Test Report

FCC:2ATLE-SU

Product Name:	Surfwheel SU electric skatebaord
Trademark:	Surfwheel
Model Name :	SU SU+
Prepared For : Address :	Koofy Development Ltd. Room 2, Unit 111-113, 1/F Enterprise Place, No.5 Science Park West Avenue, New Territories, Hong Kong
Prepared By : Address :	Shenzhen BCTC Testing Co., Ltd. BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China
Test Date:	May 08, 2019 – Jun. 12, 2019
Date of Report :	Jun. 12, 2019
Report No.:	BCTC-LH190500199E

TEST RESULT CERTIFICATION

Applicant's name ..... :	Koofy Development Ltd.
Address ..... :	Room 2, Unit 111-113, 1/F Enterprise Place, No.5 Science Park West Avenue, New Territories, Hong Kong
Manufacture's Name..... :	Koofy Development Ltd.
Address ..... :	Room 2, Unit 111-113, 1/F Enterprise Place, No.5 Science Park West Avenue, New Territories, Hong Kong
Product description	
Product name ..... :	Surfwheel SU electric skatebaord
Trademark ..... :	Surfwheel
Model and/or type reference :	SU SU+
Standards ..... :	FCC Part15.247 ANSI C63.10:2013

This device described above has been tested by BCTC, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Prepared by(Engineer):	Leke Xie	Leke Xie
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倍测检测 BCTC APPROVED SHENZHEN TESTING CO., LTD

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1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

RSS-247 Issue 2: February 2017 FCC Part15 (15.247) , Subpart C			
Standard Section	Test Item	Judgment	Remark
RSS-GEN 8.8 RSS-247 3.1 15.207	Conducted Emission	PASS	
RSS-247 5.2 (a) 15.247 (a)(2)	6dB Bandwidth	PASS	
RSS-247 5.4 (b) 15.247 (b)	Peak Output Power	PASS	
RSS-247 5.5 15.247 (d)	Radiated Spurious Emission	PASS	
RSS-247 5.2 (b) 15.247 (e)	Power Spectral Density	PASS	
RSS-247 5.5 15.205	Restricted Band of Operation	PASS	
RSS-Gen.6.7 15.247(d)	Band Edge (Out of Band Emissions)	PASS	
RSS-GEN 8.8 RSS-247 3.1 15.203	Antenna Requirement	PASS	

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

1.1 TEST FACILITY

Shenzhen BCTC Testing Co., Ltd.
Add.: BCTC Building & 1-2F, East of B Building, Pengzhou Industrial, Fuyuan 1st Road, Qiaotou Community, Fuyong Street, Bao'an District, Shenzhen, China

FCC Test Firm Registration Number: 712850
IC Registered No.: 23583

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y ± U**，where expended uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**，providing a level of confidence of approximately **95** %。

No.	Item	Uncertainty
1	3m camber Radiated spurious emission(30MHz-1GHz)	U=4.3dB
2	3m chamber Radiated spurious emission(1GHz-18GHz)	U=4.5dB
3	3m chamber Radiated spurious emission(18GHz-40GHz)	U=3.34dB
4	Conducted Adjacent channel power	U=1.38dB
5	Conducted output power uncertainty Above 1G	U=1.576dB
6	Conducted output power uncertainty below 1G	U=1.28dB
7	humidity uncertainty	U=5.3%
8	Temperature uncertainty	U=0.59℃

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	Surfwheel SU electric skatebaord
Trade Name	Surfwheel
Model Name	SU SU+
Model Difference	All the model are the same circuit and RF module, except model names .
Product Description	The EUT is a Surfwheel SU electric skatebaord Operation Frequency: 2404-2478 MHz Modulation Type: GFSK Number Of Channel 38CH Antenna Designation: Please see Note 3. Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.
Channel List	Please refer to the Note 2.
Ratings	DC 43.2V For battery
Adapter	INPUT: 100V-240VAC 50/60Hz 1.5A max OUTPUT: DC42.0V 1.5A
Connecting I/O Port(s)	Please refer to the User's Manual
Hardware Version:	H1.0
Software Version:	S1.0

Note:
1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2404	11	2422	21	2442
02	2406	12	2424	22	2444
03	2408	13	2426	23	2446
~	~	~	~	~	~
09	2418	19	2438	38	2478
10	2420	20	2440		

3.

Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Gain (dBi)
1	N/A	N/A	PCB antenna	2

2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

For All Mode	Description	Modulation Type
Mode 1	CH01	GFSK
Mode 2	CH20	
Mode 3	CH38	
Mode 4	Link mode(conducted emission and Radiated emission)	

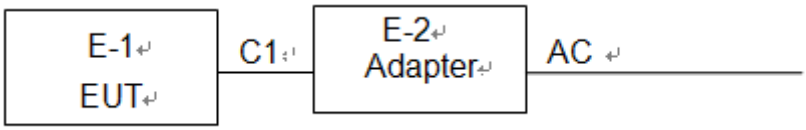
Note:

(1) The measurements are performed at the highest, middle, lowest available channels.

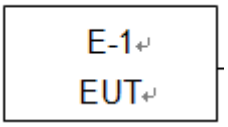
(2) Fully-charged battery is used during the test

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Conducted Emission



Radiated Spurious Emission



2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Device Type	Brand	Model	Series No.	Data Cable
E-1	Surfwheel SU electric skatebaord	N/A	SU	N/A	EUT
E-2	Adapter	N/A	XVE70-420 0150	N/A	Auxiliary

Item	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	1M	DC cable unshielded

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation Test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Spectrum Analyzer (9kHz-26.5GHz)	Agilent	E4407B	MY45109572	2018.06.20	2019.06.20
2	Test Receiver (9kHz-7GHz)	R&S	ESR7	101154	2018.06.20	2019.06.20
3	Bilog Antenna (30MHz-3GHz)	SCHWARZBECK	VULB9163	VULB9163-942	2018.06.23	2019.06.23
4	Horn Antenna (1GHz-18GHz)	SCHWARZBECK	BBHA9120D	1541	2018.06.23	2021.06.22
5	Horn Antenna (18GHz-40GHz)	SCHWARZBECK	BBHA9170	822	2018.08.06	2019.08.06
6	Amplifier (9KHz-6GHz)	SCHWARZBECK	BBV9744	9744-0037	2018.06.20	2019.06.20
7	Amplifier (0.5GHz-18GHz)	SCHWARZBECK	BBV9718	9718-309	2018.06.20	2019.06.20
8	Amplifier (18GHz-40GHz)	MITEQ	TTA1840-35-HG	2034381	2018.08.06	2019.08.06
9	Loop Antenna (9KHz-30MHz)	SCHWARZBECK	FMZB1519B	014	2018.06.23	2019.06.23
10	RF cables1 (9kHz-30MHz)	Huber+Suhnar	9kHz-30MHz	B1702988-0008	2019.02.12	2020.02.12
11	RF cables2 (30MHz-1GHz)	Huber+Suhnar	30MHz-1GHz	1486150	2019.03.27	2020.03.27
12	RF cables3 (1GHz-40GHz)	Huber+Suhnar	1GHz-40GHz	1607106	2018.06.19	2019.06.19
13	Power Metter	Keysight	E4419	\	2018.06.15	2019.06.15
14	Power Sensor (AV)	Keysight	E9 300A	\	2018.06.15	2019.06.15
15	Signal Analyzer 20kHz-26.5GHz	KEYSIGHT	N9020A	MY49100060	2018.08.14	2019.08.13
16	Test Receiver 9kHz-40GHz	R&S	FSP40	100550	2018.06.13	2019.06.12
17	D.C. Power Supply	LongWei	TPR-6405D	\	\	\
18	Software	Frad	EZ-EMC	FA-03A2 RE	\	\

Conduction Test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Test Receiver	R&S	ESR3	102075	2018.06.20	2019.06.20
2	LISN	SCHWARZBECK	NSLK8127	8127739	2018.06.19	2019.06.19
3	LISN	R&S	ENV216	101375	2018.06.20	2019.06.20
4	RF cables	Huber+Suhnar	9kHz-30MHz	B1702988-0008	2019.02.12	2020.02.12
5	Software	Frad	EZ-EMC	EMC-CON 3A1	\	\

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	Limit (dBuV)		Standard
	Quas -peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	56.00	46.00	FCC
5.0 -30.0	60.00	50.00	FCC

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

3.1.2 TEST PROCEDURE

a. The EUT was placed 0.1 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

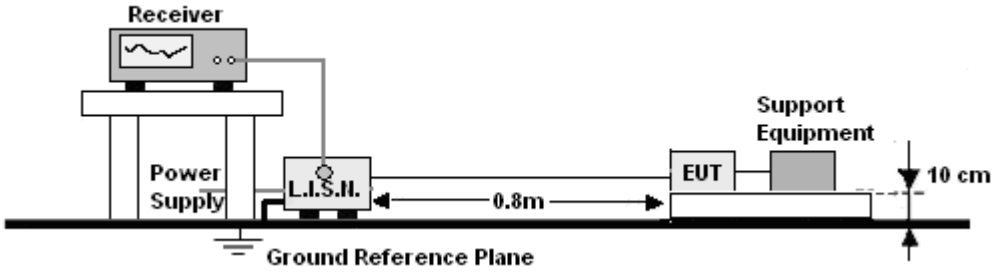
d. LISN at least 80 cm from nearest part of EUT chassis.

e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 DEVIATION FROM TEST STANDARD

No deviation

3.1.4 TEST SETUP



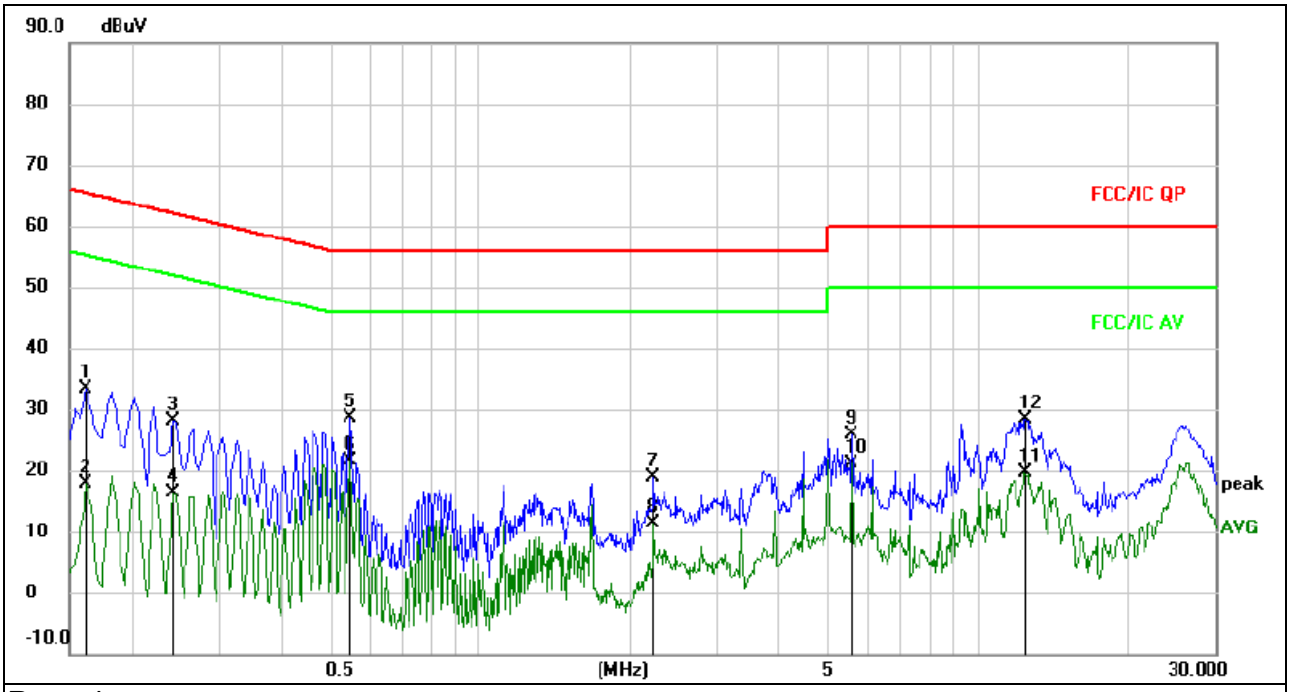
3.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

We pretest AC 120V and AC 240V, the worst voltage was AC 120V and the data recording in the report.

3.1.6 TEST RESULTS

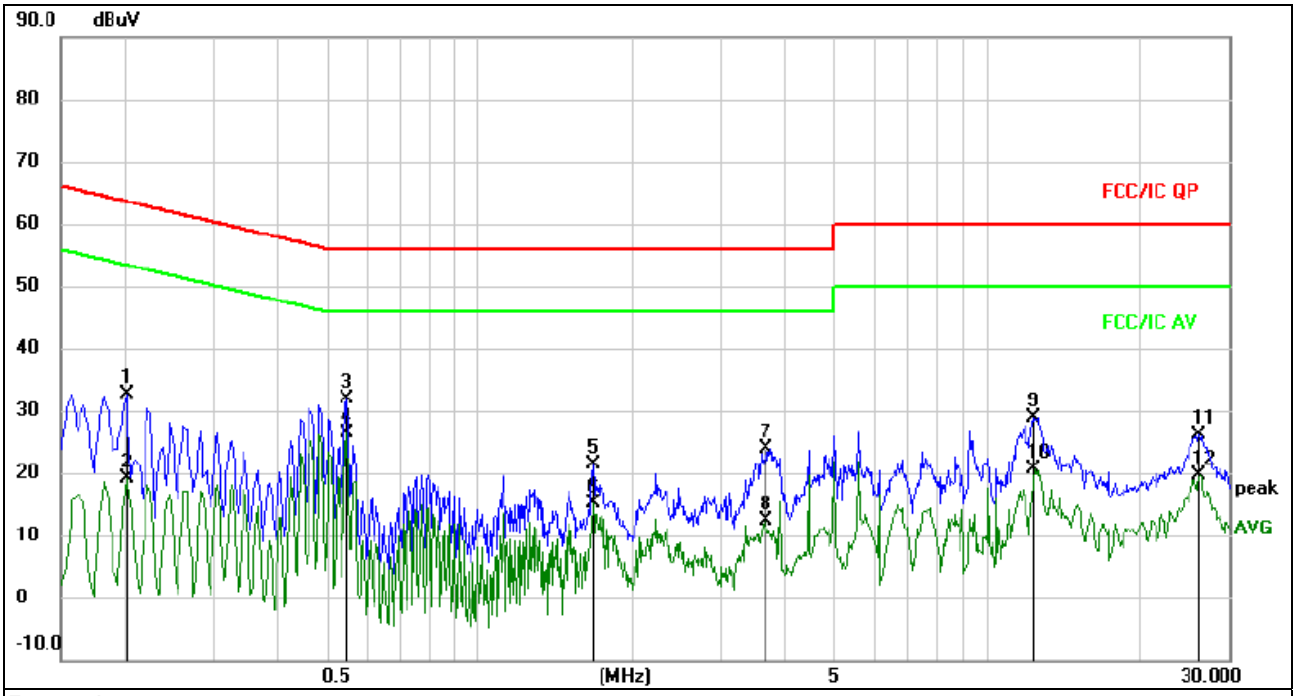
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	101kPa	Phase：	L
Test Voltage ：	AC120V 60Hz	Test Mode：	Mode 4



Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV		dBuV	dBuV	dB	Detector	Comment
1		0.1620	23.95	9.51	33.46	65.36	-31.90	QP	
2		0.1620	8.27	9.51	17.78	55.36	-37.58	AVG	
3		0.2420	18.64	9.51	28.15	62.03	-33.88	QP	
4		0.2420	6.88	9.51	16.39	52.03	-35.64	AVG	
5		0.5500	18.84	9.80	28.64	56.00	-27.36	QP	
6	*	0.5500	11.84	9.80	21.64	46.00	-24.36	AVG	
7		2.2340	9.27	9.61	18.88	56.00	-37.12	QP	
8		2.2340	1.73	9.61	11.34	46.00	-34.66	AVG	
9		5.5820	16.00	9.78	25.78	60.00	-34.22	QP	
10		5.5820	11.39	9.78	21.17	50.00	-28.83	AVG	
11		12.4060	9.96	9.69	19.65	50.00	-30.35	AVG	
12		12.4860	18.78	9.69	28.47	60.00	-31.53	QP	

Temperature :	26 ℃	Relative Humidity :	54%
Pressure :	101kPa	Phase :	N
Test Voltage :	AC120V 60Hz	Test Mode :	Mode 4



Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV		dBuV	dBuV	dB	Detector	Comment
1		0.2020	23.25	9.46	32.71	63.53	-30.82	QP	
2		0.2020	9.76	9.46	19.22	53.53	-34.31	AVG	
3		0.5500	22.07	9.80	31.87	56.00	-24.13	QP	
4	*	0.5500	16.58	9.80	26.38	46.00	-19.62	AVG	
5		1.6740	11.83	9.58	21.41	56.00	-34.59	QP	
6		1.6740	5.55	9.58	15.13	46.00	-30.87	AVG	
7		3.6580	14.26	9.71	23.97	56.00	-32.03	QP	
8		3.6580	2.57	9.71	12.28	46.00	-33.72	AVG	
9		12.3780	19.17	9.69	28.86	60.00	-31.14	QP	
10		12.3780	10.93	9.69	20.62	50.00	-29.38	AVG	
11		26.2099	16.49	9.73	26.22	60.00	-33.78	QP	
12		26.2099	9.81	9.73	19.54	50.00	-30.46	AVG	

3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS (Frequency Range 9kHz-1000MHz)

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

(2) The tighter limit applies at the band edges.

(3) Emission level (dBuV/m)=20log Emission level (uV/m).

FREQUENCY RANGE OF RADIATED MEASUREMENT (For unintentional radiators)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	Range (MHz)
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

3.2.2 TEST PROCEDURE

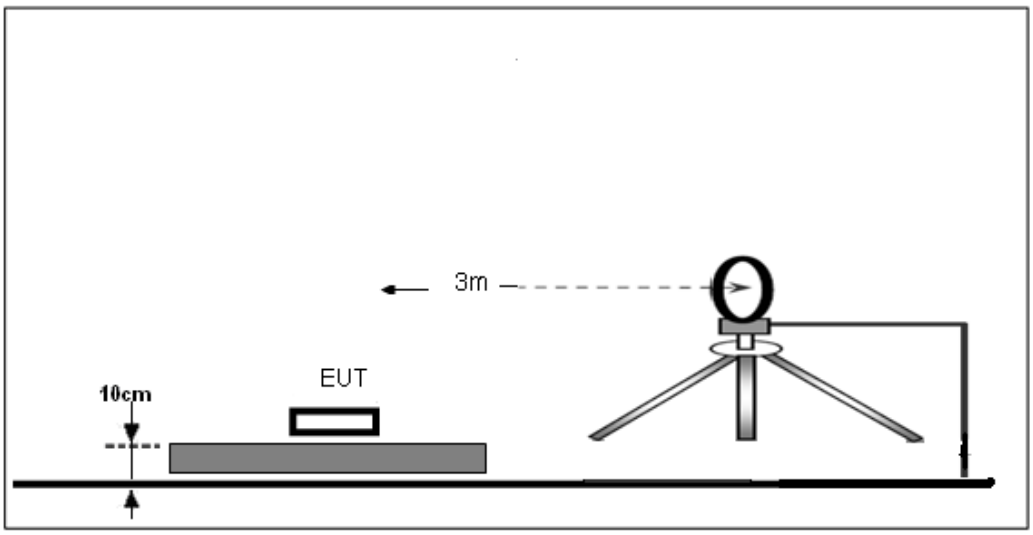
a. The measuring distance of at 3 m shall be used for measurements at frequency up to 25GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
b. The EUT was placed on the top of a rotating table 0.1 meters above the ground at a 3 meter semi-chamber test. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment or of the substitution antenna shall be 0.1m; above 1GHz, the height was 1.5m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.
g. 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.
Note:
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

3.2.3 DEVIATION FROM TEST STANDARD

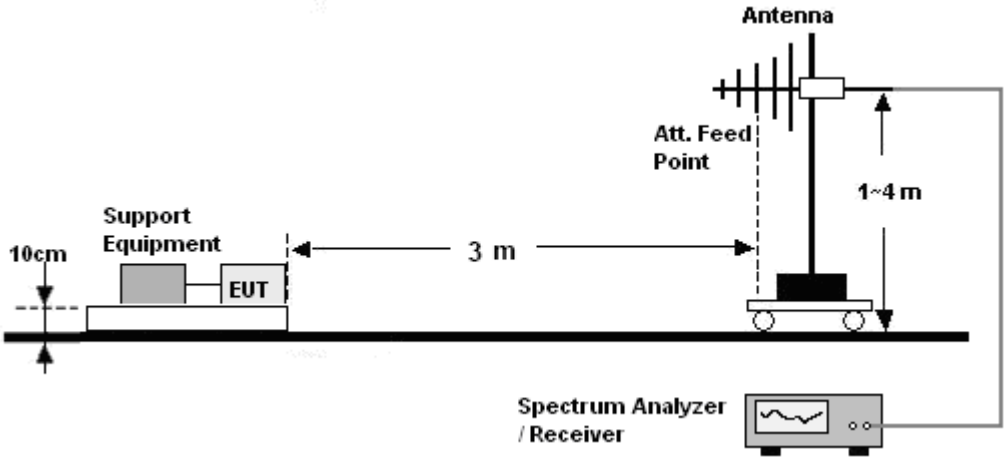
No deviation

3.2.4 TEST SETUP

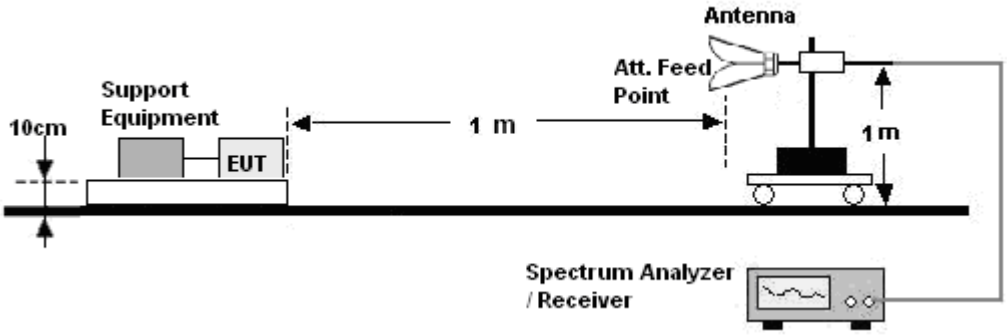
（A）Radiated Emission Test-Up Frequency Below 30MHz



（B）Radiated Emission Test-Up Frequency 30MHz~1GHz



（C）Radiated Emission Test-Up Frequency Above 1GHz



3.2.5 EUT OPERATING 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.

3.2.6 TEST RESULTS (BETWEEN 9KHZ – 30 MHZ)

Temperature:	26℃	Relative Humidtity:	54%
Pressure:	101 kPa	Test Voltage :	AC120V 60Hz
Test Mode :	Mode 4	Polarization :	--

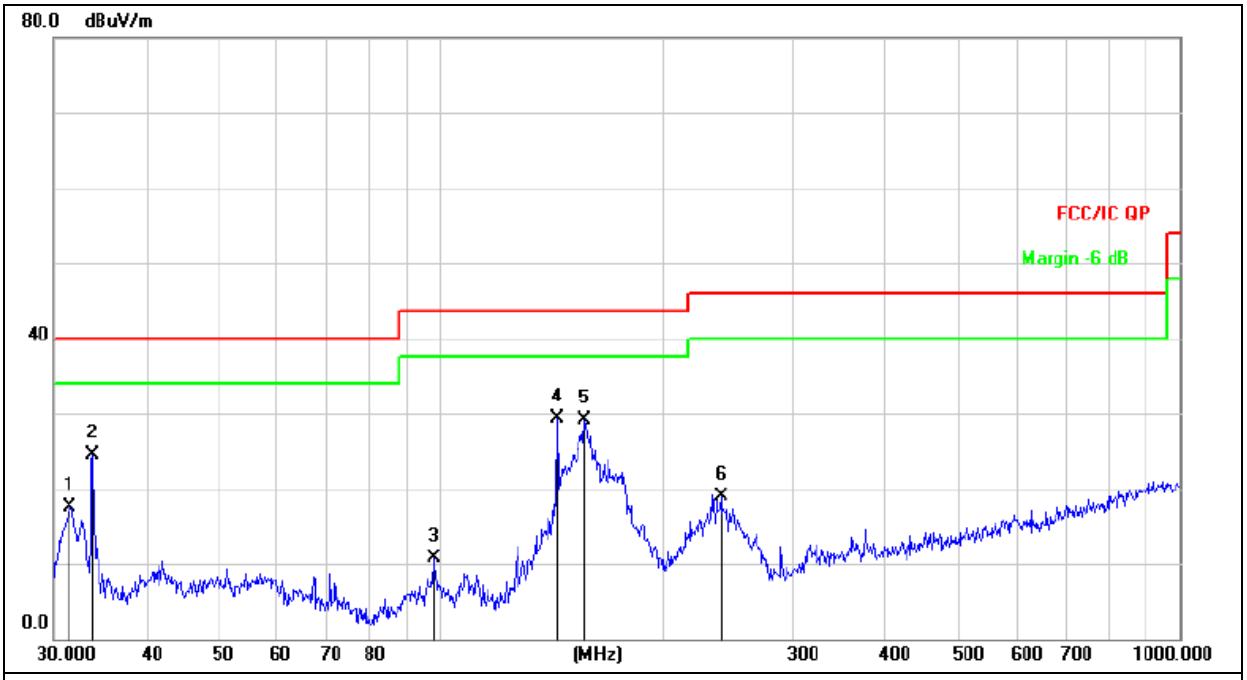
Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

NOTE:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

3.2.7 TEST RESULTS (BETWEEN 30MHZ – 1GHZ)

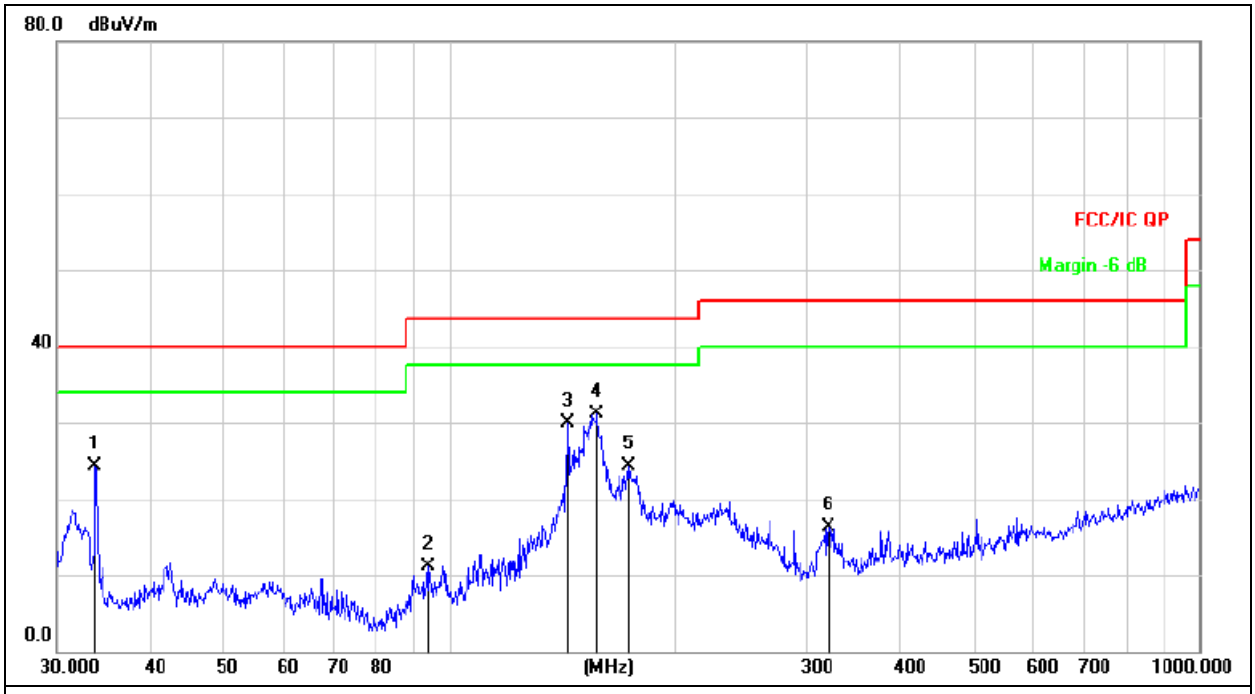
Temperature :	26℃	Relative Humidity :	54%
Pressure :	101 kPa	Polarization :	Horizontal
Test Voltage :	AC120V 60Hz		
Test Mode :	Mode 4		



Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		31.5095	34.60	-17.00	17.60	40.00	-22.40	QP
2		33.7986	41.08	-16.57	24.51	40.00	-15.49	QP
3		98.1419	27.41	-16.62	10.79	43.50	-32.71	QP
4	*	143.8295	48.37	-19.10	29.27	43.50	-14.23	QP
5		156.4578	48.25	-19.09	29.16	43.50	-14.34	QP
6		239.1473	34.39	-15.40	18.99	46.00	-27.01	QP

Temperature :	26℃	Relative Humidity :	54%
Pressure :	101kPa	Polarization :	Vertical
Test Voltage :	AC120V 60Hz		
Test Mode :	Mode 4		



Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		33.6802	40.89	-16.59	24.30	40.00	-15.70	QP
2		93.4402	28.60	-17.47	11.13	43.50	-32.37	QP
3		143.8295	49.05	-19.10	29.95	43.50	-13.55	QP
4	*	157.5588	50.06	-19.02	31.04	43.50	-12.46	QP
5		173.8135	42.38	-17.98	24.40	43.50	-19.10	QP
6		319.9370	29.26	-13.05	16.21	46.00	-29.79	QP

Remark:
Test all the modes and only worst case was reported.

3.2.8 TEST RESULTS (1ghz~25ghz)

GFSK

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Low Channel:2404MHz									
V	4808.00	50.23	39.55	7.77	25.66	44.11	74.00	-29.89	PK
V	4808.00	43.72	39.55	7.77	25.66	37.60	54.00	-16.40	AV
V	7212.00	50.10	38.33	7.3	24.55	43.62	74.00	-30.38	PK
V	7212.00	43.52	38.33	7.3	24.55	37.04	54.00	-16.96	AV
V	15450.00	52.05	35.23	6.6	26.59	50.01	74.00	-23.99	PK
H	4808.00	51.48	39.55	7.77	25.66	45.36	74.00	-28.64	PK
H	4808.00	43.16	39.55	7.77	25.66	37.04	54.00	-16.96	AV
H	7212.00	51.66	38.33	7.3	23.55	44.18	74.00	-29.82	PK
H	7212.00	43.62	38.33	7.3	23.22	35.81	54.00	-18.19	AV
H	15450.00	50.77	35.45	6.6	27.88	49.80	74.00	-24.20	PK

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
Middle Channel:2440MHz									
V	4880.00	51.79	38.89	7.57	25.45	45.92	74.00	-28.08	PK
V	4880.00	43.53	38.89	7.57	25.45	37.66	54.00	-16.34	AV
V	7320.00	51.57	38.78	7.35	24.78	44.92	74.00	-29.08	PK
V	7320.00	43.89	38.78	7.35	24.78	37.24	54.00	-16.76	AV
V	15450.00	54.53	35.89	6.42	26.47	51.53	74.00	-22.47	PK
H	4880.00	52.32	38.89	7.57	25.45	46.45	74.00	-27.55	PK
H	4880.00	43.94	38.89	7.57	25.45	38.07	54.00	-15.93	AV
H	7320.00	51.43	38.78	7.35	24.78	44.78	74.00	-29.22	PK
H	7320.00	43.26	38.78	7.35	24.78	36.61	54.00	-17.39	AV
H	15450.00	53.98	36.68	6.42	26.65	50.37	74.00	-23.63	PK

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
High Channel: 2478MHz									
V	4956.00	51.37	38.75	7.38	25.45	45.45	74.00	-28.55	PK
V	4956.00	43.14	38.75	7.38	25.45	37.22	54.00	-16.78	AV
V	7434.00	50.13	38.65	7.15	24.78	43.41	74.00	-30.59	PK
V	7434.00	43.43	38.65	7.15	24.78	36.71	54.00	-17.29	AV
V	15450.00	50.52	35.58	6.25	26.47	47.66	74.00	-26.34	PK
H	4956.00	51.29	38.75	7.38	25.45	45.37	74.00	-28.63	PK
H	4956.00	43.98	38.75	7.38	25.45	38.06	54.00	-15.94	AV
H	7434.00	51.04	38.65	7.15	24.78	44.32	74.00	-29.68	PK
H	7434.00	43.02	38.65	7.15	24.78	36.30	54.00	-17.70	AV
H	15450.00	54.65	36.42	6.25	26.65	51.13	74.00	-22.87	PK

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,

Margin= Emission Level - Limit

2. If peak below the average limit, the average emission was no test.

3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

3.3 RADIATED BAND EMISSION MEASUREMENT

3.3.1 TEST REQUIREMENT:

FCC Part15 C Section 15.209 and 15.205

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

(2) The tighter limit applies at the band edges.

(3) Emission level (dBuV/m)=20log Emission level (uV/m).

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	2300MHz
Stop Frequency	2520
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

3.3.2 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:

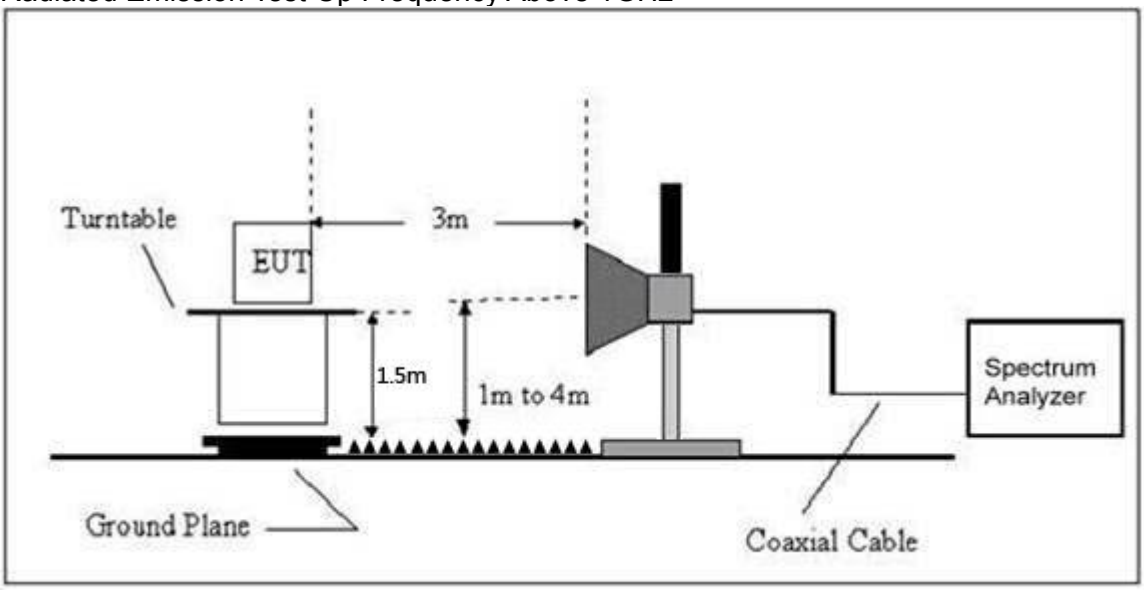
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

3.3.3 DEVIATION FROM TEST STANDARD

No deviation

3.3.4 TEST SETUP

Radiated Emission Test-Up Frequency Above 1GHz



3.3.5 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.

3.3.6 TEST RESULT

	Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission evel (dBuV/m)	Limits (dBuV/m)		Result
							PK	PK	AV	
GFSK	**Low Channel 2404MHz**									
	H	2390.00	59.19	38.06	7.42	20.15	48.70	74.00	54.00	PASS
	H	2400.00	55.56	38.06	7.42	20.15	45.07	74.00	54.00	PASS
	V	2390.00	60.71	38.06	7.42	20.15	50.22	74.00	54.00	PASS
	V	2400.00	50.77	38.06	7.42	20.15	40.28	74.00	54.00	PASS
	High Channel 2478MHz									
	H	2483.50	58.28	38.17	7.45	20.54	48.10	74.00	54.00	PASS
	H	2485.50	51.02	38.17	7.45	20.54	40.84	74.00	54.00	PASS
	V	2483.50	58.66	38.2	7.45	20.54	48.45	74.00	54.00	PASS
	V	2485.50	52.79	38.2	7.45	20.54	42.58	74.00	54.00	PASS

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit
2. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

4. POWER SPECTRAL DENSITY TEST

4.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

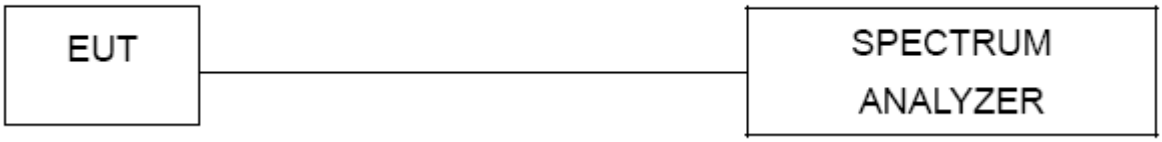
4.1.1 TEST PROCEDURE

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

4.1.2 DEVIATION FROM STANDARD

No deviation.

4.1.3 TEST SETUP



4.1.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.1 Unless otherwise a special operating condition is specified in the follows during the testing.
Note: Power Spectral Density(dBm)=Reading+Cable Loss

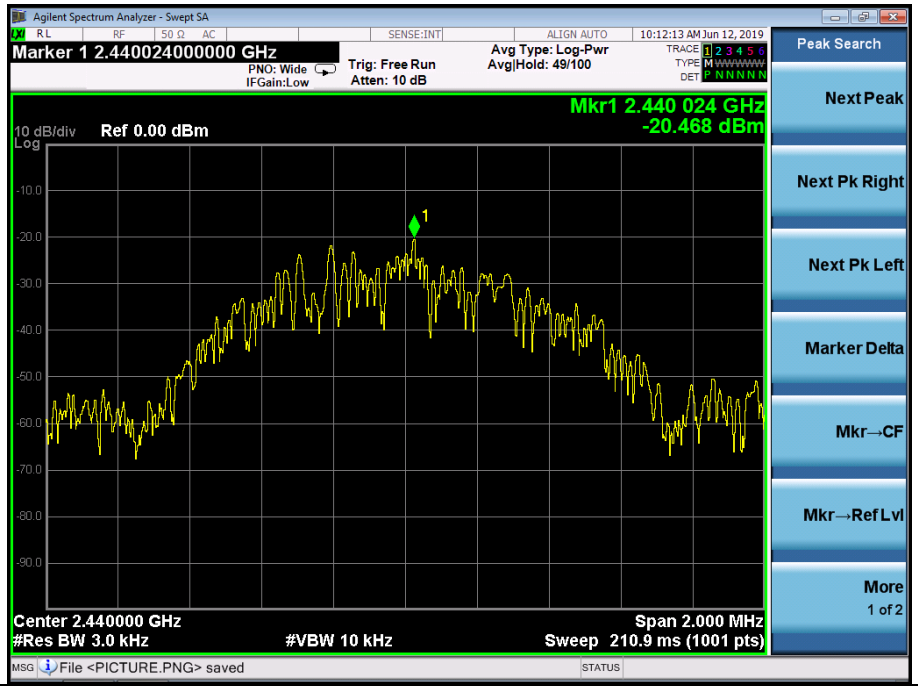
4.1.5 TEST RESULTS

Temperature :	26℃	Relative Humidity :	54%
Test Mode :	GFSK	Test Voltage :	DC 43.2V

Frequency	Power Spectral Density(dBm)	Limit (dBm)	Result
2404 MHz	-20.631	8	PASS
2440 MHz	-20.468	8	PASS
2478 MHz	-20.411	8	PASS

CH01

CH20


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.440024000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 49/100
10:12:13 AM Jun 12, 2019
Mkr1 2.440 024 GHz
-20.468 dBm
10 dB/div
Ref 0.00 dBm
Log
Center 2.440000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 2.000 MHz
Sweep 210.9 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
File <PICTURE.PNG> saved

CH38

Agilent Spectrum Analyzer - Swept SA
Marker 1 2.478024000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 23/100
10:11:46 AM Jun 12, 2019
Mkr1 2.478 024 GHz
-20.411 dBm
10 dB/div
Ref 0.00 dBm
Log
Center 2.478000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 2.000 MHz
Sweep 210.9 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

5. BANDWIDTH TEST

5.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

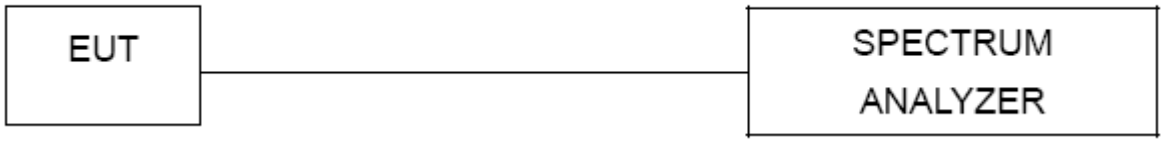
5.1.1 TEST PROCEDURE

1. Set RBW = 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 frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.1.2 DEVIATION FROM STANDARD

No deviation.

5.1.3 TEST SETUP



5.1.4 EUT OPERATION CONDITIONS

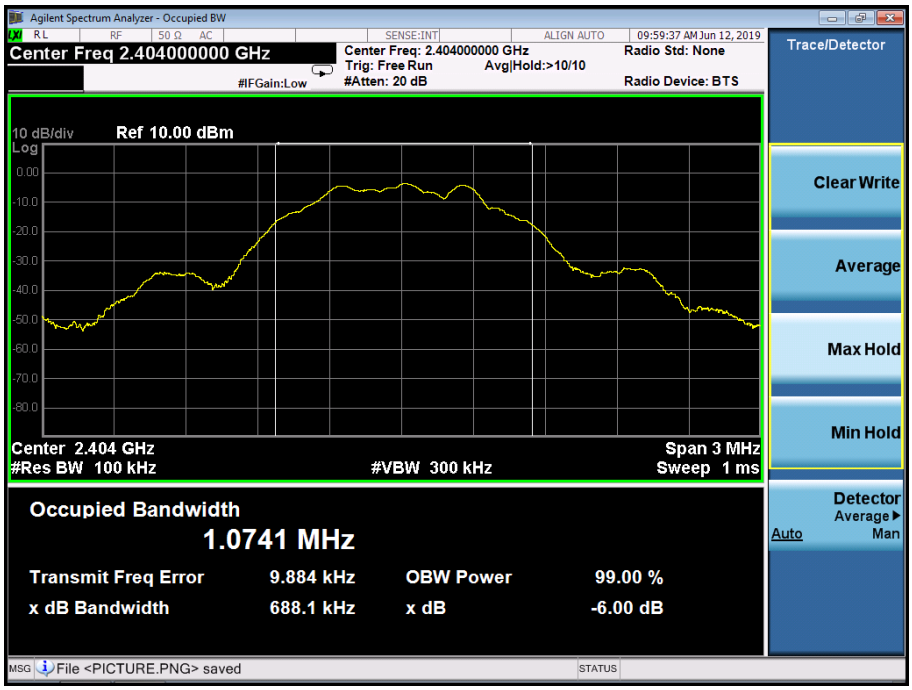
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

5.1.5 TEST RESULTS

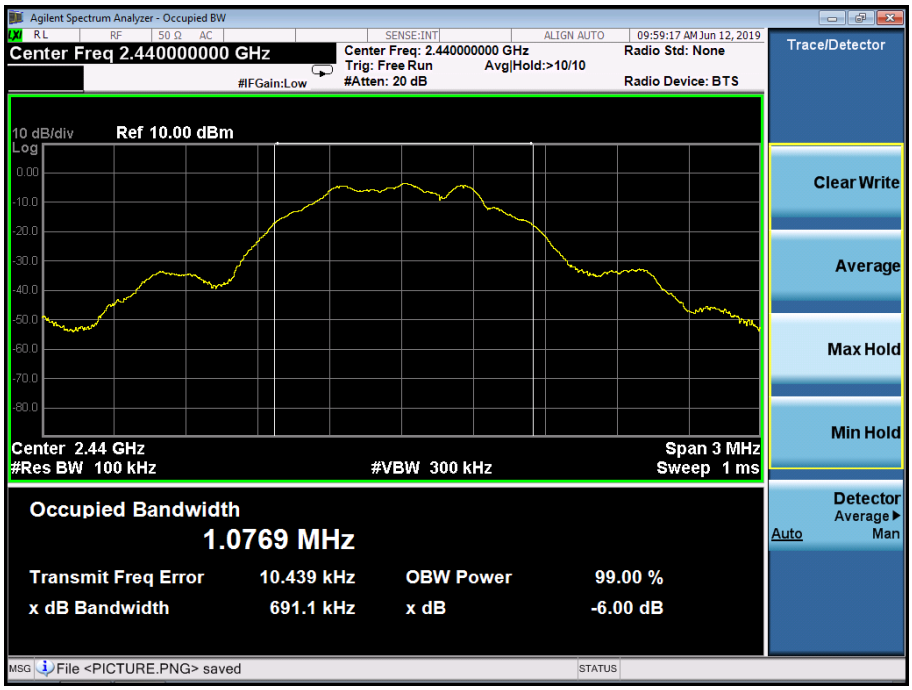
Temperature :	26℃	Relative Humidity :	54%
Test Mode :	GFSK	Test Voltage :	DC 43.2V

Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
2404	0.688	500	Pass
2440	0.691	500	Pass
2478	0.692	500	Pass

CH 01



CH20


Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.440000000 GHz
Center Freq: 2.440000000 GHz
Trig: Free Run
#Atten: 20 dB
Avg|Hold:>10/10
Radio Std: None
Radio Device: BTS
#IFGain:Low
09:59:17 AM Jun 12, 2019
Trace/Detector
10 dB/div
Ref 10.00 dBm
Clear Write
Average
Max Hold
Min Hold
Detector
Average
Auto
Man
Center 2.44 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3 MHz
Sweep 1 ms
Occupied Bandwidth
1.0769 MHz
Transmit Freq Error 10.439 kHz
OBW Power 99.00 %
x dB Bandwidth 691.1 kHz
x dB -6.00 dB
File <PICTURE.PNG> saved

CH38

Agilent Spectrum Analyzer - Occupied BW
x dB -6.00 dB
Center Freq: 2.478000000 GHz
Trig: Free Run
#Atten: 20 dB
Avg|Hold:>10/10
Radio Std: None
Radio Device: BTS
#IFGain:Low
09:58:51 AM Jun 12, 2019
Trace/Detector
10 dB/div
Ref 10.00 dBm
Clear Write
Average
Max Hold
Min Hold
Detector
Average
Auto
Man
Center 2.478 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3 MHz
Sweep 1 ms
Occupied Bandwidth
1.0805 MHz
Transmit Freq Error 10.177 kHz
OBW Power 99.00 %
x dB Bandwidth 691.8 kHz
x dB -6.00 dB

6. PEAK OUTPUT POWER TEST

6.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5	PASS

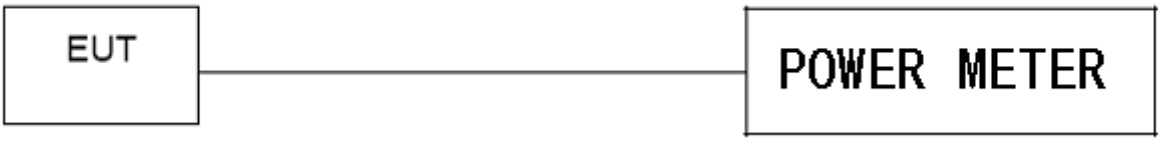
6.1.1 TEST PROCEDURE

a. The EUT was directly connected to the Power meter

6.1.2 DEVIATION FROM STANDARD

No deviation.

6.1.3 TEST SETUP



6.1.4 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.

6.1.5 TEST RESULTS

Temperature：	26℃	Relative Humidity：	54%
Test Voltage ：	DC 43.2V		

	Frequency	Maximum Conducted Output Power(PK)	Conducted Output Power Limit
	(MHz)	(dBm)	dBm
GFSK	2404	-3.47	30
	2440	-3.50	30
	2478	-3.44	30

7. 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE

7.1 APPLICABLE STANDARD

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

7.2 TEST PROCEDURE

Using the following spectrum analyzer setting:

a) Set the RBW = 100KHz.
b) Set the VBW = 300KHz.
c) Sweep time = auto couple.
d) Detector function = peak.
e) Trace mode = max hold.
f) Allow trace to fully stabilize.

7.3 DEVIATION FROM STANDARD

No deviation.

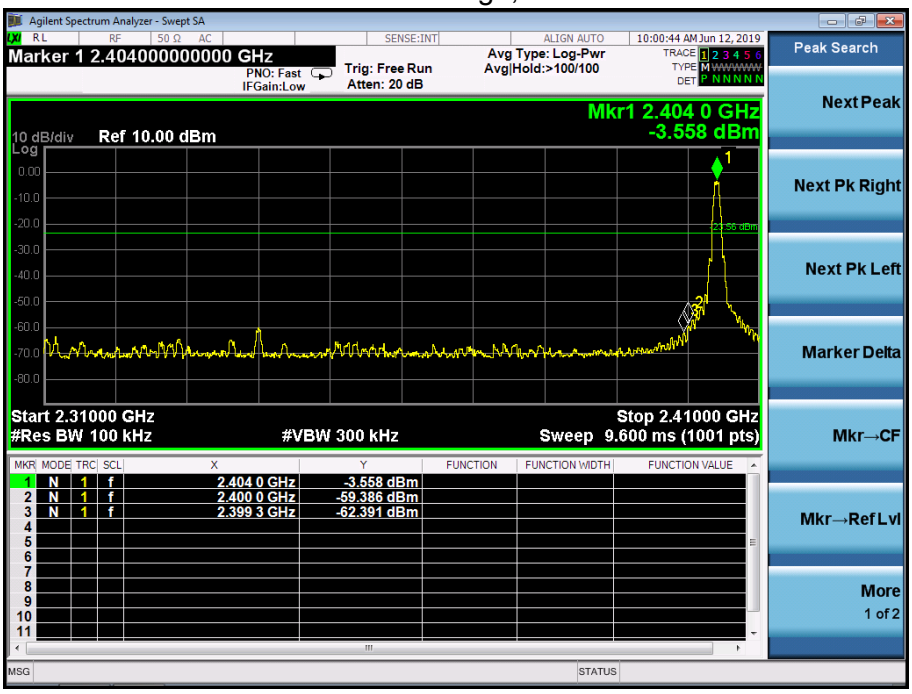
7.4 TEST SETUP

7.5 EUT OPERATION CONDITIONS

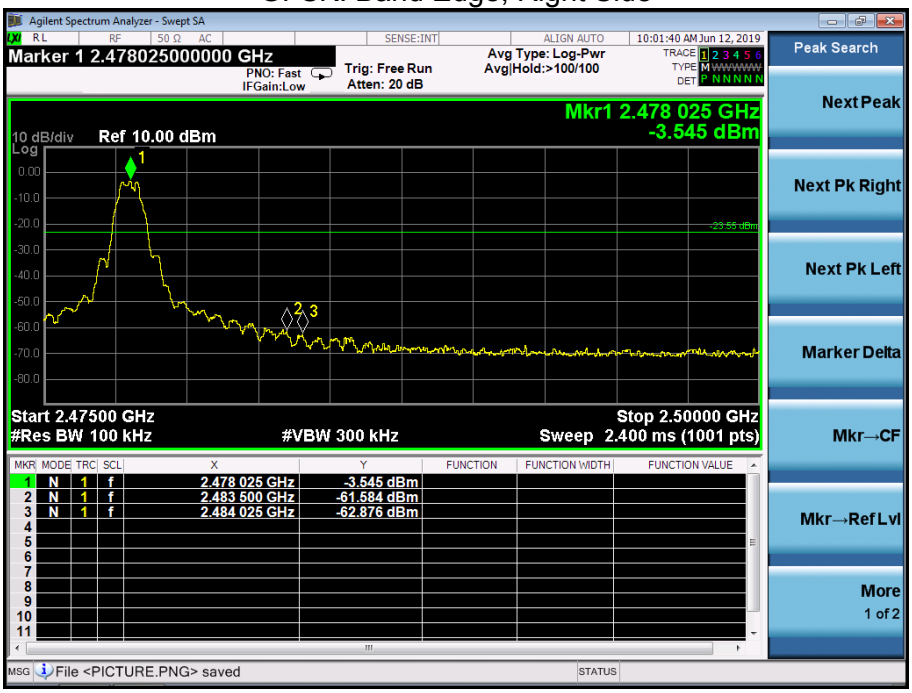
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

7.6 TEST RESULTS

GFSK: Band Edge, Left Side



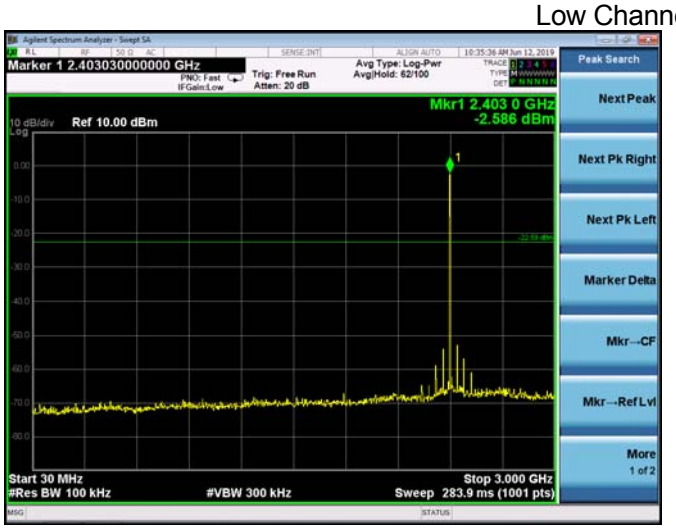
GFSK: Band Edge, Right Side



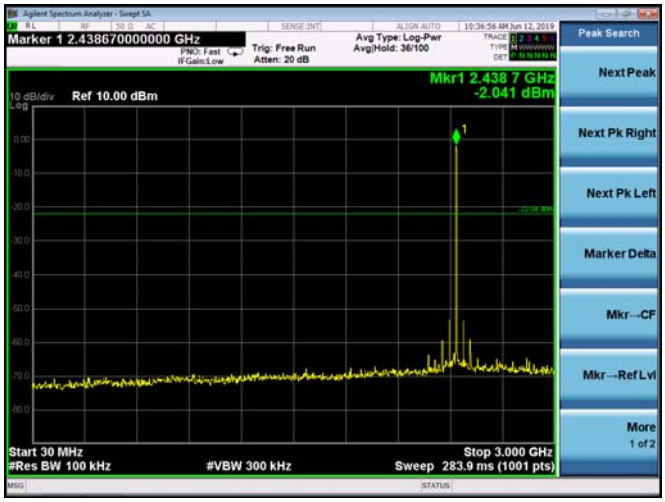
CONDUCTED EMISSION MEASUREMENT

GFSK

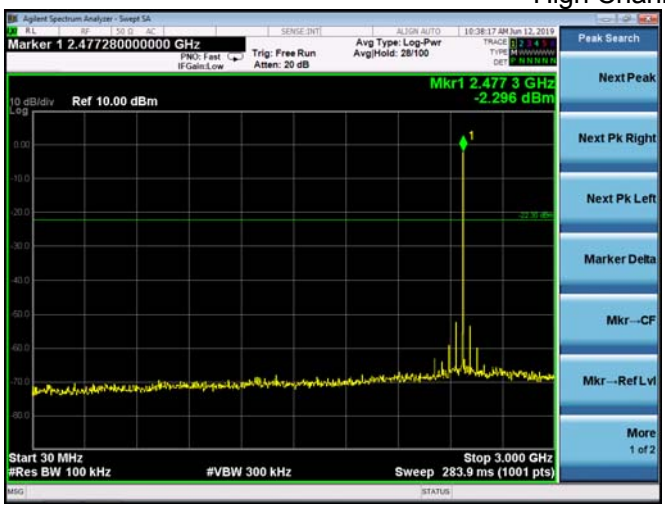
Low Channel 2404MHz



Middle Channel 2440MHz



High Channel 2478MHz



8. ANTENNA REQUIREMENT

8.1 STANDARD REQUIREMENT

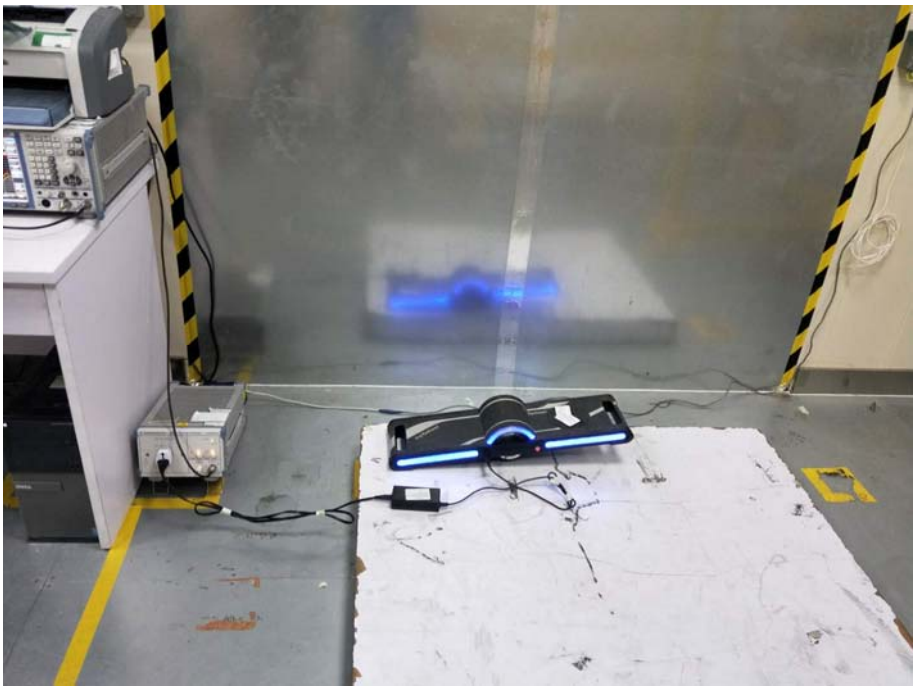
15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

8.2 EUT ANTENNA

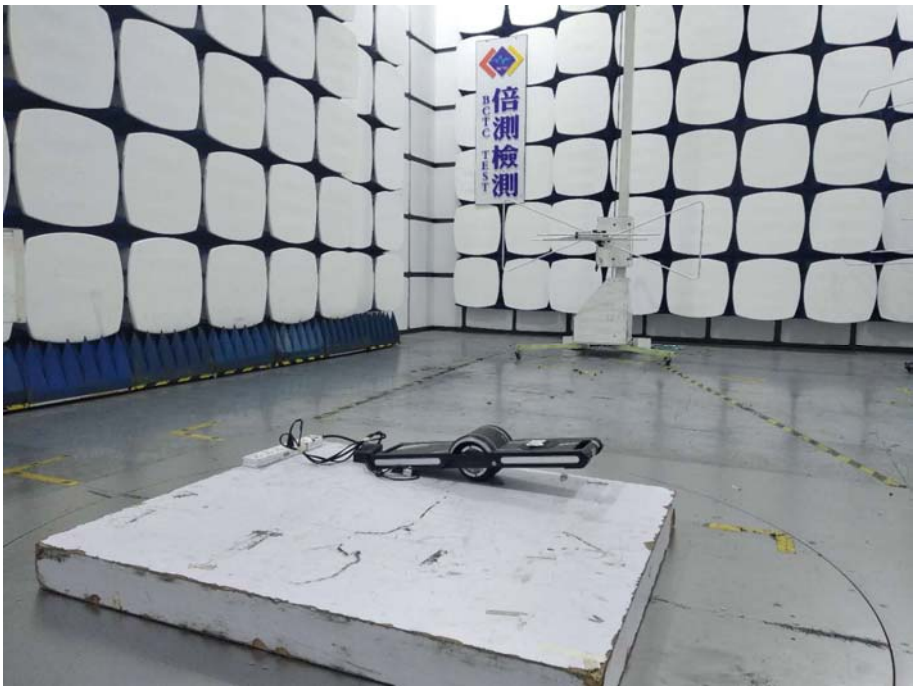
The EUT antenna is PCB antenna, fulfill the requirement of this section.

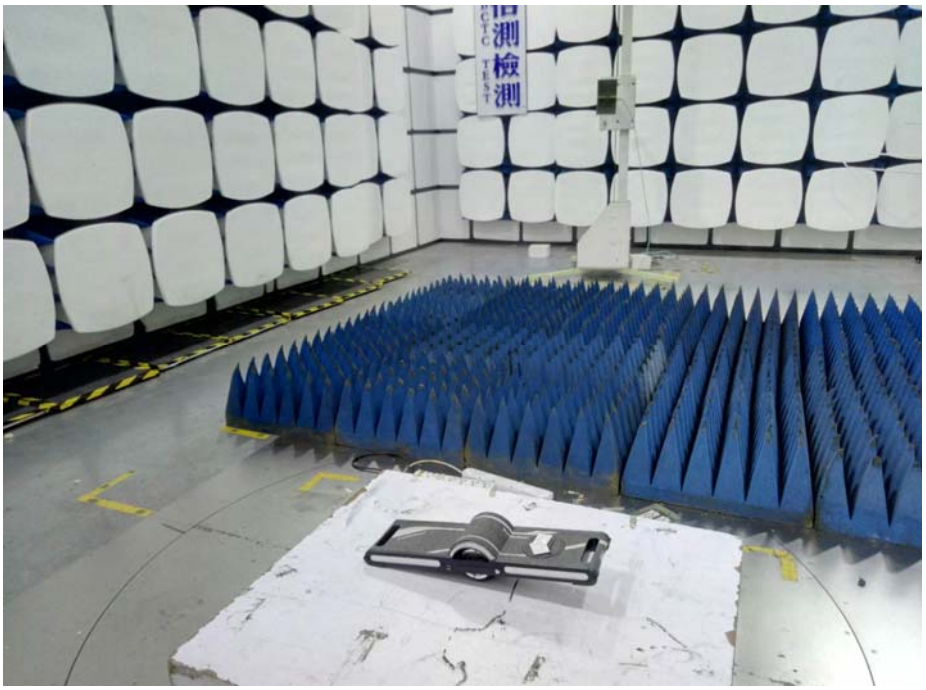
9. EUT TEST PHOTO

Conducted Emission



Radiated Measurement Photos





10. EUT PHOTO

※※※※※ **END OF REPORT** ※※※※※