

# FCC TEST REPORT

## FCC ID: OXGAL67

Product	:	Show Home App Laser RGB 3D Hologram Projector
Model Name	:	AL67-3D
Brand	:	SHOW HOME
Report No.	:	PTC18060104201E-FC01
<b>Prepared for</b>		
Willis Electric Co., Ltd.		
No.504-1, Chung-Hua Road, Sec.4 Hsin Chu Taiwan		
<b>Prepared by</b>		
Dongguan Precise Testing & Certification Corp., Ltd.		
Building D, Baoding Technology Park, Guangming Road 2, Guangming Community, Dongcheng District, Dongguan, Guangdong, China		



# 1 TEST RESULT CERTIFICATION

Applicant's name : Willis Electric Co., Ltd.  
Address : No.504-1, Chung-Hua Road, Sec.4 Hsin Chu Taiwan  
Manufacture's name : Kupoint (DongGuan) Electric Co., Ltd  
Address : Huai De Industrial Humen Town Dong Guan City Guang Dong Province  
Product name : Show Home App Laser RGB 3D Hologram Projector  
Model name : AL67-3D  
Standards : FCC CFR47 Part 15 Section 15.247  
Test procedure : ANSI C63.10:2013  
Test Date : June 01, 2018 to June 04, 2018  
Date of Issue : June 04, 2018  
Test Result : Pass

This device described above has been tested by PTC, 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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Test Engineer:

Leo Yang / Engineer

Technical Manager:

Chris Du / Manager



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## 2 Test Summary

Test Items	Test Requirement	Result
Conduct Emission	15.207	PASS
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Conducted Spurious Emission	15.247(d)	N/A
Band edge	15.247(d) 15.205(a)	N/A
6dB Bandwidth	15.247(a)(2)	N/A
Maximum Peak Output Power	15.247(b)(1)	N/A
Power Spectral Density	15.247(e)	N/A
Antenna Requirement	15.203	N/A

Note: N/A is an abbreviation for Not Applicable.



PRECISE TESTING

Report No.: PTC18060104201E-FC01

## Test Site

Dongguan Precise Testing & Certification Corp., Ltd.

Address: Building D, Baoding Technology Park, Guangming Road2, Dongcheng District, Dongguan, Guangdong, China

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A-1

Test Lab: Shenzhen BCTC Testing Co., Ltd.

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

FCC Registered No.: 712850

Test items: Radiated Spurious Emission(18GHz to 25GHz)



### 3 General Information

#### 3.1 General Description of E.U.T.

Product Name	:	Show Home App Laser RGB 3D Hologram Projector
Model Name	:	AL67-3D
Bluetooth Version	:	BLE 4.0
Operating frequency	:	2402-2480MHz
Number of Channels	:	40
Type of Modulation	:	GFSK
Antenna installation	:	Internal PCB Antenna
Antenna Gain	:	0.5dBi
Power supply	:	For Adapter: Model: K25C120200U Input: AC 120V, 50/60Hz, 0.6A Output: DC 12V, 2.0A
Hardware Version	:	AL67_3D_V1
Software Version	:	AL67-3D_V10



### 3.2 Channel List

The EUT has been tested under its typical operating condition. Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting. Only the worst case data were reported.

The EUT has been associated with peripherals pursuant to ANSI C63.10-2013 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 KHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

The details of test channels and bandwidth were for RF conductive measurement.

Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	<b>2402</b>	14	2430	28	2458
01	2404	15	2432	29	2460
02	2406	16	2434	30	2462
03	2408	17	2436	31	2464
04	2410	18	2438	32	2466
05	2412	<b>19</b>	<b>2440</b>	33	2468
06	2414	20	2442	34	2470
07	2416	21	2444	35	2472
08	2418	22	2446	36	2474
09	2420	23	2448	37	2476
10	2422	24	2450	38	2478
11	2424	25	2452	39	<b>2480</b>
12	2426	26	2454		
13	2428	27	2456		

Note:

1. Test of channel was included the lowest 2402MHz, middle 2440MHz and highest frequency 2480MHz in highest data rate and to perform the test, then record on this report.



## 4 Equipment During Test

### 4.1 Equipments List

RF Conducted Test

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
MXG Signal Analyzer	Agilent	N9020A	MY56070279	10Hz-30GHz	Apr. 07, 2019
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	Oct. 09, 2018
Antenna Connector	Florida RF Labs	N/A	RF01#	N/A	Aug. 26, 2018

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

Radiated Emissions(Test Frequency from 9KHz-18GHz)

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Sep. 03, 2018
Loop Antenna	Schwarzbeck	FMZB 1519	012	9 KHz -30MHz	Aug 31, 2018
Bilog Antenna	SCHWARZBECK	VULB9160	9160-3355	25MHz-2GHz	Aug 31, 2018
Preamplifier (low frequency)	SCHWARZBECK	BBV 9475	9745-0013	1MHz-1GHz	Sep. 03, 2018
Cable	Schwarzbeck	PLF-100	549489	9KHz-3GHz	Sep. 03, 2018
Spectrum Analyzer	Agilent	E4407B	MY45109572	9KHz-40GHz	Oct. 13, 2018
Horn Antenna	SCHWARZBECK	9120D	9120D-1246	1GHz-18GHz	Aug. 31, 2018
Power Amplifier	LUNAR EM	LNA1G18-40	J10100000081	1GHz-26.5GHz	Aug. 31, 2018
Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	Sep. 03, 2018





## Radiated Emission (Test Frequency from 18GHz-25GHz)

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
Spectrum Analyzer	Agilent	E4407B	MY45109572	9KHz-26.5GHz	2018.08.26
Test Receiver	R&S	ESPI	101396	9KHz-7GHz	2018.08.26
Horn Antenna	SCHWARZBECK	BBHA 9170	9170-181	14GHz-40GHz	2018.09.02
Amplifier	SCHWARZBECK	BBV 9721	9721-205	18GHz-40GHz	2018.08.26
RF Cable	R&S	R204	R21X	1GHz-40GHz	2018.08.26

## Conducted Emissions

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Sep. 03, 2018
Artificial Mains Network	Rohde&Schwarz	L2-16B	000WX31025	9KHz-300MHz	Sep. 03, 2018
Artificial Mains Network	Rohde&Schwarz	ENV216	101342	9KHz-300MHz	Sep. 03, 2018



## 4.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	±1.0dB
Power Spectral Density, conducted	±2.2dB
Radio Frequency	± 1 x 10 <sup>-6</sup>
Bandwidth	± 1.5 x 10 <sup>-6</sup>
Time	±2%
Duty Cycle	±2%
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±3%
Conducted Emissions (150kHz~30MHz)	±3.64dB
Radiated Emission(30MHz~1GHz)	±5.03dB
Radiated Emission(1GHz~25GHz)	±4.74dB
Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95%	



PRECISE TESTING

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### 4.3 Description of Support Units

Equipment	Model No.	Series No.
N/A	N/A	N/A



## 5 Conducted Emission

Test Requirement : FCC CFR 47 Part 15 Section 15.207  
Test Method : ANSI C63.10: 2013  
Test Result : PASS  
Frequency Range : 150kHz to 30MHz  
Class/Severity : Class B

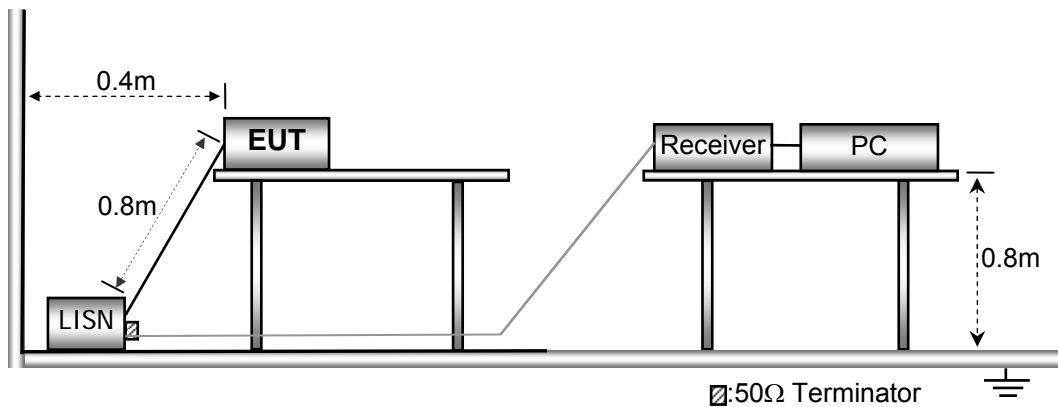
### 5.1 E.U.T. Operation

Operating Environment :

Temperature : 25.5 °C  
Humidity : 51 % RH  
Atmospheric Pressure : 101.2kPa

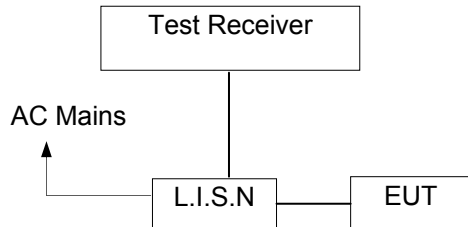
### 5.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.





### 5.3 Test SET-UP (Block Diagram of Configuration)



### 5.4 Measurement Procedure

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

### 5.5 Conducted Emission Limit

#### Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

**Note:**

1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### 5.6 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

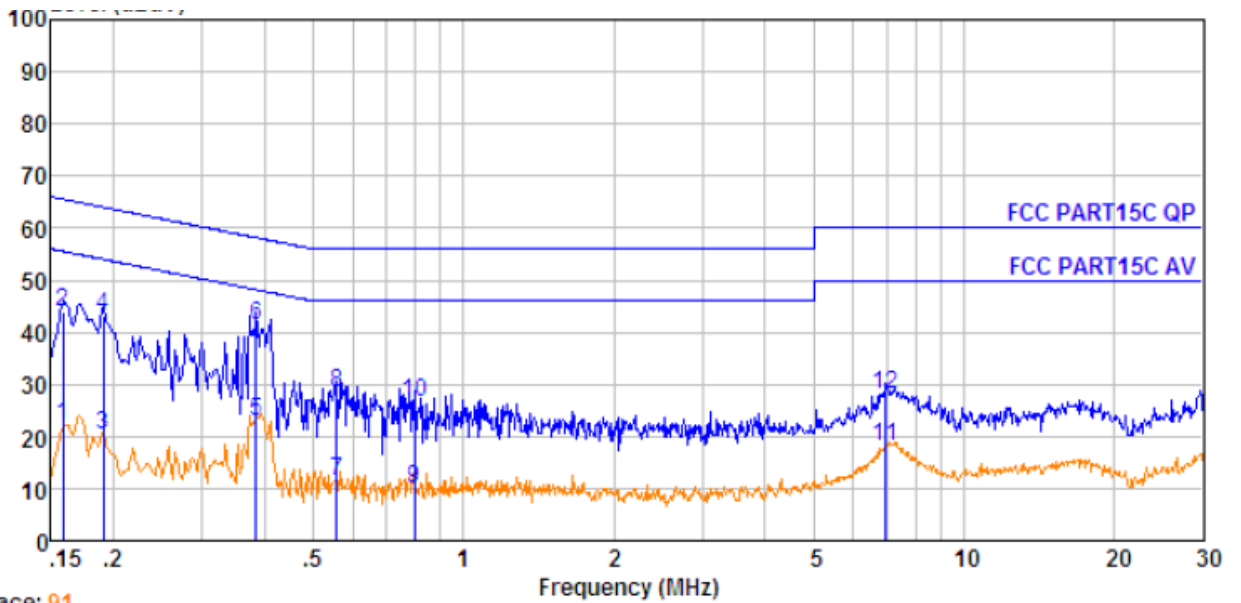
### 5.7 Conducted Emission Test Result

Pass.

All the modulation modes were tested the data of the worst mode (GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.



Line-AC 120V/60Hz

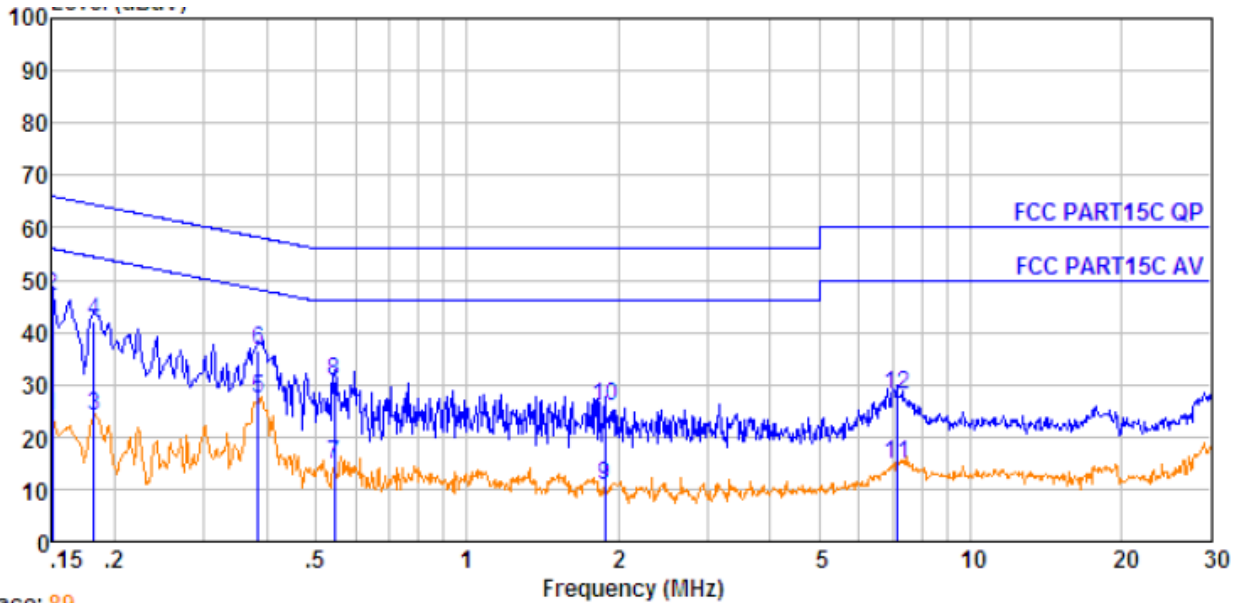


Trace: 91

No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.158	0.22	9.51	12.56	22.29	55.56	-33.27	Average
2.	0.158	0.22	9.51	34.14	43.87	65.56	-21.69	QP
3.	0.190	0.27	9.57	10.38	20.22	54.02	-33.80	Average
4.	0.190	0.27	9.57	33.41	43.25	64.02	-20.77	QP
5.	0.385	0.40	9.73	12.64	22.77	48.17	-25.40	Average
6.	0.385	0.40	9.73	31.16	41.29	58.17	-16.88	QP
7.	0.558	0.43	9.79	1.29	11.51	46.00	-34.49	Average
8.	0.558	0.43	9.79	18.21	28.43	56.00	-27.57	QP
9.	0.796	0.45	9.81	-0.42	9.84	46.00	-36.16	Average
10.	0.796	0.45	9.81	16.43	26.69	56.00	-29.31	QP
11.	6.988	0.55	9.99	7.60	18.14	50.00	-31.86	Average
12.	6.988	0.55	9.99	17.43	27.97	60.00	-32.03	QP



Neutral-AC 120V/60Hz



Trace: 89

No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBuV	Emission Level dBuV	Limit dBuV	Over Limit dB	Remark
1.	0.150	0.21	9.53	14.10	23.84	56.00	-32.16	Average
2.	0.150	0.21	9.53	37.14	46.88	66.00	-19.12	QP
3.	0.182	0.25	9.59	14.10	23.94	54.42	-30.48	Average
4.	0.182	0.25	9.59	32.36	42.20	64.42	-22.22	QP
5.	0.385	0.40	9.76	17.08	27.24	48.17	-20.93	Average
6.	0.385	0.40	9.76	26.21	36.37	58.17	-21.80	QP
7.	0.546	0.43	9.82	4.41	14.66	46.00	-31.34	Average
8.	0.546	0.43	9.82	20.41	30.66	56.00	-25.34	QP
9.	1.878	0.47	9.88	0.39	10.74	46.00	-35.26	Average
10.	1.878	0.47	9.88	15.41	25.76	56.00	-30.24	QP
11.	7.137	0.55	9.99	4.38	14.92	50.00	-35.08	Average
12.	7.137	0.55	9.99	17.55	28.09	60.00	-31.91	QP



## 6 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209 & 15.247  
 Test Method : ANSI C63.10:2013  
 Test Result : PASS  
 Measurement Distance : 3m  
 Limit : See the follow table

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
1.705 ~ 30	30	30	$100 * 30$	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

### 6.1 EUT Operation

Operating Environment :

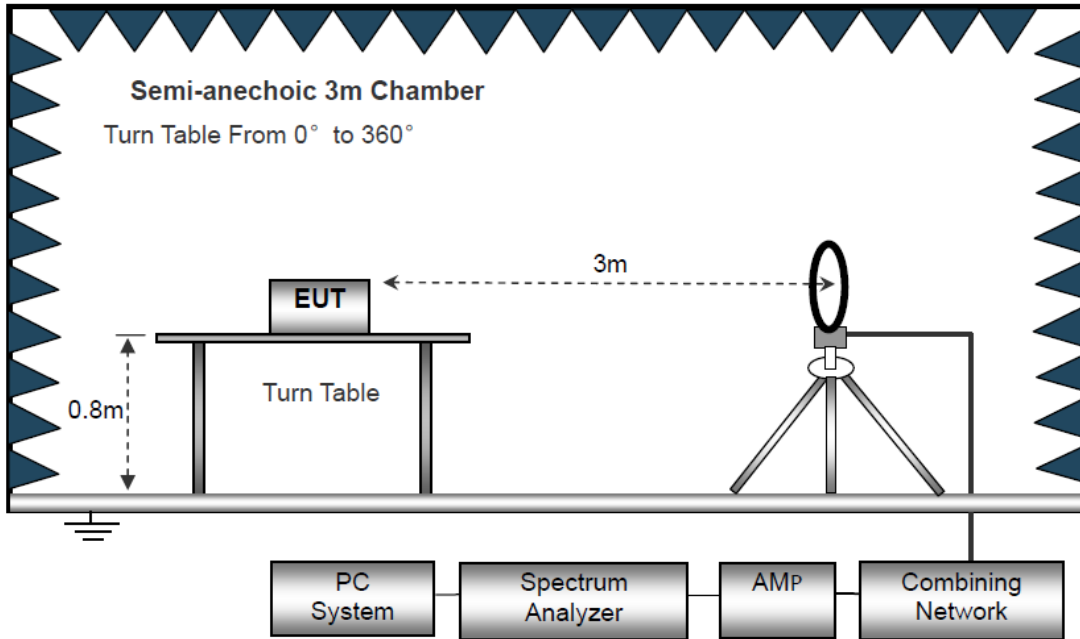
Temperature : 23.5 °C  
 Humidity : 51.1 % RH  
 Atmospheric Pressure : 101.2kPa



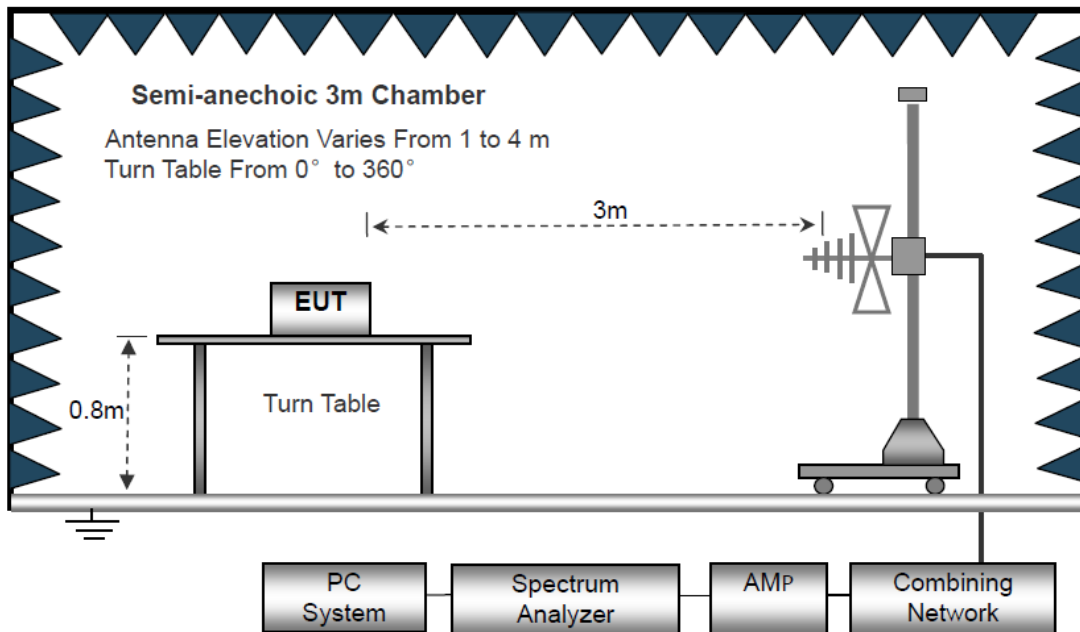
### 6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

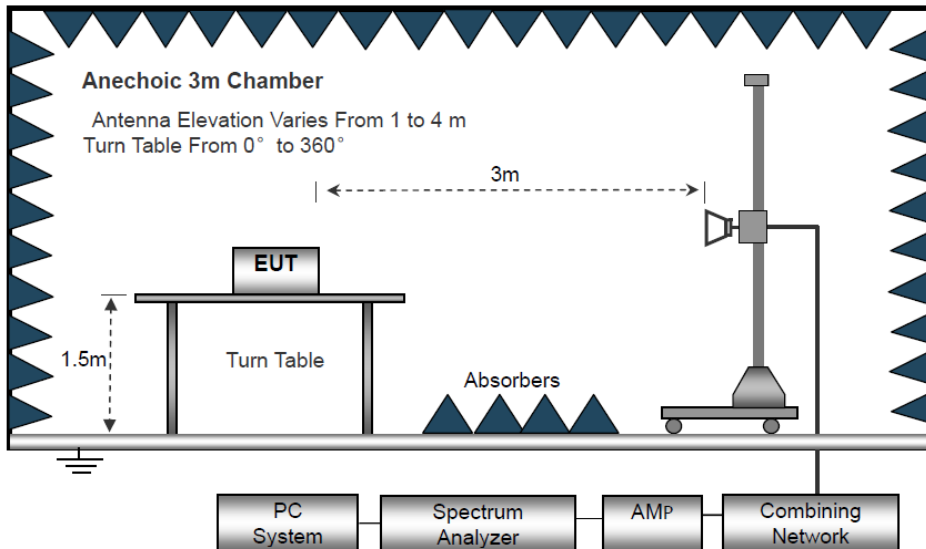
The test setup for emission measurement below 30MHz



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz



### 6.3 Spectrum Analyzer Setup

Below 30MHz			
IF Bandwidth	:	10kHz	
Resolution Bandwidth	:	10kHz	
Video Bandwidth	:	10kHz	
30MHz ~ 1GHz			
Detector	:	PK	QP
Resolution Bandwidth	:	100kHz	120kHz
Video Bandwidth	:	300kHz	300kHz
Above 1GHz			
Detector	:	PK	AV
Resolution Bandwidth	:	1MHz	1MHz
Video Bandwidth	:	3MHz	10Hz



## 6.4 Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2013.
2. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.
7. Test Procedure of measurement (For Above 1GHz):
  - 1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).
  - 2) Change the antenna polarization and repeat 1) with vertical polarization.
  - 3) Make a hardcopy of the spectrum.
  - 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
  - 5) Change the analyser mode to Clear/ Write and found the cone of emission.
  - 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.
  - 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.
  - 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.
8. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.



For Average Measurement:

VBW=10Hz, when duty cycle is no less than 98 percent.

VBW $\geq$ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

Band	Duty Cycle(%)	T( $\mu$ s)	1/T(KHz)	Average Correction Factor	VBW Setting
2402-2480	100	-	-	0	10Hz



### 6.5 Summary of Test Results

#### Test Frequency: 9KHz-30MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	>20

Note:

The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor =  $40\log(\text{Specific distance/ test distance})$  (dB);

Limit line=Specific limits(dBuV) + distance extrapolation factor.

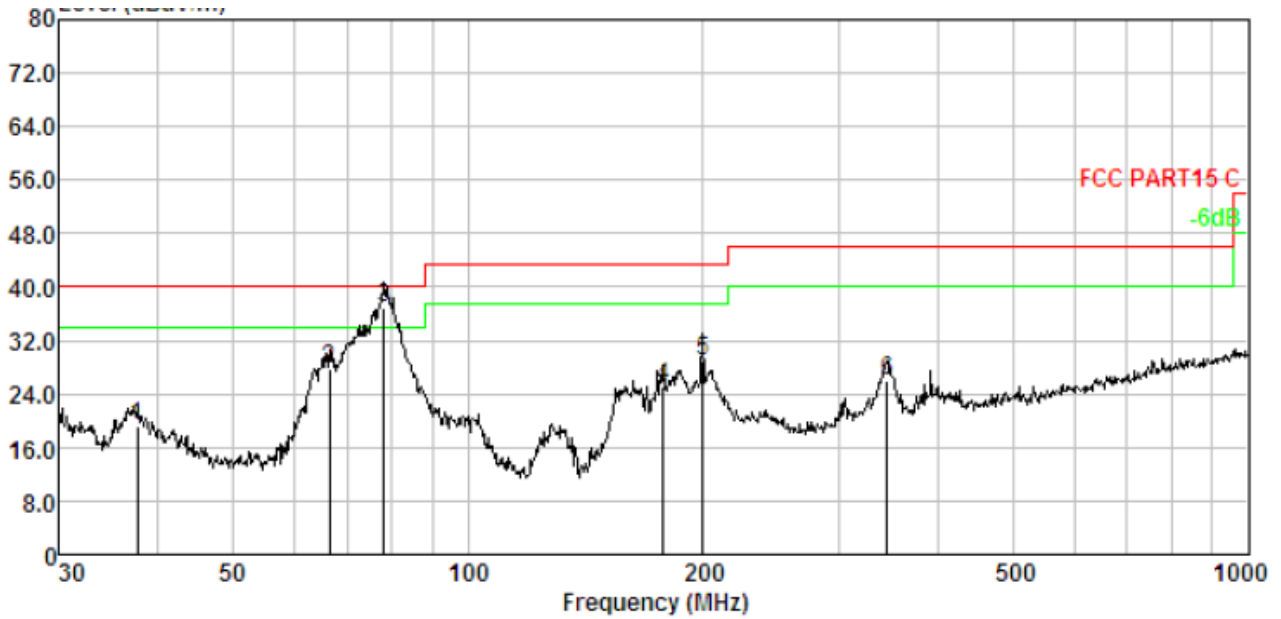
#### Test Frequency: 30MHz ~ 1GHz

Pass.

Please refer to the following test plots for the worst test mode (GFSK (CH00: 2402MHz)).



Antenna Polarization: Horizontal GFSK(CH00: 2402MHz)

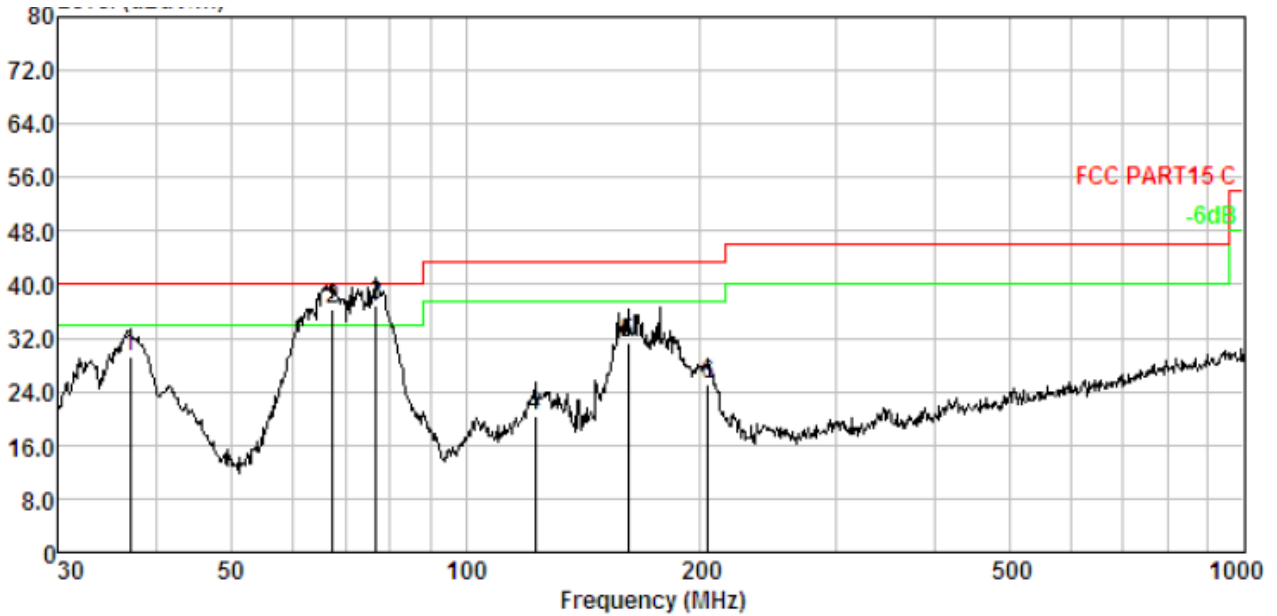


No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	37.680	1.26	13.52	34.44	30.05	19.17	40.00	-20.83	QP
2.	66.499	1.78	11.27	45.04	30.25	27.84	40.00	-12.16	QP
3.	78.139	1.92	9.17	56.08	30.30	36.87	40.00	-3.13	QP
4.	178.133	2.67	12.60	40.54	30.59	25.22	43.50	-18.28	QP
5.	199.986	2.77	10.38	46.52	30.63	29.04	43.50	-14.46	QP
6.	344.386	3.26	14.16	39.38	30.82	25.98	46.00	-20.02	QP

Remark: Emission Level = Reading + Cable Loss + ANT Factor - AMP Factor



Antenna Polarization: Vertical GFSK(CH00: 2402MHz)



No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamplifier Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	37.025	1.25	13.49	44.62	30.04	29.32	40.00	-10.68	QP
2.	67.438	1.79	10.92	53.82	30.25	36.28	40.00	-3.72	QP
3.	76.781	1.91	9.47	55.83	30.30	36.91	40.00	-3.09	QP
4.	122.834	2.33	12.20	36.26	30.46	20.33	43.50	-23.17	QP
5.	161.474	2.58	13.80	45.45	30.56	31.27	43.50	-12.23	QP
6.	204.955	2.79	10.48	42.32	30.64	24.95	43.50	-18.55	QP

Remark: Emission Level = Reading + Cable Loss + ANT Factor - AMP Factor



**Test Frequency 1GHz-18GHz:**

**GFSK Low Channel (2402MHz)**

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4804	29.35	AV	V	8.16	9.11	12.04	34.58	54	-19.42
4804	30.14	AV	H	8.16	9.11	12.04	35.37	54	-18.63
4804	28.43	PK	V	8.16	9.11	12.04	33.66	74	-40.34
4804	31.25	PK	H	8.16	9.11	12.04	36.48	74	-37.52
16325	30.18	AV	V	8.63	11.03	7.68	42.16	54	-11.84
16325	29.65	AV	H	8.63	11.03	7.68	41.63	54	-12.37
16325	33.06	PK	V	8.63	11.03	7.68	45.04	74	-28.96
16325	32.48	PK	H	8.63	11.03	7.68	44.46	74	-29.54

**GFSK Middle Channel (2440MHz)**

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4880	30.23	AV	V	9.09	10.35	7.82	41.85	54	-12.15
4880	31.45	AV	H	9.09	10.35	7.82	43.07	54	-10.93
4880	29.05	PK	V	9.09	10.35	7.82	40.67	74	-33.33
4880	29.18	PK	H	9.09	10.35	7.82	40.8	74	-33.2
17004	30.46	AV	V	8.74	10.49	11.06	38.63	54	-15.37
17004	31.29	AV	H	8.74	10.49	11.06	39.46	54	-14.54
17004	31.48	PK	V	8.74	10.49	11.06	39.65	74	-34.35
17004	32.08	PK	H	8.74	10.49	11.06	40.25	74	-33.75

**GFSK High Channel (2480MHz)**

Frequency (MHz)	S.A Reading (dBuV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4960	30.32	AV	V	9.52	10.84	11.69	38.99	54	-15.01
4960	31.08	AV	H	9.52	10.84	11.69	39.75	54	-14.25
4960	29.46	PK	V	9.52	10.84	11.69	38.13	74	-35.87
4960	31.05	PK	H	9.52	10.84	11.69	39.72	74	-34.28
16958	32.61	AV	V	11.06	9.62	10.02	43.27	54	-10.73
16958	29.58	AV	H	11.06	9.62	10.02	40.24	54	-13.76
16958	27.04	PK	V	11.06	9.62	10.02	37.70	74	-36.30
16958	28.14	PK	H	11.06	9.62	10.02	38.80	74	-35.20

Note: 1. The testing has been conformed to  $10 \times 2480\text{MHz} = 24800\text{MHz}$ .

- 2. All other emissions more than 30dB below the limit.
- 3. Factor = Antenna Factor + Cable Loss – Pre-amplifier.  
 Emission Level = Reading + Factor  
 Margin=Emission Level-Limit



**Test Frequency: From 18GHz to 25GHz**

The measurements were more than 20dB below the limit and not reported.

## 7 Test Setup

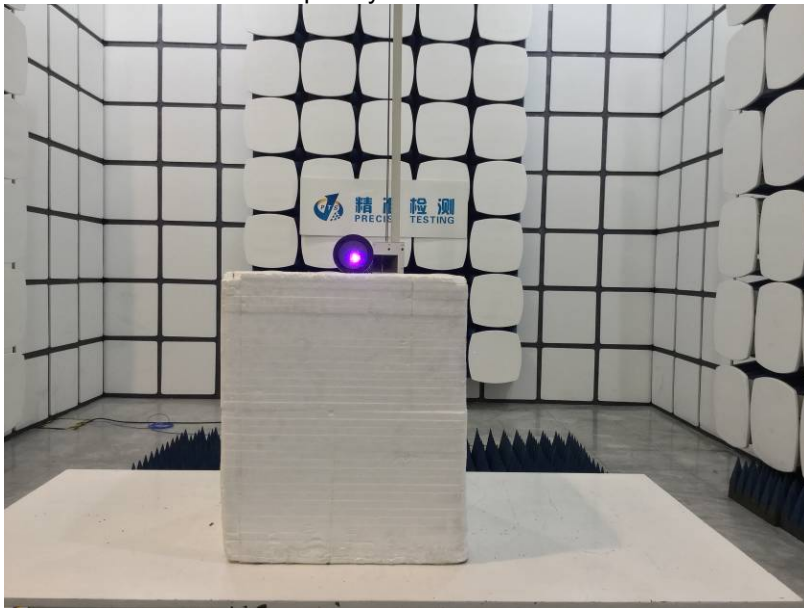
### Conducted Emissions



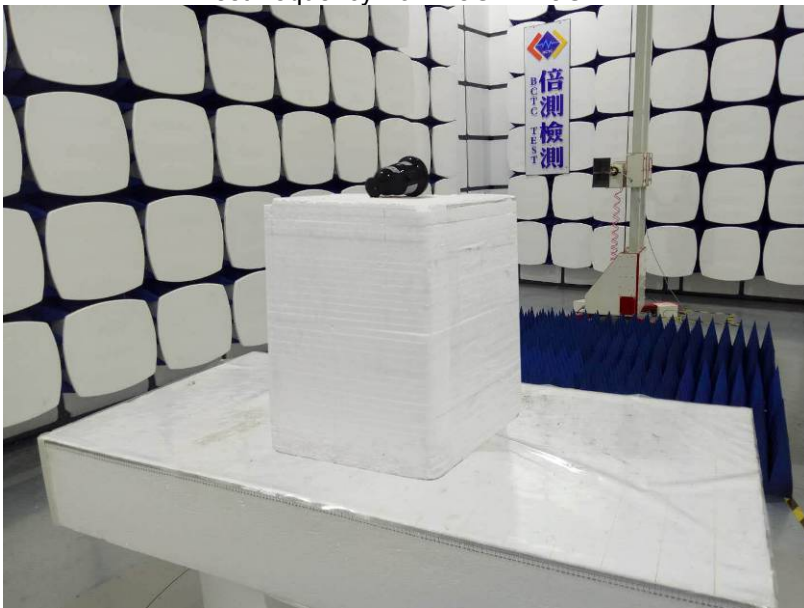
### Radiated Spurious Emissions Test Frequency From 30MHz-1000MHz



Test frequency from 1GHz-18GHz



Test frequency from 18GHz-25GHz





### 8 EUT Photos



