FCC Part 15C Test Report

FCC ID: 2AHWMTB-BTS30

Product Name:	ALARM CLOCK SPEAKER
Trademark:	N/A
Model Name :	TB-BTS30
Prepared For :	Dolphin Electronics Co., Ltd
Address :	Building8,Fuqiao No.3 Industrial Zone, Fuyong Baoan District, ShenZhen,China
Prepared By :	Shenzhen BCTC Technology Co., Ltd.
Address :	No.101,Yousong Road,Longhua New District, Shenzhen,China
Test Date:	Jun. 10, 2017 – Jun. 16, 2017
Date of Report :	Jun. 16, 2017
Report No.:	BCTC-LH170602400E

TEST RESULT CERTIFICATION

Applicant's name..... : Dolphin Electronics Co., Ltd

Address..... : Building8,Fuqiao No.3 Industrial Zone, Fuyong Baoan District, ShenZhen,China

Manufacture's Name..... : Dolphin Electronics Co., Ltd

Address..... : Building8,Fuqiao No.3 Industrial Zone, Fuyong Baoan District, ShenZhen,China

Product description

Product name.....: ALARM CLOCK SPEAKER

Trademark.....: N/A

Model and/or type reference : TB-BTS30

Standards..... : FCC Part15.249
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): Snow Zeng

Reviewer(Supervisor): Jade Yang

Approved(Manager): Carson Zhang

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1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15 (15.249) , Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	PASS	
15.249	Radiated Spurious Emission	PASS	
15.249	Bandwidth	PASS	
15.205	Band Edge Emission	PASS	
15.203	Antenna Requirement	PASS	

NOTE:

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

1.1 TEST FACILITY

Shenzhen BCTC Technology Co., Ltd.
Add. : No.101,Yousong Road,Longhua New District, Shenzhen,China
FCC Registered No.: 187086

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	Conducted Emission Test	±1.38dB
2	RF power,conducted	±0.16dB
3	Spurious emissions,conducted	±0.21dB
4	All emissions,radiated(<1G)	±4.68dB
5	All emissions,radiated(>1G)	±4.89dB
6	Temperature	±0.5°C
7	Humidity	±2%

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

<table>
<tr><td>Equipment</td><td>ALARM CLOCK SPEAKER</td></tr>
<tr><td>Trade Name</td><td>N/A</td></tr>
<tr><td>Model Name</td><td>TB-BTS30</td></tr>
<tr><td>Model Difference</td><td>N/A</td></tr>
<tr><td>Product Description</td><td>The EUT is a Bluetooth Speaker
<table>
<tr><td>Operation Frequency:</td><td>2402~2480 MHz</td></tr>
<tr><td>Modulation Type:</td><td>GFSK, PI/4 DQPSK, 8DPSK</td></tr>
<tr><td>Bit Rate of Transmitter</td><td>1/2/3Mbps</td></tr>
<tr><td>Number Of Channel</td><td>79 CH</td></tr>
<tr><td>Antenna type:</td><td>PCB antenna</td></tr>
<tr><td>Antenna Gain (dBi)</td><td>0dBi</td></tr>
</table>
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.</td></tr>
<tr><td>Channel List</td><td>Please refer to the Note 2.</td></tr>
<tr><td>Power</td><td>DC 5V from adapter</td></tr>
<tr><td>Adapter</td><td>Model:JK050300-S04US
I/P: AC 100-240V 50/60Hz
O/P: DC 5V 3000mA</td></tr>
<tr><td>hardware version</td><td>--</td></tr>
<tr><td>Software version</td><td>--</td></tr>
<tr><td>Serial number</td><td>--</td></tr>
<tr><td>Connecting I/O Port(s)</td><td>Please refer to the User's Manual</td></tr>
</table>

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)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
~	~	~	~	~	~
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2441	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
~	~	~	~	~	~
14	2416	41	2443	68	2470
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

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.

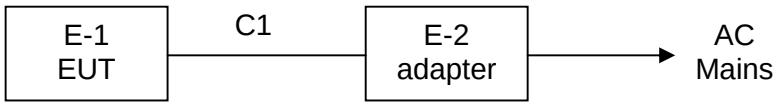
Pretest Mode	Description	
Mode 1	CH00	GFSK,PI/4 DQPSK,8DPSK
Mode 2	CH39	
Mode 3	CH78	
Mode 4	Link Mode	
For Conducted & Radiated Emission		
Final Test Mode	Description	
Mode 1	CH00	GFSK,PI/4 DQPSK,8DPSK
Mode 2	CH39	
Mode 3	CH78	
Mode 4	Link Mode	

Note:

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

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated & Conducted Spurious Emission Test



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.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	ALARM CLOCK SPEAKER	N/A	TB-BTS30	N/A	EUT
E-2	Adapter (provide by lab)	N/A	JK050300-S04US	N/A	

Item	Shielded Type	Ferrite Core	Length	Note
C1	No	No	0.8m	DC Line

Note:

(1) 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, Band-edge test and 6db bandwidth test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Spectrum Analyzer (9kHz-26.5GHz)	Agilent	E4407B	MY45108040	2016.08.27	2017.08.26
2	Test Receiver (9kHz-7GHz)	R&S	ESPI	101318	2016.08.27	2017.08.26
3	Bilog Antenna (30MHz-1GHz)	R&S	VULB 9168	VULB91 68-438	2016.08.27	2017.08.26
4	Horn Antenna (1GHz-18GHz)	SCHWARZBECK	BBHA9120D	1201	2016.09.03	2017.09.03
5	Horn Antenna (14GHz-40GHz)	SCHWARZBECK	BBHA 9170	9170-181	2016.09.03	2017.09.03
6	Amplifier (9KHz-6GHz)	SCHWARZBECK	BBV9744	9744-0037	2016.08.27	2017.08.26
7	Amplifier (1GHz-18GHz)	SCHWARZBECK	BBV9718	9718-309	2016.08.27	2017.08.26
8	Amplifier (18GHz-40GHz)	SCHWARZBECK	BBV 9721	9721-205	2016.08.27	2017.08.26
9	Loop Antenna (9KHz-30MHz)	SCHWARZBECK	FMZB1519B	00014	2016.09.03	2017.09.03
10	RF cables1 (9kHz-1GHz)	R&S	R203	R20X	2016.08.27	2017.08.26
11	RF cables2 (1GHz-40GHz)	R&S	R204	R21X	2016.08.27	2017.08.26
12	Antenna connector	Florida RF Labs	N/A	RF 01#	2016.08.27	2017.08.26
13	Power Metter	ANRITSU	ML2487A	6K00001568	2016.08.27	2017.08.26
14	Power Sensor (AV)	ANRITSU	ML2491A	030989	2016.08.27	2017.08.26
15	Signal Analyzer 9kHz-26.5GHz	Agilent	N9010A	MY48030494	2016.08.27	2017.08.26
16	Test Receiver 20kHz-40GHz	R&S	ESU 40	100376	2016.08.27	2017.08.26
17	D.C. Power Supply	LongWei	PS-305D	010964729	2016.08.27	2017.08.26

Conduction Test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Test Receiver	R&S	ESCI	1166.5950K03-1 01165-ha	2016.08.27	2017.08.26
2	LISN	SCHWARZBECK	NSLK8127	8127739	2016.08.27	2017.08.26
3	LISN	R&S	NSLK8126	8126487	2016.08.27	2017.08.26
4	RF cables	R&S	R204	R20X	2016.08.27	2017.08.26
5	Attenuator	R&S	ESH3-Z2	143206	2016.08.27	2017.08.26

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
	Quasi-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 0.8 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.

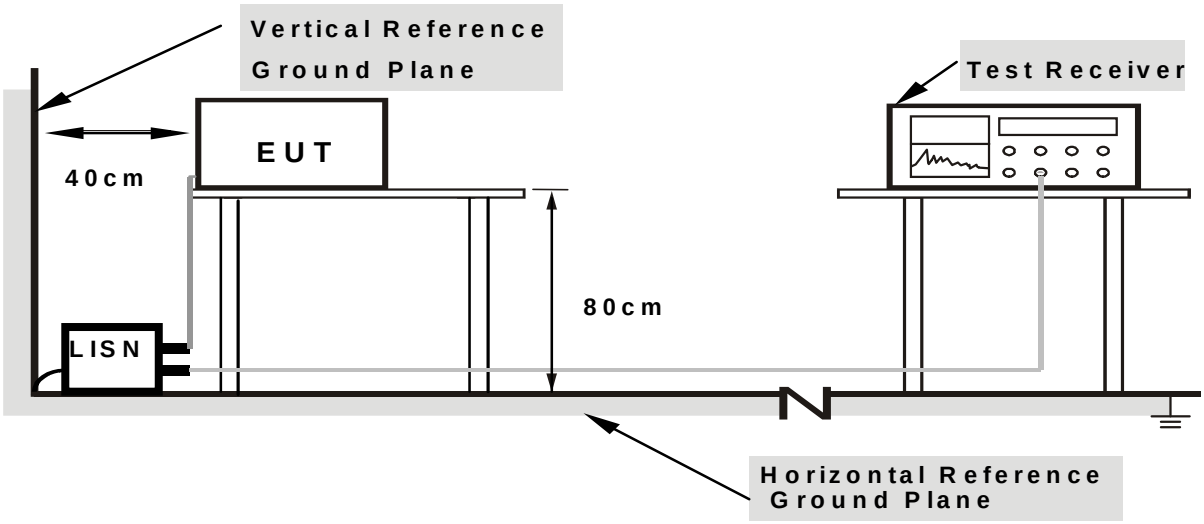
d. LISN at least 80 cm from nearest part of EUT chassis.

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



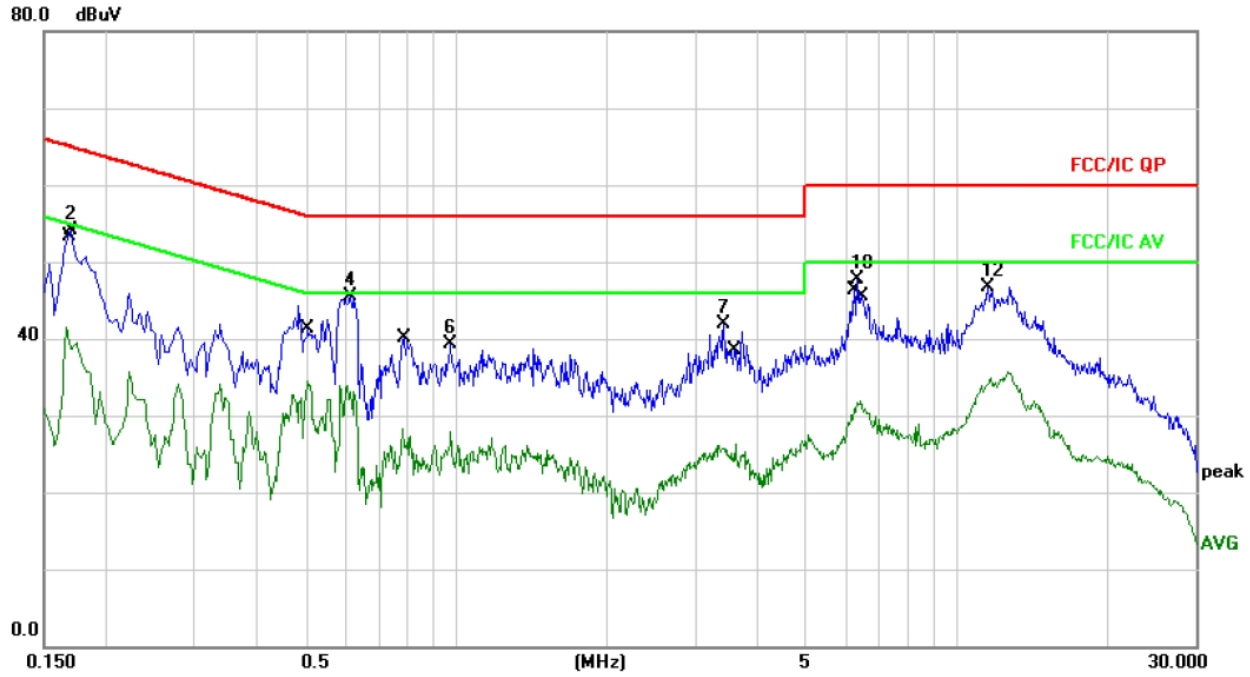
Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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.

3.1.6 TEST RESULTS

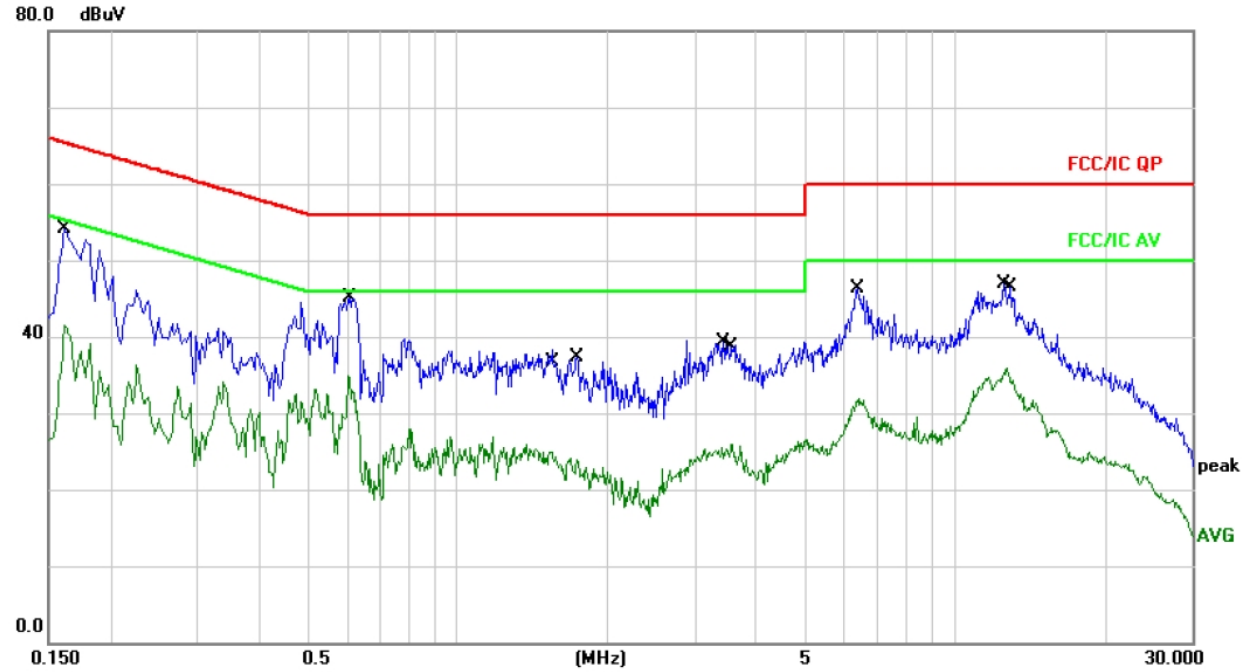
Temperature：	25 ℃	Relative Humidity：	54%
Pressure：	1010hPa	Phase：	L
Test Voltage ：	AC 120V/60Hz	Test Mode：	Mode 4



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	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1660	31.39	10.06	41.45	55.15	-13.70	AVG	
2		0.1700	44.01	10.06	54.07	64.96	-10.89	peak	
3		0.5060	24.40	10.12	34.52	46.00	-11.48	AVG	
4	*	0.6140	35.29	10.13	45.42	56.00	-10.58	peak	
5		0.7820	18.10	10.14	28.24	46.00	-17.76	AVG	
6		0.9740	29.22	10.16	39.38	56.00	-16.62	peak	
7		3.4260	31.82	10.18	42.00	56.00	-14.00	peak	
8		3.6220	16.05	10.17	26.22	46.00	-19.78	AVG	
9		6.1540	20.06	10.09	30.15	50.00	-19.85	AVG	
10		6.3460	37.60	10.09	47.69	60.00	-12.31	peak	
11		6.4380	21.81	10.09	31.90	50.00	-18.10	AVG	
12		11.5420	36.54	10.13	46.67	60.00	-13.33	peak	

Temperature：	25 ℃	Relative Humidity：	54%
Pressure：	1010hPa	Phase：	N
Test Voltage ：	AC 120V/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	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1620	43.99	10.05	54.04	65.36	-11.32	QP	
2		0.1620	31.50	10.05	41.55	55.36	-13.81	AVG	
3		0.6020	24.77	10.13	34.90	46.00	-11.10	AVG	
4	*	0.6060	35.06	10.13	45.19	56.00	-10.81	QP	
5		1.5700	14.22	10.18	24.40	46.00	-21.60	AVG	
6		1.7420	27.12	10.18	37.30	56.00	-18.70	QP	
7		3.4180	29.05	10.18	39.23	56.00	-16.77	QP	
8		3.5500	15.77	10.17	25.94	46.00	-20.06	AVG	
9		6.3820	36.17	10.09	46.26	60.00	-13.74	QP	
10		6.4420	21.74	10.09	31.83	50.00	-18.17	AVG	
11		12.5500	36.79	10.14	46.93	60.00	-13.07	QP	
12		12.7660	25.79	10.14	35.93	50.00	-14.07	AVG	

3.2 RADIATED EMISSION MEASUREMENT

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

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).

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	25GHz
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

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
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.

Above 1GHz test procedure as below:

g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).
h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel

Note:

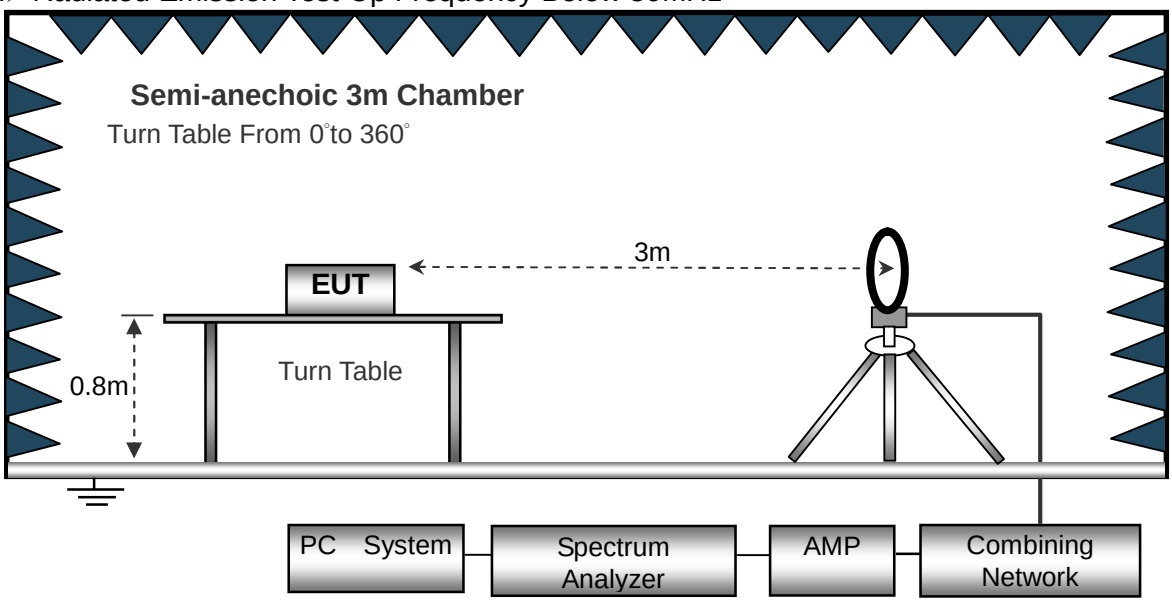
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

3.2.3 DEVIATION FROM TEST STANDARD

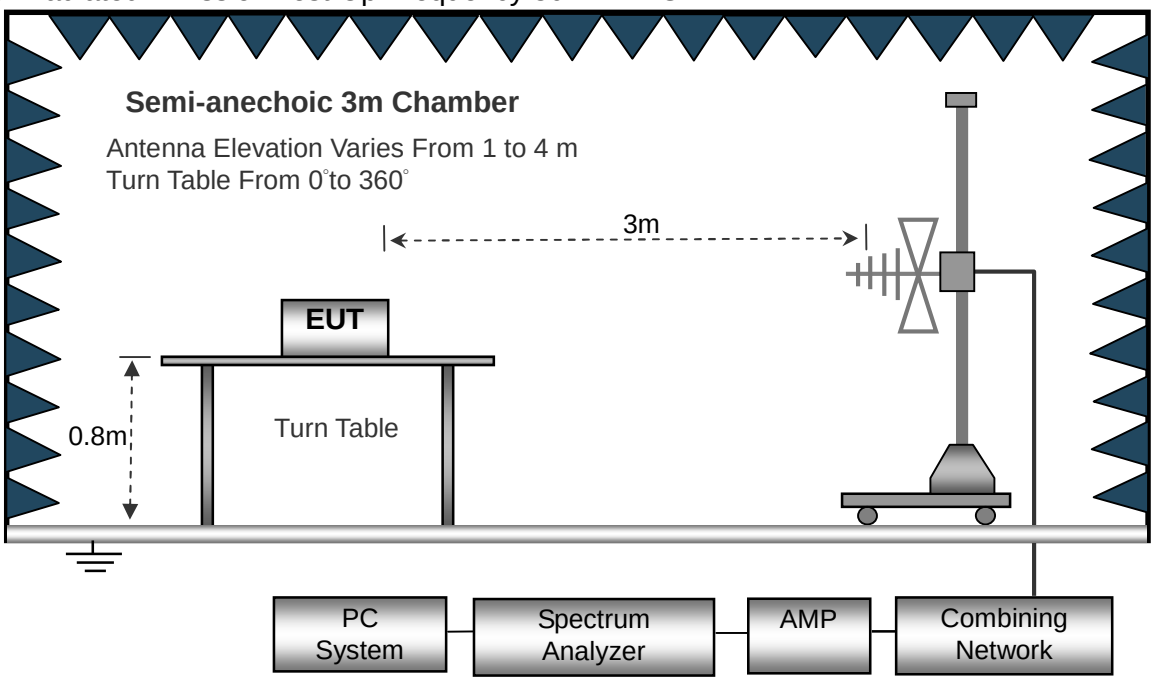
No deviation

3.2.4 TEST SETUP

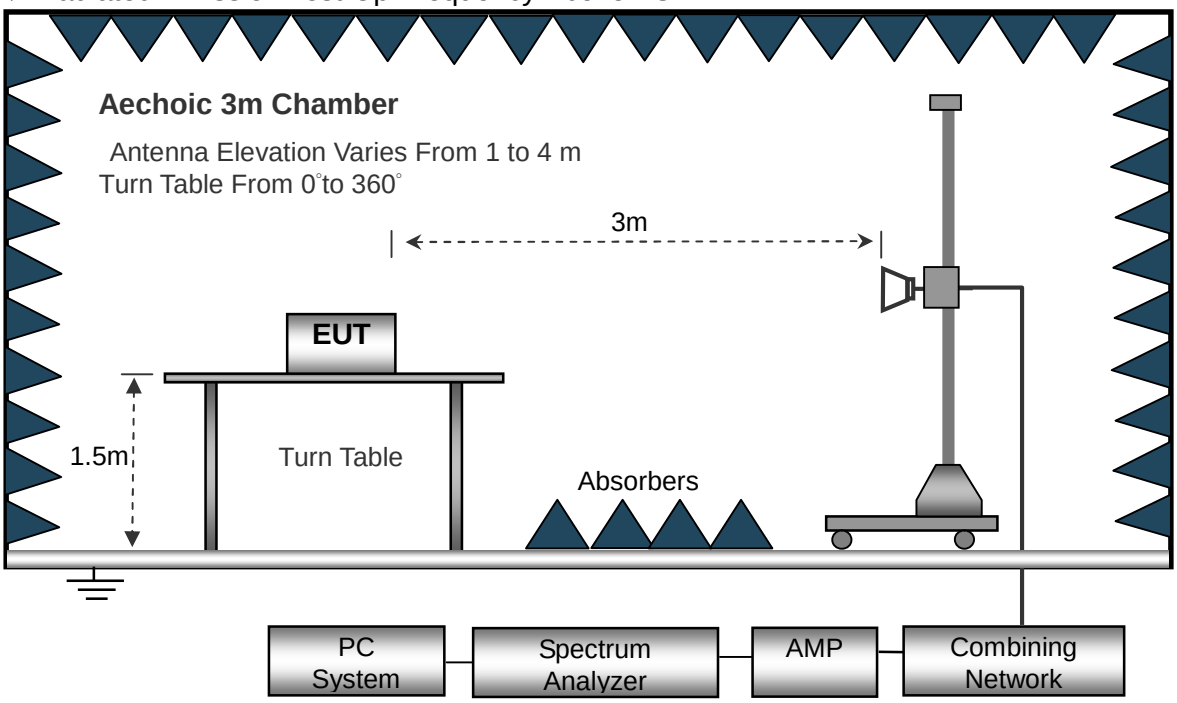
（A）Radiated Emission Test-Up Frequency Below 30MHz



（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 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

3.2.6 TEST RESULTS (BETWEEN 9KHZ – 30 MHZ)

Temperature:	20℃	Relative Humidtity:	48%
Pressure:	1010 hPa	Test Voltage :	DC 3.7V
Test Mode :	Mode 4	Polarization :	--

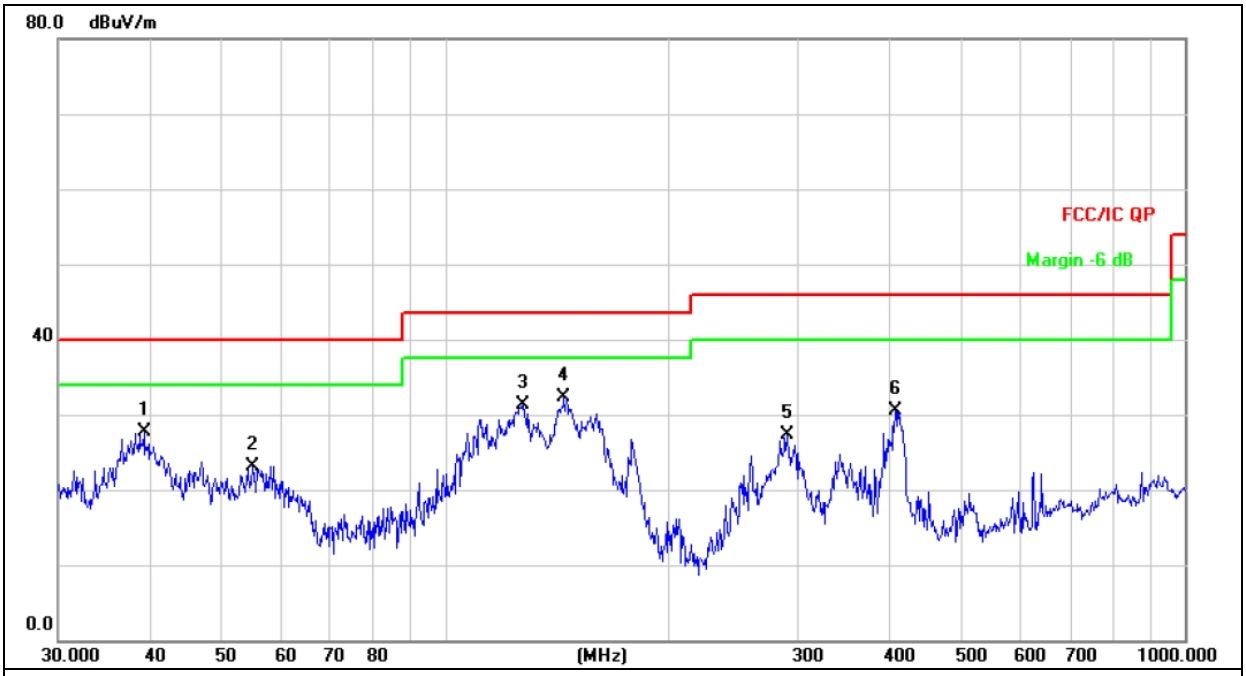
Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

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)

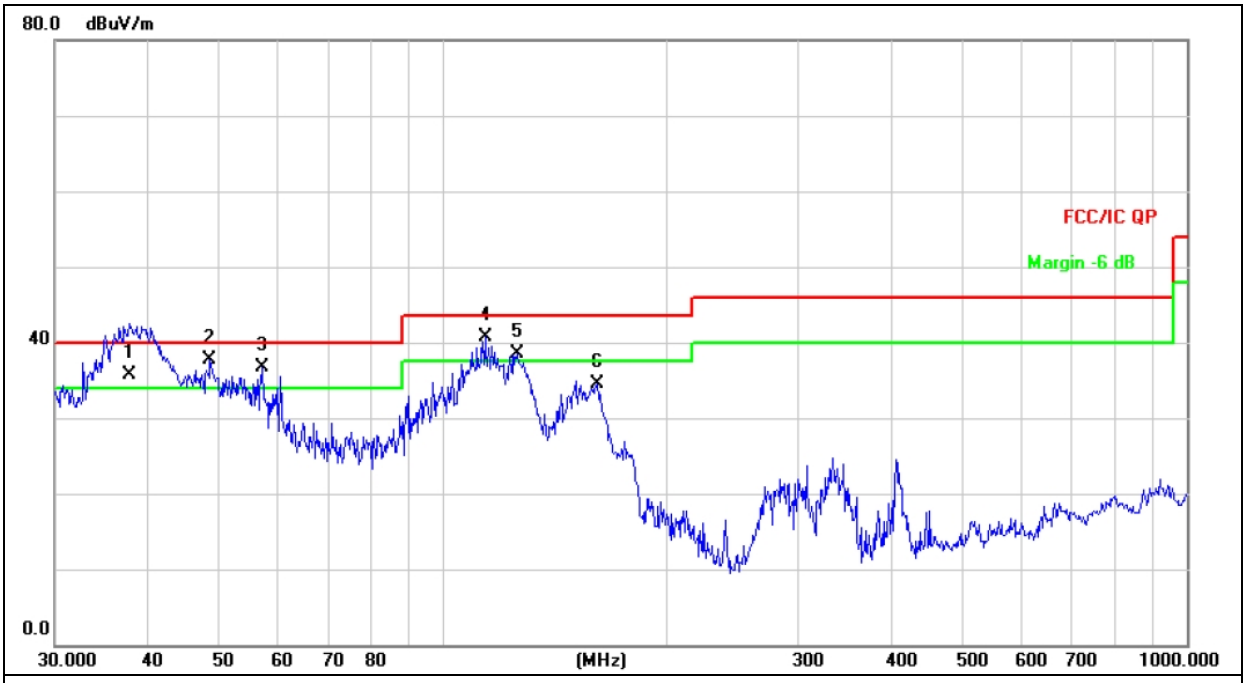
Temperature：	26℃	Relative Humidity：	54%
Pressure：	1010 hPa	Polarization：	Horizontal
Test Voltage ：	DC 3.7V		
Test Mode ：	Mode 4		



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

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		39.1616	36.44	-8.81	27.63	40.00	-12.37	QP
2		54.8348	34.29	-11.10	23.19	40.00	-16.81	QP
3		127.6645	45.55	-14.24	31.31	43.50	-12.19	QP
4	*	144.8418	45.51	-13.13	32.38	43.50	-11.12	QP
5		290.0172	40.09	-12.84	27.25	46.00	-18.75	QP
6		406.0880	40.51	-10.05	30.46	46.00	-15.54	QP

Temperature：	26℃	Relative Humidity：	54%
Pressure：	1010 hPa	Polarization：	Vertical
Test Voltage ：	DC 3.7V		
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/m	dBuV/m	dBuV/m	dB	Detector
1	!	37.9121	44.55	-8.75	35.80	40.00	-4.20	QP
2	*	48.5016	47.73	-10.04	37.69	40.00	-2.31	QP
3	!	56.9912	47.89	-11.28	36.61	40.00	-3.39	QP
4	!	113.7143	56.04	-15.30	40.74	43.50	-2.76	QP
5	!	125.8864	52.87	-14.36	38.51	43.50	-4.99	QP
6		160.9089	47.40	-12.93	34.47	43.50	-9.03	QP

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/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2402									
V	2402.00	108.48	38.06	7.42	20.15	97.99	114.00	-16.01	PK
V	2402.00	97.38	38.06	7.42	20.15	86.89	94.00	-7.11	AV
V	4804.00	58.50	38.53	7.78	23.25	51.00	74.00	-23.00	PK
V	4804.00	45.07	38.53	7.78	23.25	37.57	54.00	-16.43	AV
V	16132.00	49.22	38.75	10.36	26.57	47.40	74.00	-26.60	PK
H	2402.00	109.43	38.06	7.42	20.15	98.94	114.00	-15.06	PK
H	2402.00	97.98	38.06	7.42	20.15	87.49	94.00	-6.51	AV
H	4804.00	59.34	38.53	7.78	23.25	51.84	74.00	-22.16	PK
H	4804.00	44.94	38.53	7.78	23.25	37.44	54.00	-16.56	AV
H	16132.00	48.97	38.75	10.36	26.57	47.15	74.00	-26.85	PK
operation frequency:2441									
V	2441.00	108.00	38.11	7.42	20.36	97.67	114.00	-16.33	PK
V	2441.00	96.55	38.11	7.42	20.36	86.22	94.00	-7.78	AV
V	4880.00	59.44	38.65	7.78	23.61	52.18	74.00	-21.82	PK
V	4880.00	45.11	38.65	7.78	23.61	37.85	54.00	-16.15	AV
V	16132.00	47.52	38.75	10.36	26.57	45.70	74.00	-28.30	PK
H	2441.00	109.00	38.11	7.42	20.36	98.67	114.00	-15.33	PK
H	2441.00	96.41	38.11	7.42	20.36	86.08	94.00	-7.92	AV
H	4880.00	60.48	38.65	7.78	23.61	53.22	74.00	-20.78	PK
H	4880.00	45.82	38.65	7.78	23.61	38.56	54.00	-15.44	AV
H	16132.00	49.13	38.75	10.36	26.57	47.31	74.00	-26.69	PK
operation frequency:2480									
V	2480.00	109.03	38.17	7.42	20.51	98.79	114.00	-15.21	PK
V	2480.00	97.60	38.17	7.42	20.51	87.36	94.00	-6.64	AV
V	4960.00	60.24	38.69	7.78	23.83	53.16	74.00	-20.84	PK
V	4960.00	45.39	38.69	7.78	23.83	38.31	54.00	-15.69	AV
V	16132.00	49.35	38.75	10.36	26.57	47.53	74.00	-26.47	PK
H	2480.00	109.06	38.17	7.42	20.51	98.82	114.00	-15.18	PK
H	2480.00	97.46	38.17	7.42	20.51	87.22	94.00	-6.78	AV
H	4960.00	60.43	38.69	7.78	23.83	53.35	74.00	-20.65	PK
H	4960.00	45.42	38.69	7.78	23.83	38.34	54.00	-15.66	AV
H	16132.00	49.65	38.75	10.36	26.57	47.83	74.00	-26.17	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.

PI/4 DQPSK

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2402									
V	2402.00	108.51	38.06	7.42	20.15	98.02	114.00	-15.98	PK
V	2402.00	95.57	38.06	7.42	20.15	85.08	94.00	-8.92	AV
V	4804.00	57.98	38.53	7.78	23.25	50.48	74.00	-23.52	PK
V	4804.00	44.66	38.53	7.78	23.25	37.16	54.00	-16.84	AV
V	16132.00	48.80	38.75	10.36	26.57	46.98	74.00	-27.02	PK
H	2402.00	108.48	38.06	7.42	20.15	97.99	114.00	-16.01	PK
H	2402.00	96.14	38.06	7.42	20.15	85.65	94.00	-8.35	AV
H	4804.00	58.79	38.53	7.78	23.25	51.29	74.00	-22.71	PK
H	4804.00	44.55	38.53	7.78	23.25	37.05	54.00	-16.95	AV
H	16132.00	48.55	38.75	10.36	26.57	46.73	74.00	-27.27	PK
operation frequency:2441									
V	2441.00	109.01	38.11	7.42	20.36	98.68	114.00	-15.32	PK
V	2441.00	95.70	38.11	7.42	20.36	85.37	94.00	-8.63	AV
V	4880.00	58.89	38.65	7.78	23.61	51.63	74.00	-22.37	PK
V	4880.00	44.70	38.65	7.78	23.61	37.44	54.00	-16.56	AV
V	16132.00	47.10	38.75	10.36	26.57	45.28	74.00	-28.72	PK
H	2441.00	109.03	38.11	7.42	20.36	98.70	114.00	-15.30	PK
H	2441.00	96.57	38.11	7.42	20.36	86.24	94.00	-7.76	AV
H	4880.00	59.93	38.65	7.78	23.61	52.67	74.00	-21.33	PK
H	4880.00	45.42	38.65	7.78	23.61	38.16	54.00	-15.84	AV
H	16132.00	48.70	38.75	10.36	26.57	46.88	74.00	-27.12	PK
operation frequency:2480									
V	2480.00	109.06	38.17	7.42	20.51	98.82	114.00	-15.18	PK
V	2480.00	95.70	38.17	7.42	20.51	85.46	94.00	-8.54	AV
V	4960.00	59.69	38.69	7.78	23.83	52.61	74.00	-21.39	PK
V	4960.00	44.97	38.69	7.78	23.83	37.89	54.00	-16.11	AV
V	16132.00	48.92	38.75	10.36	26.57	47.10	74.00	-26.90	PK
H	2480.00	109.09	38.17	7.42	20.51	98.85	114.00	-15.15	PK
H	2480.00	96.66	38.17	7.42	20.51	86.42	94.00	-7.58	AV
H	4960.00	59.88	38.69	7.78	23.83	52.80	74.00	-21.20	PK
H	4960.00	45.00	38.69	7.78	23.83	37.92	54.00	-16.08	AV
H	16132.00	49.22	38.75	10.36	26.57	47.40	74.00	-26.60	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.

8DPSK

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2402									
V	2402.00	108.82	38.06	7.42	20.15	98.33	114.00	-15.67	PK
V	2402.00	95.68	38.06	7.42	20.15	85.19	94.00	-8.81	AV
V	4804.00	58.69	38.53	7.78	23.25	51.19	74.00	-22.81	PK
V	4804.00	45.22	38.53	7.78	23.25	37.72	54.00	-16.28	AV
V	16132.00	49.38	38.75	10.36	26.57	47.56	74.00	-26.44	PK
H	2402.00	106.80	38.06	7.42	20.15	96.31	114.00	-17.69	PK
H	2402.00	92.34	38.06	7.42	20.15	81.85	94.00	-12.15	AV
H	4804.00	59.52	38.53	7.78	23.25	52.02	74.00	-21.98	PK
H	4804.00	45.10	38.53	7.78	23.25	37.60	54.00	-16.40	AV
H	16132.00	49.13	38.75	10.36	26.57	47.31	74.00	-26.69	PK
operation frequency:2441									
V	2441.00	108.33	38.11	7.42	20.36	98.00	114.00	-16.00	PK
V	2441.00	95.82	38.11	7.42	20.36	85.49	94.00	-8.51	AV
V	4880.00	59.61	38.65	7.78	23.61	52.35	74.00	-21.65	PK
V	4880.00	45.26	38.65	7.78	23.61	38.00	54.00	-16.00	AV
V	16132.00	47.67	38.75	10.36	26.57	45.85	74.00	-28.15	PK
H	2441.00	108.35	38.11	7.42	20.36	98.02	114.00	-15.98	PK
H	2441.00	95.71	38.11	7.42	20.36	85.38	94.00	-8.62	AV
H	4880.00	60.67	38.65	7.78	23.61	53.41	74.00	-20.59	PK
H	4880.00	45.95	38.65	7.78	23.61	38.69	54.00	-15.31	AV
H	16132.00	49.29	38.75	10.36	26.57	47.47	74.00	-26.53	PK
operation frequency:2480									
V	2480.00	108.38	38.17	7.42	20.51	98.14	114.00	-15.86	PK
V	2480.00	95.93	38.17	7.42	20.51	85.69	94.00	-8.31	AV
V	4960.00	60.42	38.69	7.78	23.83	53.34	74.00	-20.66	PK
V	4960.00	45.54	38.69	7.78	23.83	38.46	54.00	-15.54	AV
V	16132.00	49.51	38.75	10.36	26.57	47.69	74.00	-26.31	PK
H	2480.00	108.41	38.17	7.42	20.51	98.17	114.00	-15.83	PK
H	2480.00	95.77	38.17	7.42	20.51	85.53	94.00	-8.47	AV
H	4960.00	60.62	38.69	7.78	23.83	53.54	74.00	-20.46	PK
H	4960.00	45.57	38.69	7.78	23.83	38.49	54.00	-15.51	AV
H	16132.00	49.82	38.75	10.36	26.57	48.00	74.00	-26.00	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:

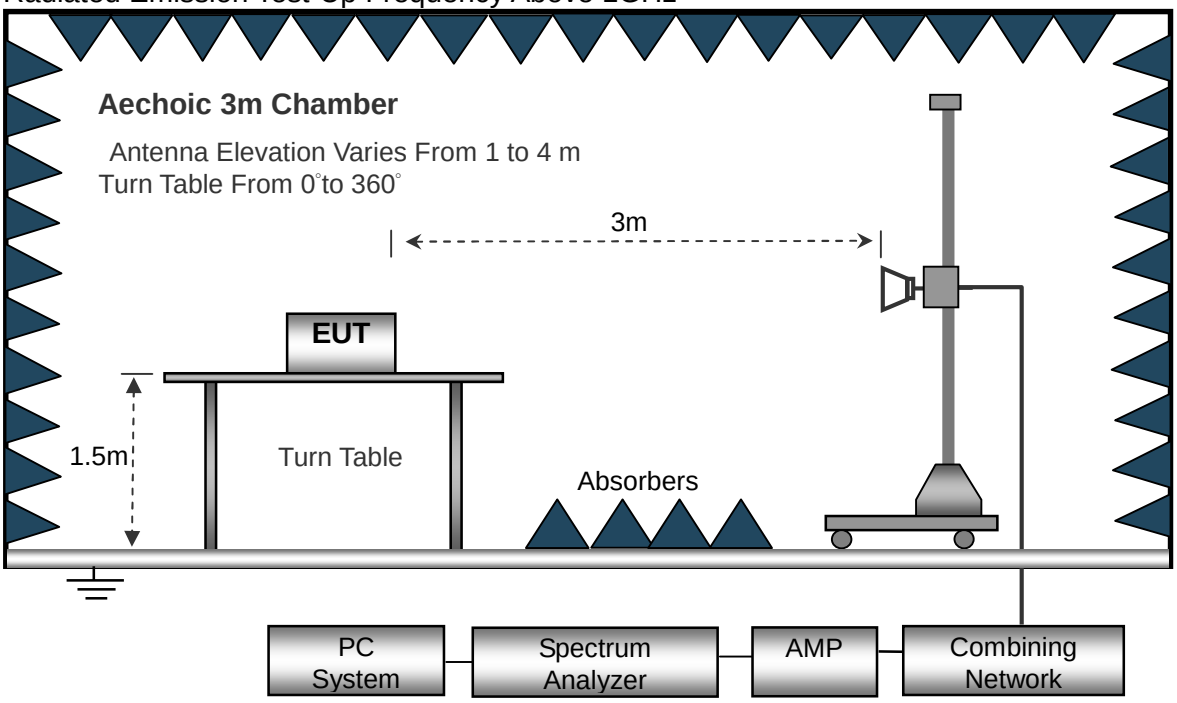
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

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

GFSK

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	Margin (dB)	Detector Type
operation frequency:2402									
V	2390.00	64.31	38.06	7.42	20.15	53.82	74.00	-20.18	PK
V	2390.00	53.43	38.06	7.42	20.15	42.94	54.00	-11.06	AV
V	2400.00	64.51	38.06	7.42	20.15	54.02	74.00	-19.98	PK
V	2400.00	53.03	38.06	7.42	20.15	42.54	54.00	-11.46	AV
H	2390.00	64.59	38.06	7.42	20.15	54.10	74.00	-19.90	PK
H	2390.00	53.45	38.06	7.42	20.15	42.96	54.00	-11.04	AV
H	2400.00	64.46	38.06	7.42	20.15	53.97	74.00	-20.03	PK
H	2400.00	53.40	38.06	7.42	20.15	42.91	54.00	-11.09	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2480									
V	2483.50	64.51	38.17	7.42	20.51	54.27	74.00	-19.73	PK
V	2483.50	53.65	38.17	7.42	20.51	43.41	54.00	-10.59	AV
V	2500.00	64.45	38.20	7.45	20.54	54.24	74.00	-19.76	PK
V	2500.00	53.13	38.20	7.45	20.54	42.92	54.00	-11.08	AV
H	2483.50	64.63	38.17	7.42	20.51	54.39	74.00	-19.61	PK
H	2483.50	53.69	38.17	7.42	20.51	43.45	54.00	-10.55	AV
H	2500.00	64.27	38.20	7.45	20.54	54.06	74.00	-19.94	PK
H	2500.00	53.94	38.20	7.45	20.54	43.73	54.00	-10.27	AV

Remark:

1. Emission Level = Meter Reading + Factor, 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.

PI/4 DQPSK

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	Margin (dB)	Detector Type
operation frequency:2402									
V	2390.00	64.46	38.06	7.42	20.15	53.97	74.00	-20.03	PK
V	2390.00	53.54	38.06	7.42	20.15	43.05	54.00	-10.95	AV
V	2400.00	64.66	38.06	7.42	20.15	54.17	74.00	-19.83	PK
V	2400.00	53.15	38.06	7.42	20.15	42.66	54.00	-11.34	AV
H	2390.00	64.75	38.06	7.42	20.15	54.26	74.00	-19.74	PK
H	2390.00	53.57	38.06	7.42	20.15	43.08	54.00	-10.92	AV
H	2400.00	64.62	38.06	7.42	20.15	54.13	74.00	-19.87	PK
H	2400.00	53.52	38.06	7.42	20.15	43.03	54.00	-10.97	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2480									
V	2483.50	64.63	38.17	7.42	20.51	54.39	74.00	-19.61	PK
V	2483.50	53.77	38.17	7.42	20.51	43.53	54.00	-10.47	AV
V	2500.00	64.58	38.20	7.45	20.54	54.37	74.00	-19.63	PK
V	2500.00	53.24	38.20	7.45	20.54	43.03	54.00	-10.97	AV
H	2483.50	64.75	38.17	7.42	20.51	54.51	74.00	-19.49	PK
H	2483.50	53.81	38.17	7.42	20.51	43.57	54.00	-10.43	AV
H	2500.00	64.38	38.20	7.45	20.54	54.17	74.00	-19.83	PK
H	2500.00	54.05	38.20	7.45	20.54	43.84	54.00	-10.16	AV

Remark:

1. Emission Level = Meter Reading + Factor, 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.

8DPSK

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m	Margin (dB)	Detector Type
operation frequency:2402									
V	2390.00	64.61	38.06	7.42	20.15	54.12	74.00	-19.88	PK
V	2390.00	53.69	38.06	7.42	20.15	43.20	54.00	-10.80	AV
V	2400.00	64.82	38.06	7.42	20.15	54.33	74.00	-19.67	PK
V	2400.00	53.29	38.06	7.42	20.15	42.80	54.00	-11.20	AV
H	2390.00	64.89	38.06	7.42	20.15	54.40	74.00	-19.60	PK
H	2390.00	53.72	38.06	7.42	20.15	43.23	54.00	-10.77	AV
H	2400.00	64.76	38.06	7.42	20.15	54.27	74.00	-19.73	PK
H	2400.00	53.65	38.06	7.42	20.15	43.16	54.00	-10.84	AV

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Pre-amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
operation frequency:2480									
V	2483.50	64.82	38.17	7.42	20.51	54.58	74.00	-19.42	PK
V	2483.50	53.92	38.17	7.42	20.51	43.68	54.00	-10.32	AV
V	2500.00	64.75	38.20	7.45	20.54	54.54	74.00	-19.46	PK
V	2500.00	53.38	38.20	7.45	20.54	43.17	54.00	-10.83	AV
H	2483.50	64.93	38.17	7.42	20.51	54.69	74.00	-19.31	PK
H	2483.50	53.96	38.17	7.42	20.51	43.72	54.00	-10.28	AV
H	2500.00	64.56	38.20	7.45	20.54	54.35	74.00	-19.65	PK
H	2500.00	54.20	38.20	7.45	20.54	43.99	54.00	-10.01	AV

Remark:

1. Emission Level = Meter Reading + Factor, 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.

4. BANDWIDTH TEST

4.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.249) , Subpart C	
Section	Test Item
15.249	Bandwidth

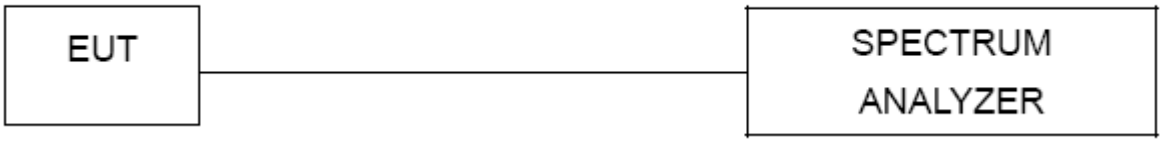
4.1.1 TEST PROCEDURE

1. Set RBW = 30 kHz.
2. Set the video bandwidth (VBW) ≥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 20 dB relative to the maximum level measured in the fundamental emission.

4.1.2 DEVIATION FROM STANDARD

No deviation.

4.1.3 TEST SETUP



4.1.4 EUT OPERATION CONDITIONS

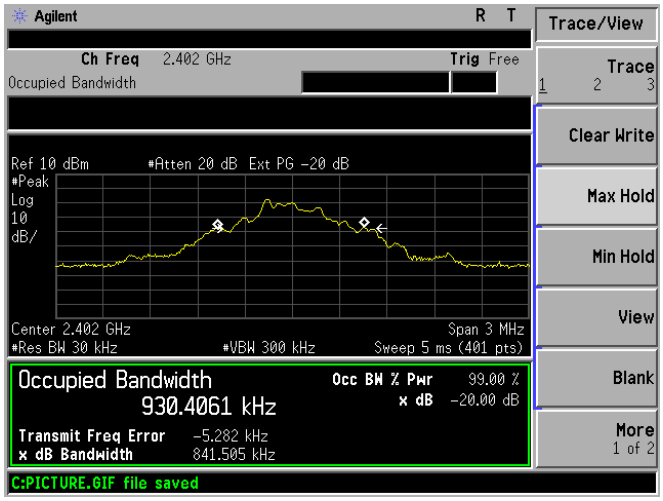
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

4.1.5 TEST RESULTS

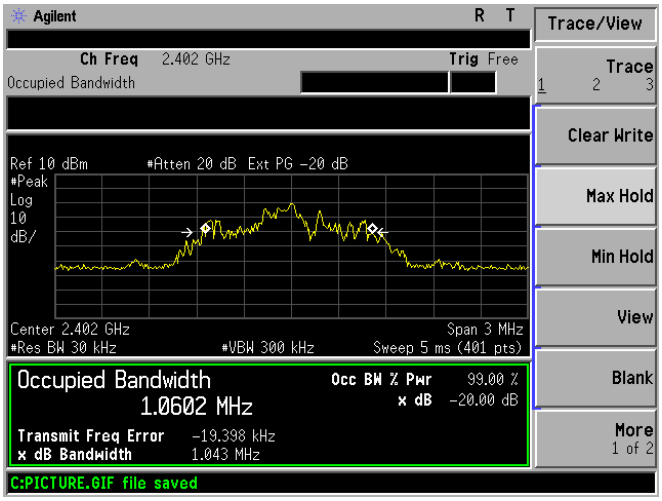
Temperature：	25℃	Relative Humidity：	60%
Pressure：	1012 hPa	Test Voltage ：	DC 3.7V
Test Mode ：	TX Mode /CH00, CH39, CH78		

	Frequency (MHz)	20dB Bandwidth (MHz)	Result
GFSK	2402	0.842	Pass
	2441	0.833	Pass
	2480	0.749	Pass
PI/4 DQPSK	2402	1.043	Pass
	2441	1.136	Pass
	2480	1.109	Pass
8DPSK	2402	1.138	Pass
	2441	1.103	Pass
	2480	1.091	Pass

GFSK 2402MHz

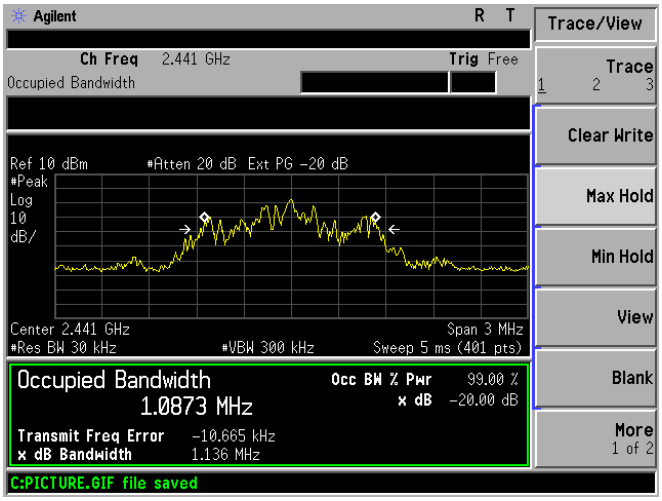


PI/4 DQPSK 2402MHz

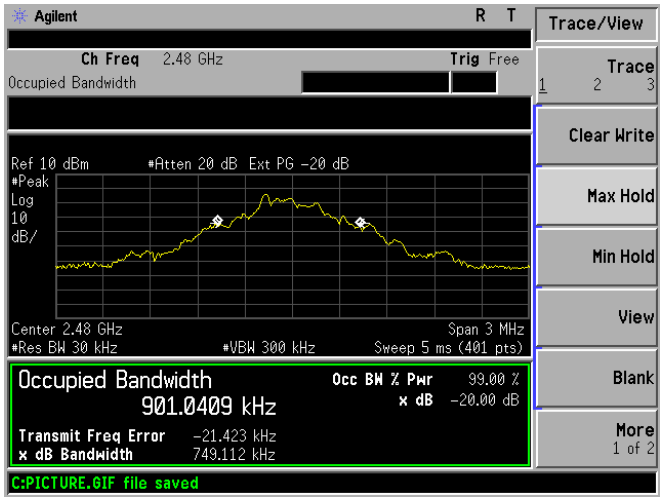


GFSK 2441MHz

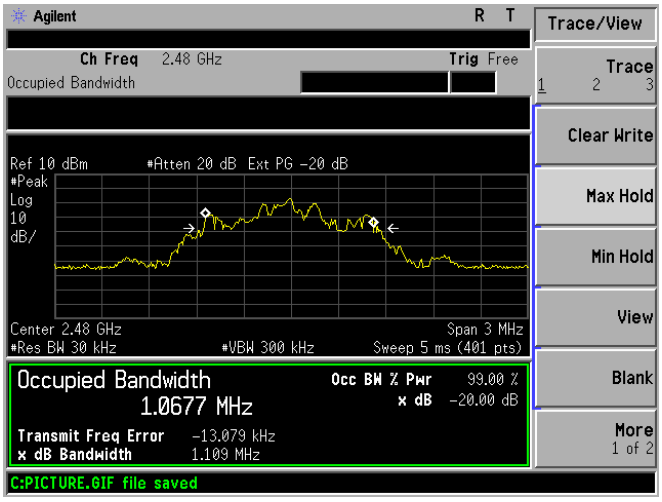
PI/4 DQPSK 2441MHz



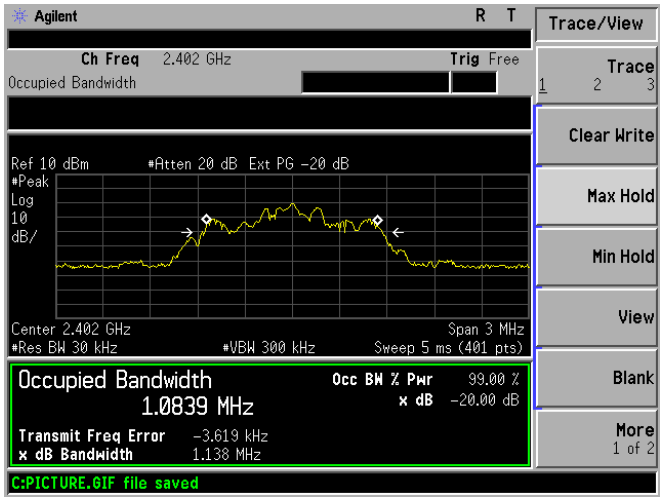
GFSK 2480MHz



PI/4 DQPSK 2480MHz



8DPSK 2402MHz



8DPSK 2441MHz

8DPSK 2480MHz

5. ANTENNA REQUIREMENT

5.1 STANDARD REQUIREMENT

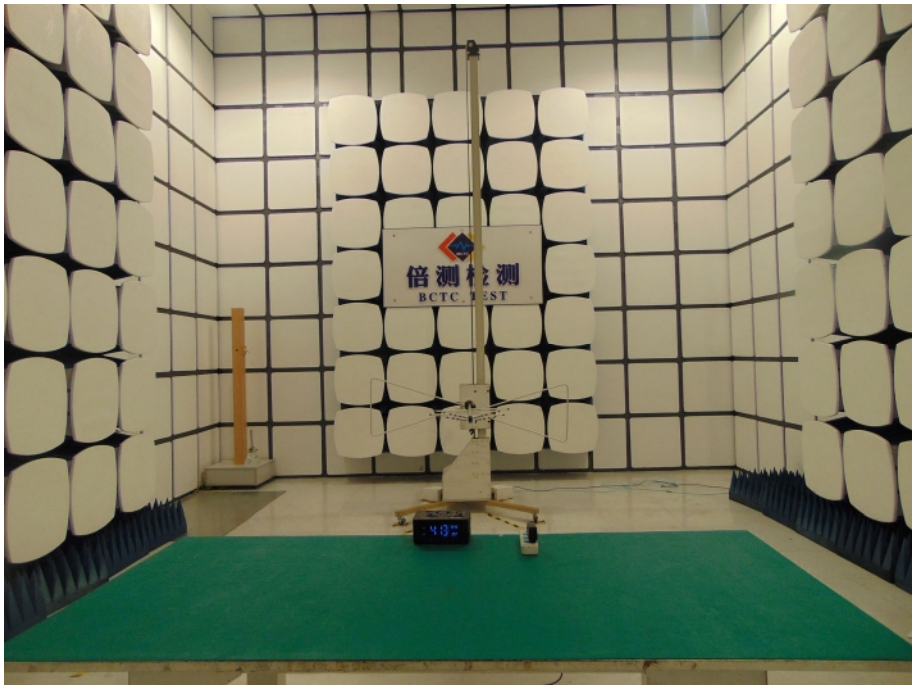
15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

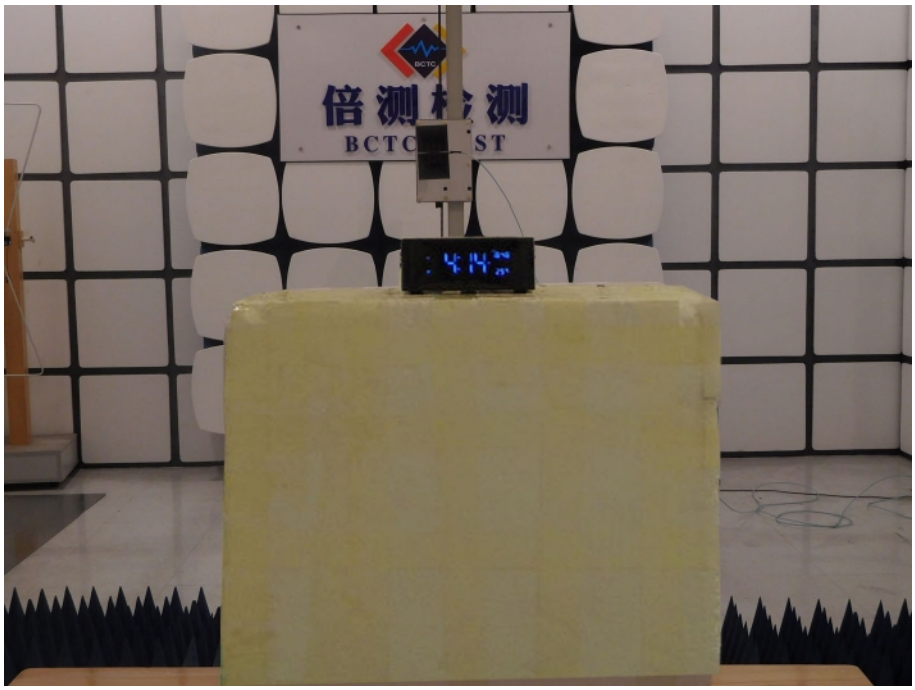
5.2 EUT ANTENNA

The EUT antenna is PCB antenna,. It comply with the standard requirement.

6. TEST SETUP PHOTO

Radiated Measurement Photos



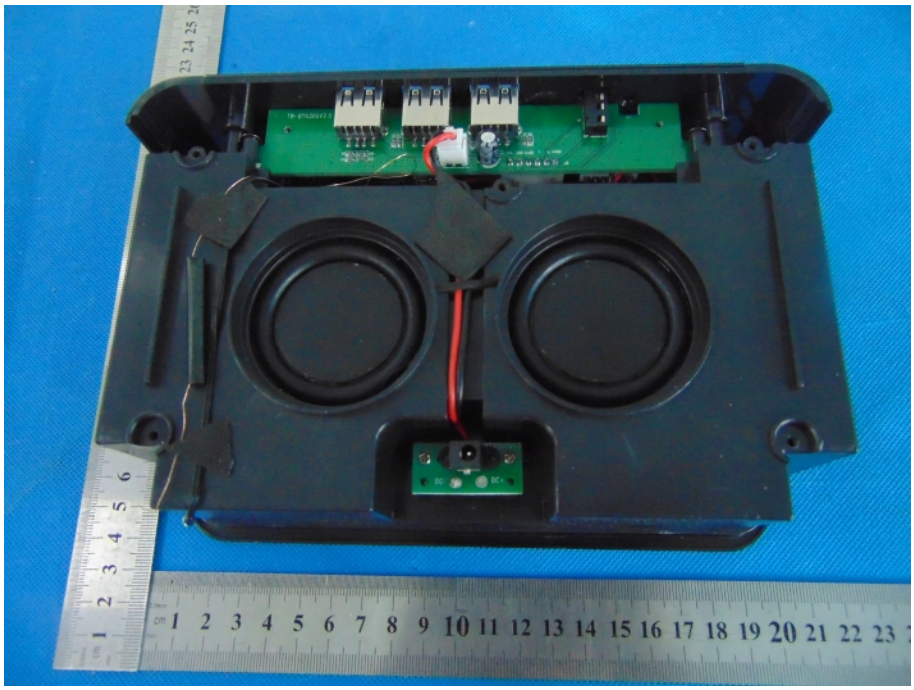


Conducted Measurement Photos

7. EUT PHOTO

NFC
-/H
+/H
OK/
ALARM
MODE/
SNOOZE

AUX IN



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