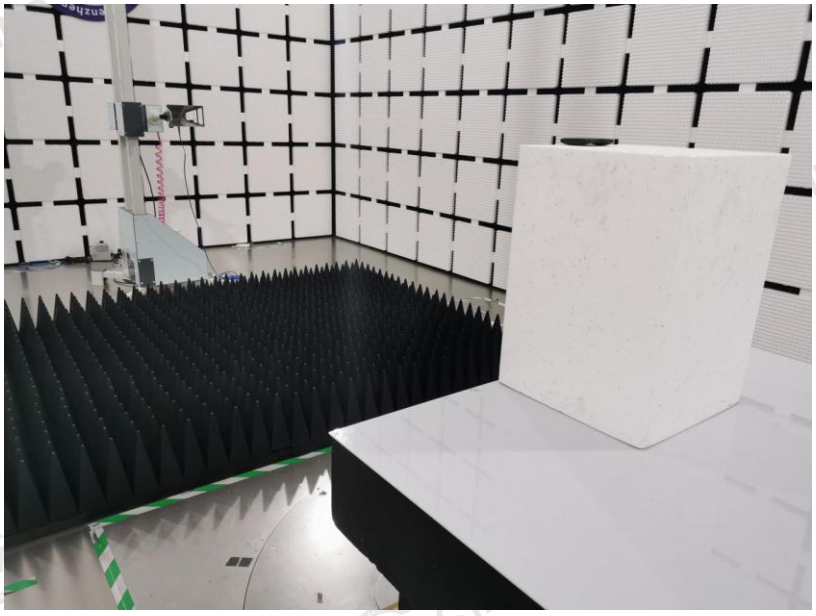
Antenna Connected Construction

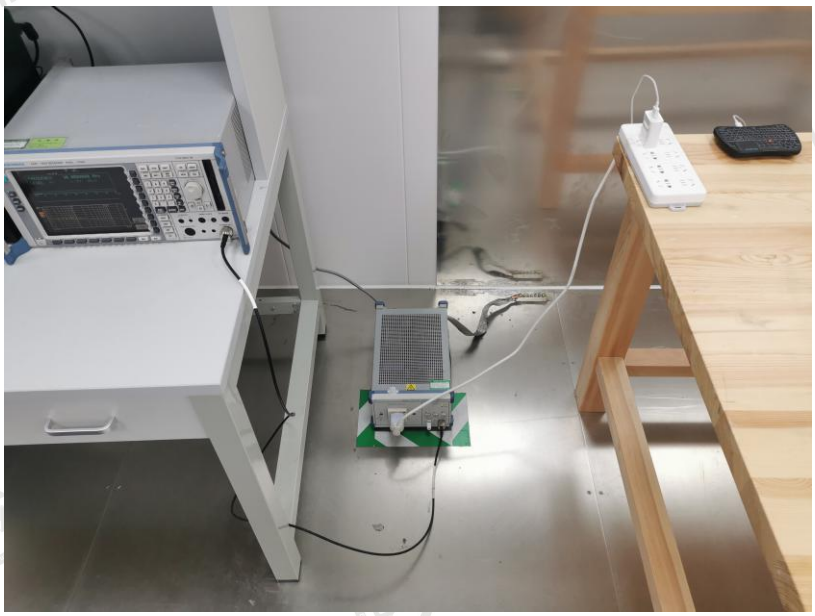
The maximum gain of antenna was 0.00 dBi.

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.

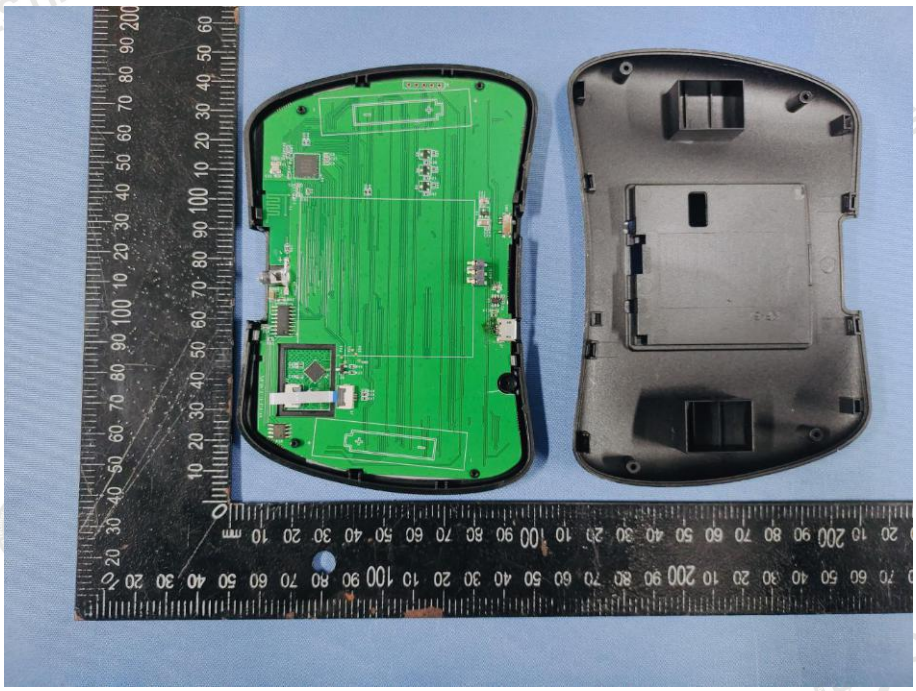
5 Test Setup Photos of the EUT

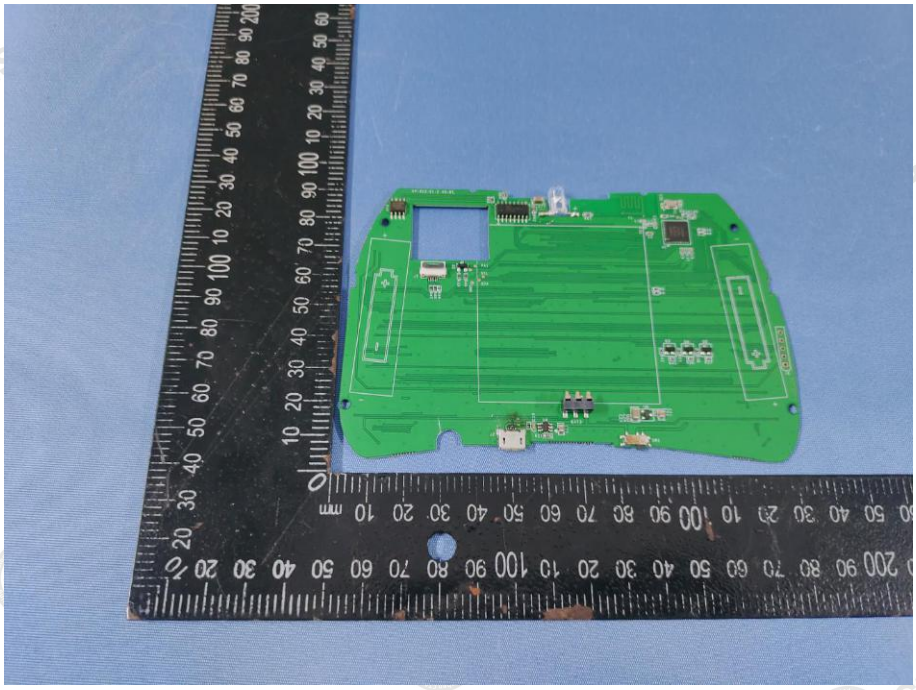


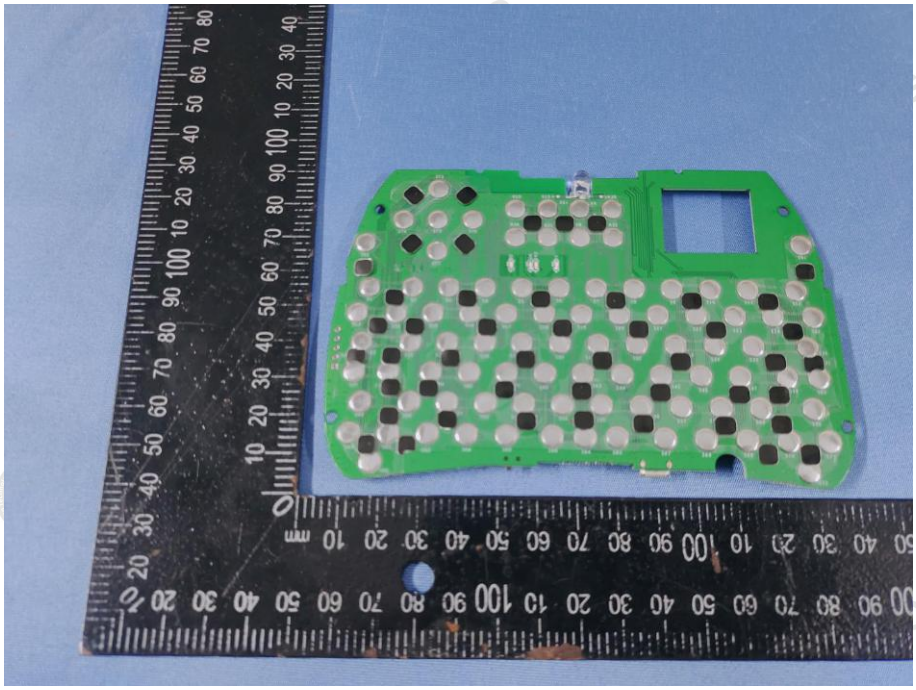


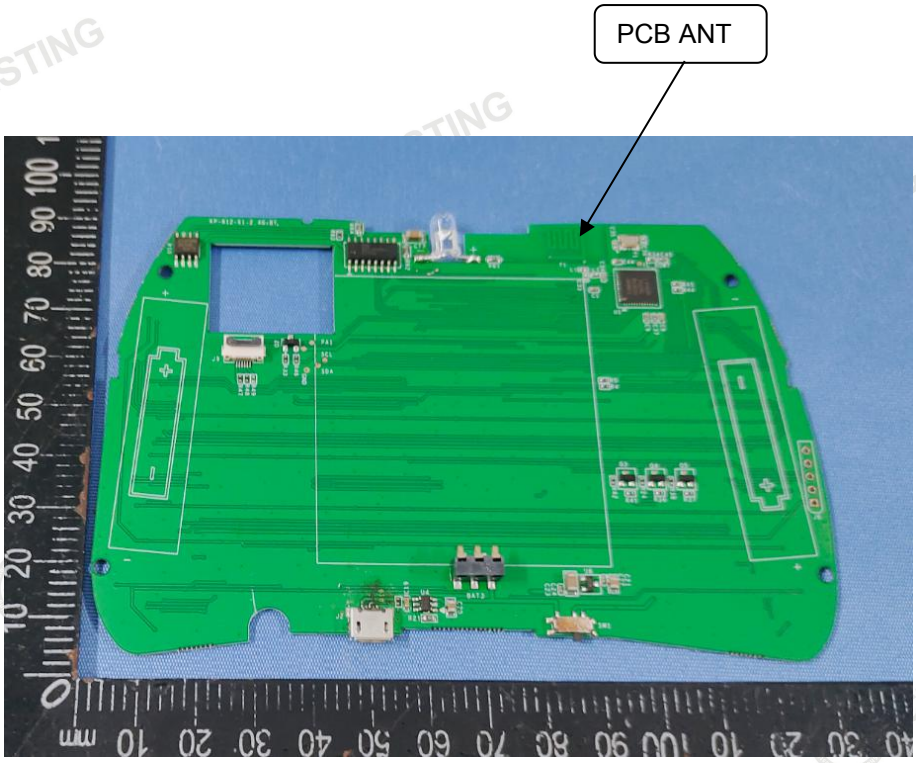


6 Photos of the EUT









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