FCC RADIO TEST REPORT
FCC 47 CFR PART 15 SUBPART C

Test Standard	**FCC Part 15.249(a)**
FCC ID	**WHBRCAREYE20**
Trade name	**BMW, MINI**
Product name	**Advanced Car Eye 2.0**
Model No.	**BMW Advanced Car Eye 2.0, MINI Advanced Car Eye 2.0**
Test Result	**Pass**

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

The test results of this report relate only to the tested sample (EUT) identified in this report.
The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc.(Wugu Laboratory)

Testing Laboratory
1309

Approved by:

Sam Chuang
Manager

Tested by:

Kevin Kuo
Engineer

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Revision History

Rev.	Issue Date	Revisions	Page	Revised By
00	October 19, 2017	Initial Issue	ALL	Allison Chen
01	November 7, 2017	1. Added Test Channel Frequencies. 2. Modify the test frequency.	P.11, P.16	Allison Chen

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Table of contents

1. GENERAL INFORMATION 4

1.1 EUT INFORMATION 4

1.2 EUT CHANNEL INFORMATION 5

1.3 ANTENNA INFORMATION 5

1.4 MEASUREMENT UNCERTAINTY 6

1.5 FACILITIES AND TEST LOCATION 7

1.6 INSTRUMENT CALIBRATION 7

1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT 8

2. TEST SUMMERY 9

3. DESCRIPTION OF TEST MODES 10

3.1 THE WORST MODE OF MEASUREMENT **10**

4. TEST RESULT 11

4.1 FIELD STRENGTH OF FUNDAMENTAL AND SPURIOUS EMISSION 11

APPENDIX 1 - PHOTOGRAPHS OF EUT

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

1. GENERAL INFORMATION

1.1 EUT INFORMATION

Applicant	Mobile Appliance, Inc. Gwanyang-dong-1701~1706, Daerung Techno #15, 401, Simin-daero, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
Equipment	Advanced Car Eye 2.0
Model Name	BMW Advanced Car Eye 2.0, MINI Advanced Car Eye 2.0
Model Discrepancy	The two model names are difference from model name, just for marketing purpose only.
EUT Functions	24G Radar
Received Date	September 4, 2017
Date of Test	October 16 ~ October 19, 2017
Output Power	Peak : 106.44dBuV/m Average : 94.72dBuV/m
Power Operation	☐ AC ☒ DC Type : ☐ Battery ☒ DC Power Supply : 12V ☐ External DC adapter

.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

1.2 EUT CHANNEL INFORMATION

Frequency Range	24.00GHz-24.25GHz
Modulation Type	CW
Number of channel	1

1.3 ANTENNA INFORMATION

Antenna Type	☐ PIFA ☒ PCB ☐ Dipole ☐ Printed ☐ Coils
Antenna Gain	9.5 dBi

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

1.4 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	N/A
Emission bandwidth, 20dB bandwidth	+/- 1.4003
RF output power, conducted	+/- 1.1372
Power density, conducted	+/- 1.4003
3M Semi Anechoic Chamber / 30M~200M	+/- 4.0138
3M Semi Anechoic Chamber / 200M~1000M	+/- 3.9483
3M Semi Anechoic Chamber / 1G~8G	+/- 2.5975
3M Semi Anechoic Chamber / 8G~18G	+/- 2.6112
3M Semi Anechoic Chamber / 18G~26G	+/- 2.7389
3M Semi Anechoic Chamber / 26G~40G	+/- 2.9683
3M Semi Anechoic Chamber / 40G~60G	+/- 1.8509
3M Semi Anechoic Chamber / 60G~75G	+/- 1.9869
3M Semi Anechoic Chamber / 75G~110G	+/- 2.9651
3M Semi Anechoic Chamber / 110G~170G	+/- 2.7807
3M Semi Anechoic Chamber / 170G~220G	+/- 3.6437
3M Semi Anechoic Chamber / 220G~325G	+/- 4.2982

***Remark**:*
1.This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2
2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

1.5 FACILITIES AND TEST LOCATION

All measurement facilities used to collect the measurement data are located at *No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)*

Test site	Test Engineer	Remark
AC Conduction Room	-	-
Radiation	Kevin Kuo	-
RF Conducted	Kevin Kuo	-

Remark: *The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.*

1.6 INSTRUMENT CALIBRATION

3M 966A Chamber Test Site					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Cal Date**	**Cal Due**
Bilog Antenna	Sunol Sciences	JB3	A030105	06/20/2017	06/19/2018
Horn Antenna	EMCO	3117	00055165	02/20/2017	02/19/2018
Horn Antenna	Schwarzbeck	BBHA 9170	N/A	04/13/2017	04/12/2018
K Type Cable	Huber+Suhner	SUCOFLEX 102	29406/2	01/10/2017	01/09/2018
K Type Cable	Huber+Suhner	SUCOFLEX 102	22470/2	01/10/2017	01/09/2018
Pre-Amplifier	EMCI	EMC 012635	980151	08/01/2017	07/31/2018
Pre-Amplifier	EMEC	EM330	060609	06/07/2017	06/06/2018
Pre-Amplifier	COM-POWER	PAM-840A	461310	04/12/2017	04/11/2018
Spectrum Analyzer	Agilent	E4446A	US42510252	12/05/2016	12/04/2017
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R

Remark: *Each piece of equipment is scheduled for calibration once a year and harmonic mixer twice a year.*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT

EUT Accessories Equipment					
No.	**Equipment**	**Brand**	**Model**	**Series No.**	**FCC ID**
	N/A				

Support Equipment					
No.	**Equipment**	**Brand**	**Model**	**Series No.**	**FCC ID**
1	DC Power Source	GWINSTEK	SPS-3610	N/A	N/A

1.8 Test methodology and applied standards

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10:2013, FCC Part 15.249.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

2. TEST SUMMERY

FCC Standard Section	Report Section	Test Item	Result
15.203	1.2	Antenna Requirement	Pass
15.249(a)	4.1	Filed strength of fundamental	Pass
15.249(a)	4.1	Radiation Spurious Emission	Pass

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

3. DESCRIPTION OF TEST MODES

3.1 THE WORST MODE OF MEASUREMENT

Radiated Emission Measurement Above 1G	
Test Condition	Band edge, Emission for Unwanted and Fundamental
Voltage/Hz	DC 12V
Test Mode	Mode 1:EUT power by DC power supply via power cable.
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4
Worst Position	☐ Placed in fixed position. ☒ Placed in fixed position at X-Plane (E2-Plane) ☐ Placed in fixed position at Y-Plane (E1-Plane) ☐ Placed in fixed position at Z-Plane (H-Plane)
Worst Polarity	☒ Horizontal ☐ Vertical

Radiated Emission Measurement Below 1G	
Test Condition	Radiated Emission Below 1G
Voltage/Hz	DC 12V
Test Mode	Mode 1:EUT power by DC power supply via power cable.
Worst Mode	☒ Mode 1 ☐ Mode 2 ☐ Mode 3 ☐ Mode 4

Test Channel Frequencies	
Operation mode	24GHz
Test Channel Frequencies	24.06GHz

Remark:
1. The worst mode was record in this test report.
2. EUT pre-scanned in three axis ,X,Y, Z and two polarity, Horizontal and Vertical for radiated measurement. The worst case(X-Plane and Horizontal) were recorded in this report
3. For below 1G, AC power line conducted emission and radiation emission were performed the EUT transmit at the highest output power channel as worse case.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

4. TEST RESULT

4.1 FIELD STRENGTH OF FUNDAMENTAL AND SPURIOUS EMISSION

4.1.1 Test Limit

According to §15.249(a)

(1) The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
2400-2483.5	50	500
5725-5875	50	500
24000-24250	250	2500

* Field strength limits are specified at a distance of 3 meters

Fundamental Limit Conversion			
Average (mV/m) at 3M	Average (dBuV/m) at 3M	Average (dBuV/m) at 1M	Peak (dBuV/m) at 1M
250	107.9588	117.50	137.50

*(Limit=107.9588+20LOG(3/1)=117.50 dBuV/m)

Harmonic Limit Conversion			
Average (uV/m) at 3M	Average (dBuV/m) at 3M	Average (dBuV/m) at 1M	Peak (dBuV/m) at 1M
2500	67.9588	77.50	97.50

*(Limit=67.9588+20LOG(3/1)=77.50 dBuV/m)

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

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

Below 30 MHz

Frequency	Field Strength (microvolts/m)	Magnetic H-Field (microamperes/m)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	2,400/F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	24,000/F (F in kHz)	30
1.705-30 MHz	30	N/A	30

Above 30 MHz

Frequency (MHz)	Field Strength microvolts/m at 3 metres (watts, e.i.r.p.)	
	Transmitters	Receivers
30-88	100 (3 nW)	100 (3 nW)
88-216	150 (6.8 nW)	150 (6.8 nW)
216-960	200 (12 nW)	200 (12 nW)
Above 960	500 (75 nW)	500 (75 nW)

4.1.2 Test Procedure

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m, below 1 GHz and above 40G is 0.8m above ground plane. The EUT Configured un accordance with ANSI C63.10, and the EUT set in a continuous mode.

2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. And EUT is set 3m away from the receiving antenna, which is scanned from 1m to 4m above the ground plane to find out the highest emissions. Measurement are made polarized in both the vertical and the horizontal positions with antenna.

3. The SA setting following：

(1) Below 1G：RBW = 100kHz, VBW ≥ 3 RBW, Sweep = Auto, Detector = Peak,

(2) Above 1G：

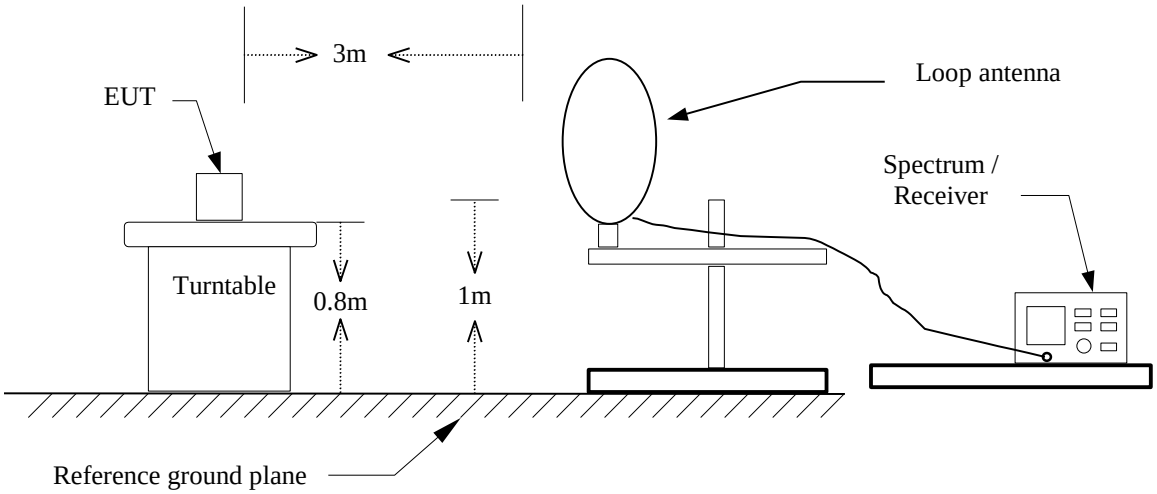
(2.1) For Peak measurement：RBW = 1MHz, VBW ≥ 3 RBW.

(2.2) For Average measurement：RBW = 1MHz, VBW = 10Hz.

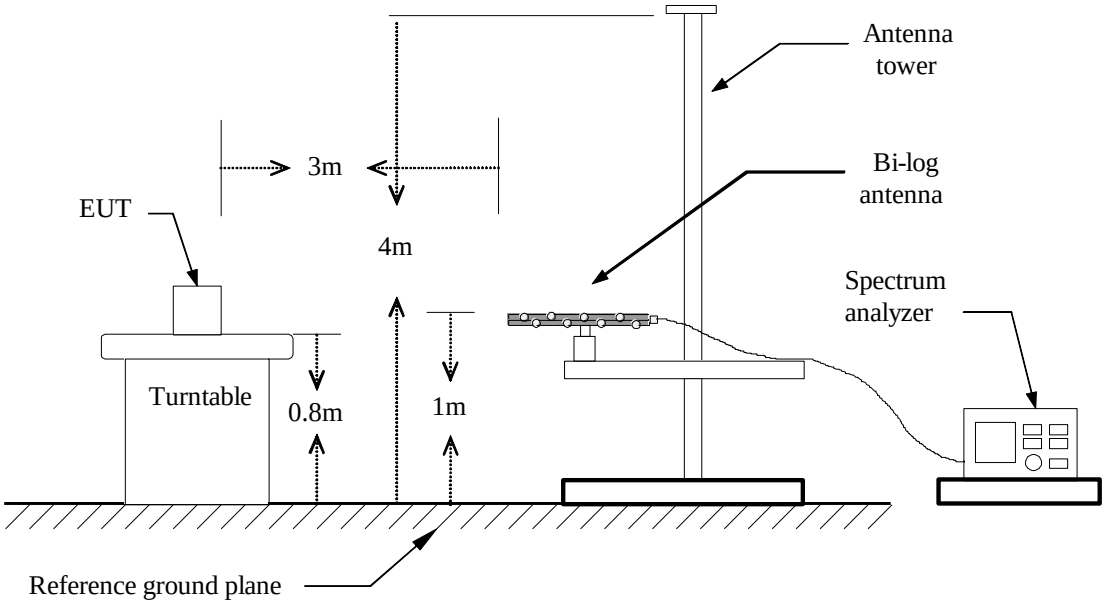
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

4.1.3 Test Setup

9kHz ~ 30MHz



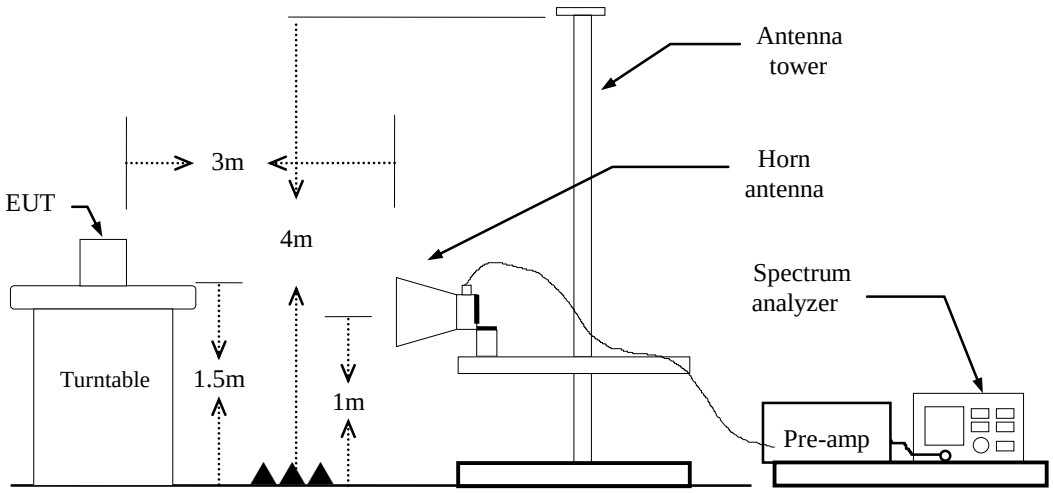
30MHz ~ 1GHz



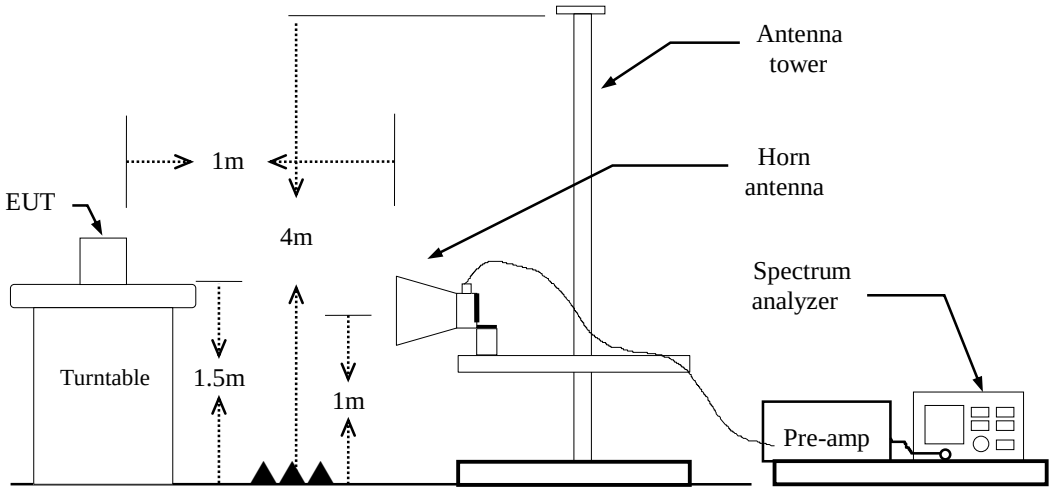
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Above 1 GHz

(1-18GHz)

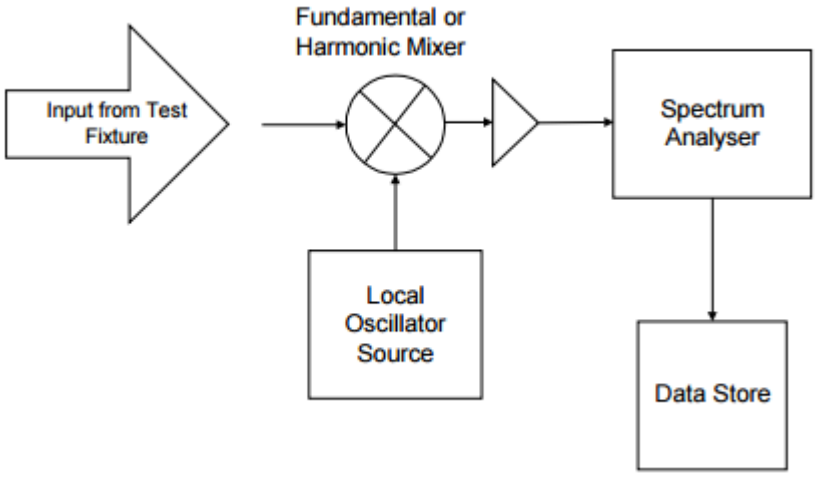


(18-40GHz)



This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Above 40 GHz



This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

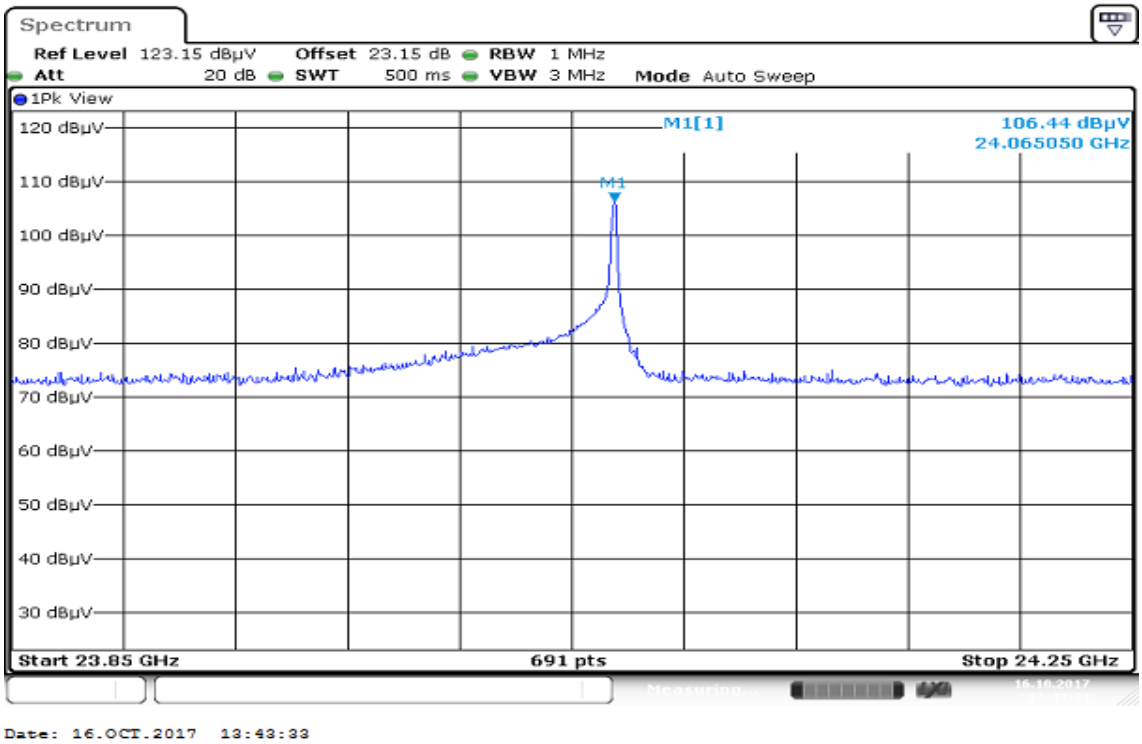
4.1.4 Test Result

Freq. (GHz)	Peak Value (dBuV/m)	Average Value (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
24.06	106.44	94.72	137.50	117.50	Pass

Test Data

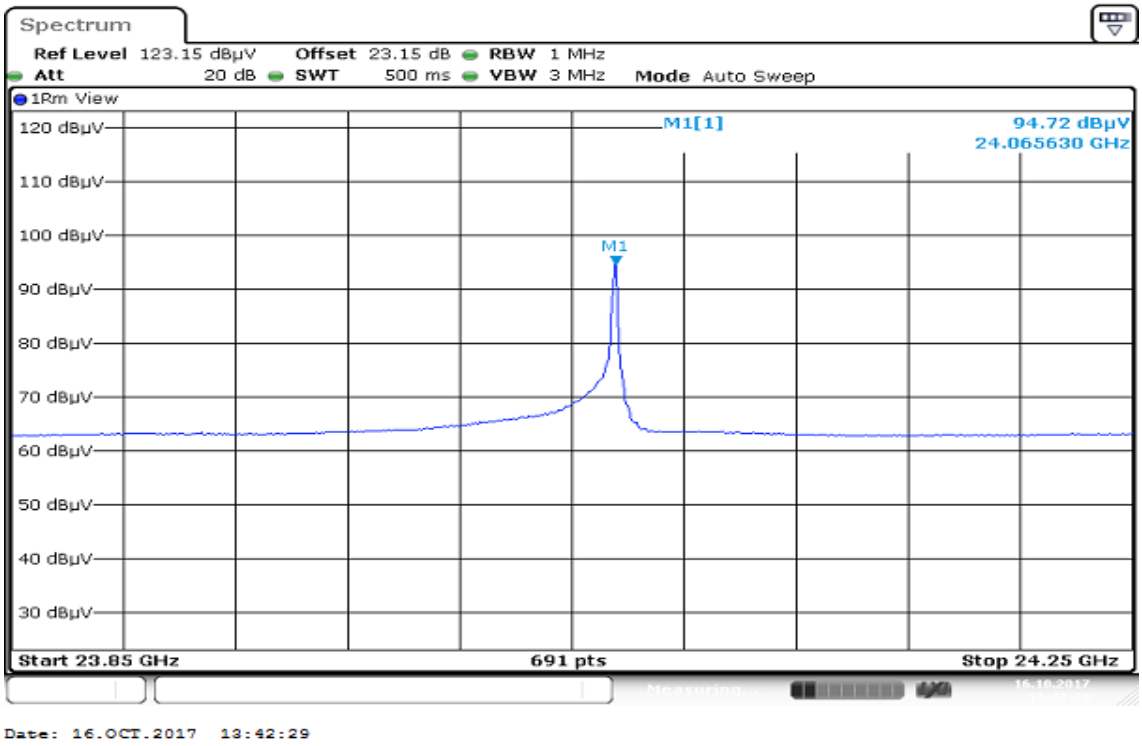
(1) Filed strength of fundamental :

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	Fundamental	Test Date	October 16, 2017
Axis	X-Plane	Test Engineer	Kevin Kuo
Detector	Peak	Test Voltage:	12Vdc



This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	Fundamental	Test Date	October 16, 2017
Polarize	Vertical	Test Engineer	Kevin Kuo
Detector	Average	Test Voltage:	12Vdc

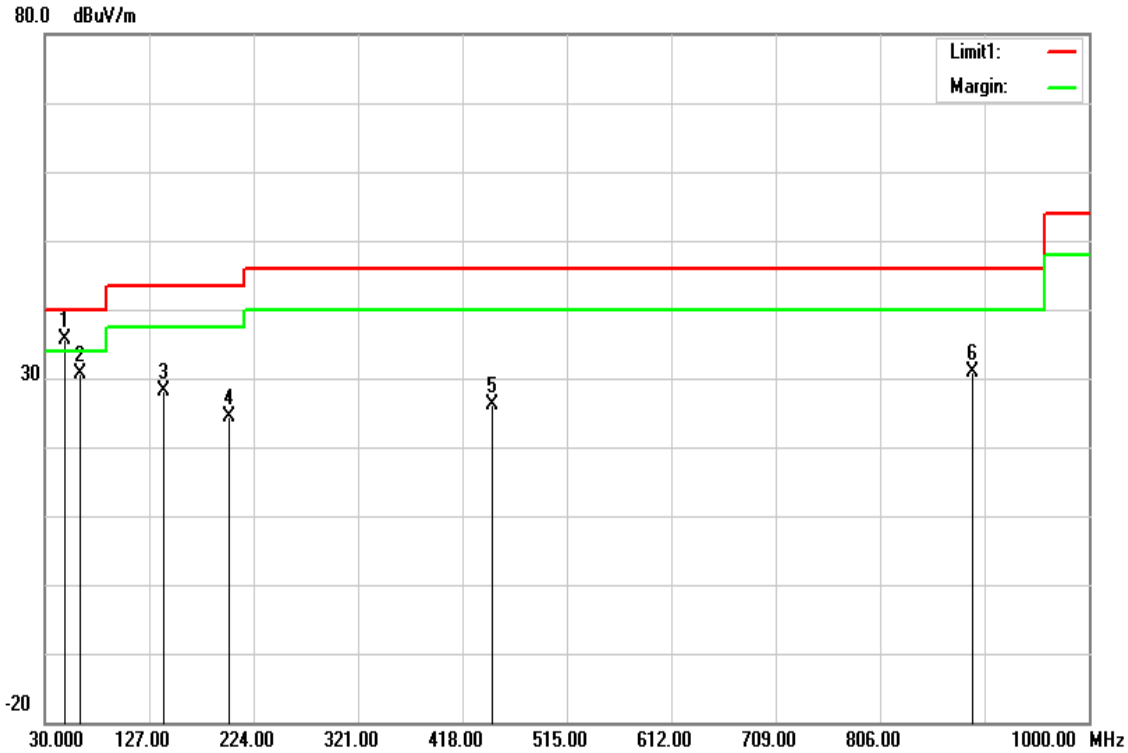


Date: 16.OCT.2017 13:42:29

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

(2) Below 1G :

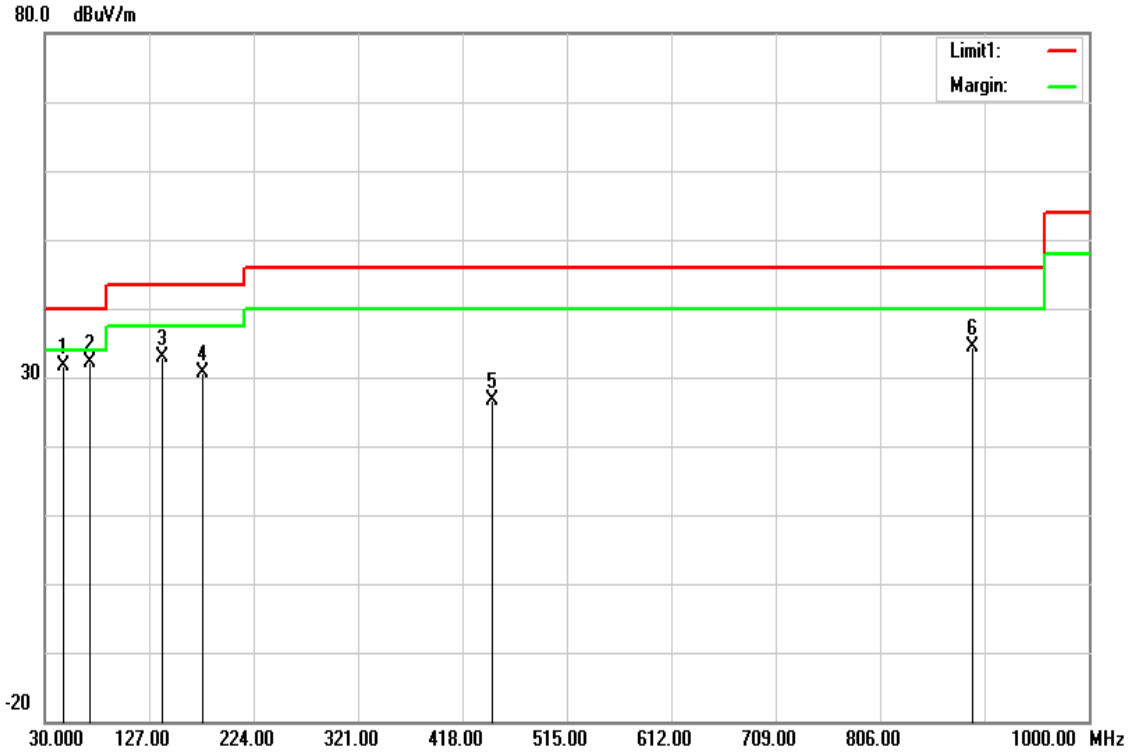
Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	30MHz-1GHz	Test Date	October 16, 2017
Polarize	Vertical	Test Engineer	Jerry Chuang
Detector	Peak and Qusi-peak	Test Voltage:	12Vdc



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
48.4300	56.06	-20.47	35.59	40.00	-4.41	QP
62.9800	52.41	-21.66	30.75	40.00	-9.25	peak
140.5800	43.75	-15.56	28.19	43.50	-15.31	peak
201.6900	39.86	-15.48	24.38	43.50	-19.12	peak
445.1600	35.92	-9.78	26.14	46.00	-19.86	peak
891.3600	33.13	-2.16	30.97	46.00	-15.03	peak

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	30MHz-1GHz	Test Date	October 16, 2017
Polarize	Horizontal	Test Engineer	Jerry Chuang
Detector	Peak and Qusi-peak	Test Voltage:	12Vdc

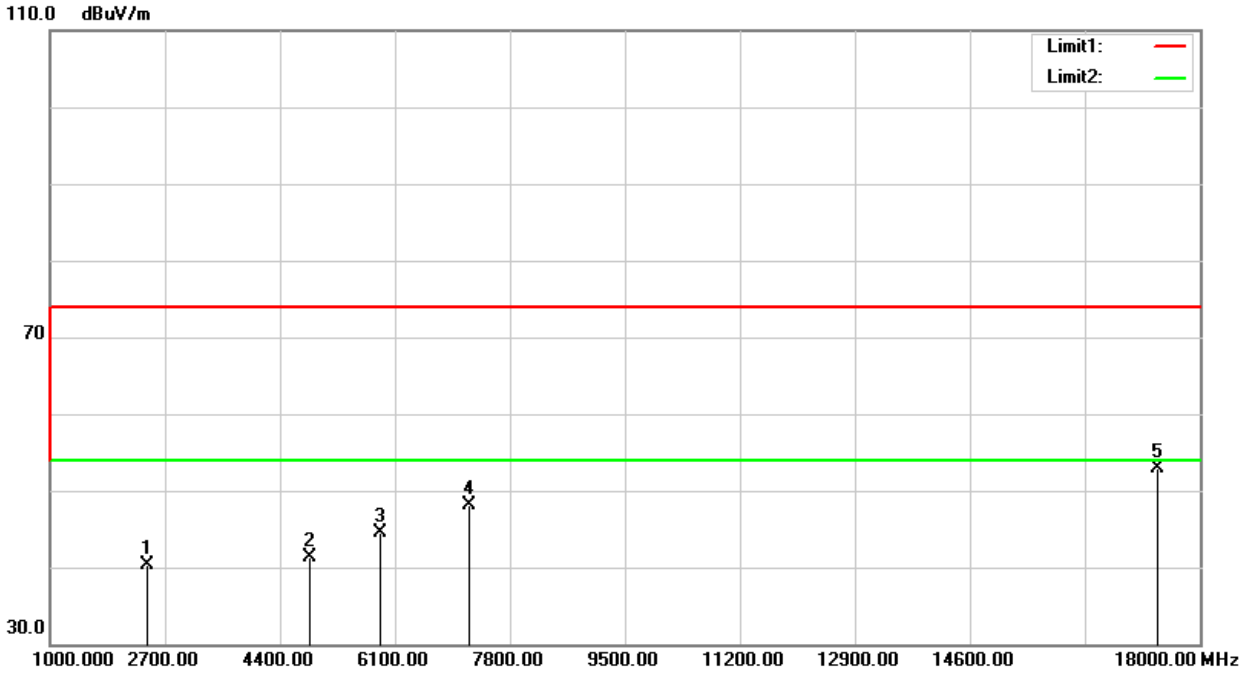


Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
47.4600	51.73	-20.08	31.65	40.00	-8.35	QP
71.7100	53.34	-21.29	32.05	40.00	-7.95	peak
139.6100	48.35	-15.53	32.82	43.50	-10.68	peak
176.4700	47.48	-16.94	30.54	43.50	-12.96	peak
445.1600	36.52	-9.78	26.74	46.00	-19.26	peak
891.3600	36.47	-2.16	34.31	46.00	-11.69	peak

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

(2) Above 1G :

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	1GHz-18GHz	Test Date	October 19, 2017
Polarize	Vertical	Test Engineer	Jerry Chuang
Detector	Peak and Average	Test Voltage:	12Vdc



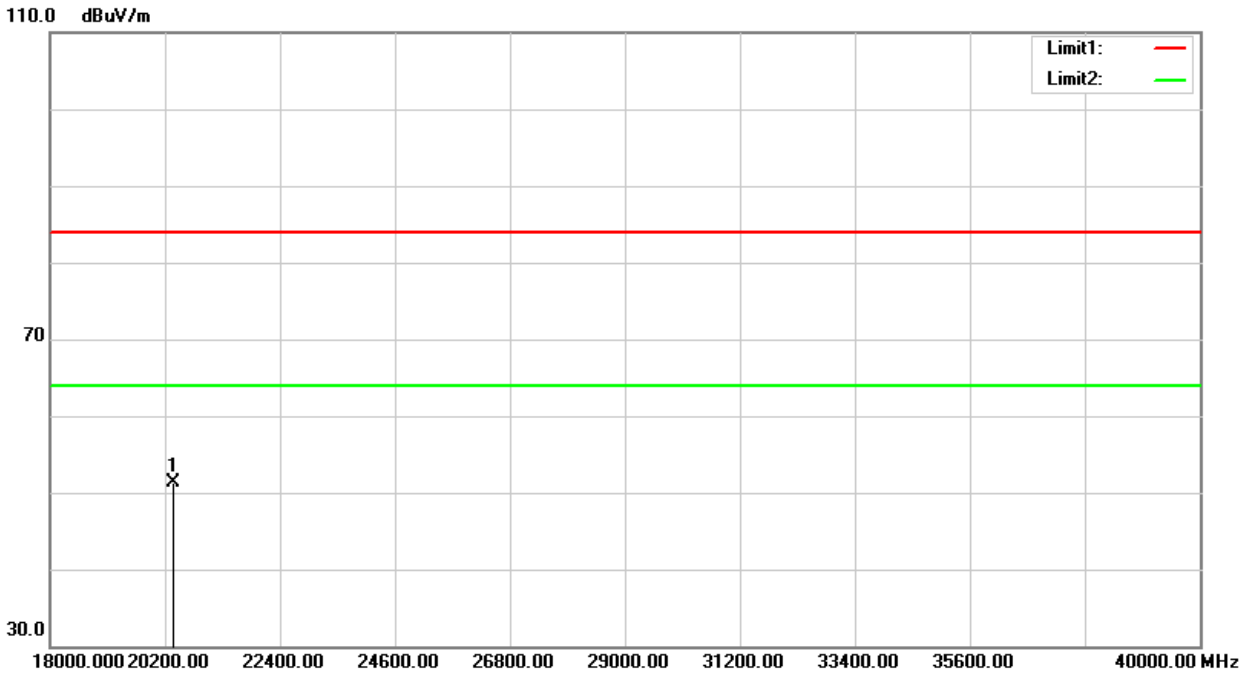
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
2428.000	40.69	-0.48	40.21	74.00	-33.79	peak
4843.000	34.52	6.88	41.40	74.00	-32.60	peak
5893.000	35.04	9.56	44.60	74.00	-29.40	peak
7195.000	34.46	13.63	48.09	74.00	-25.91	peak
17370.000	21.30	31.62	52.92	74.00	-21.08	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	18GHz-40GHz	Test Date	October 19, 2017
Polarize	Vertical	Test Engineer	Jerry Chuang
Detector	Peak and Average	Test Voltage:	12Vdc



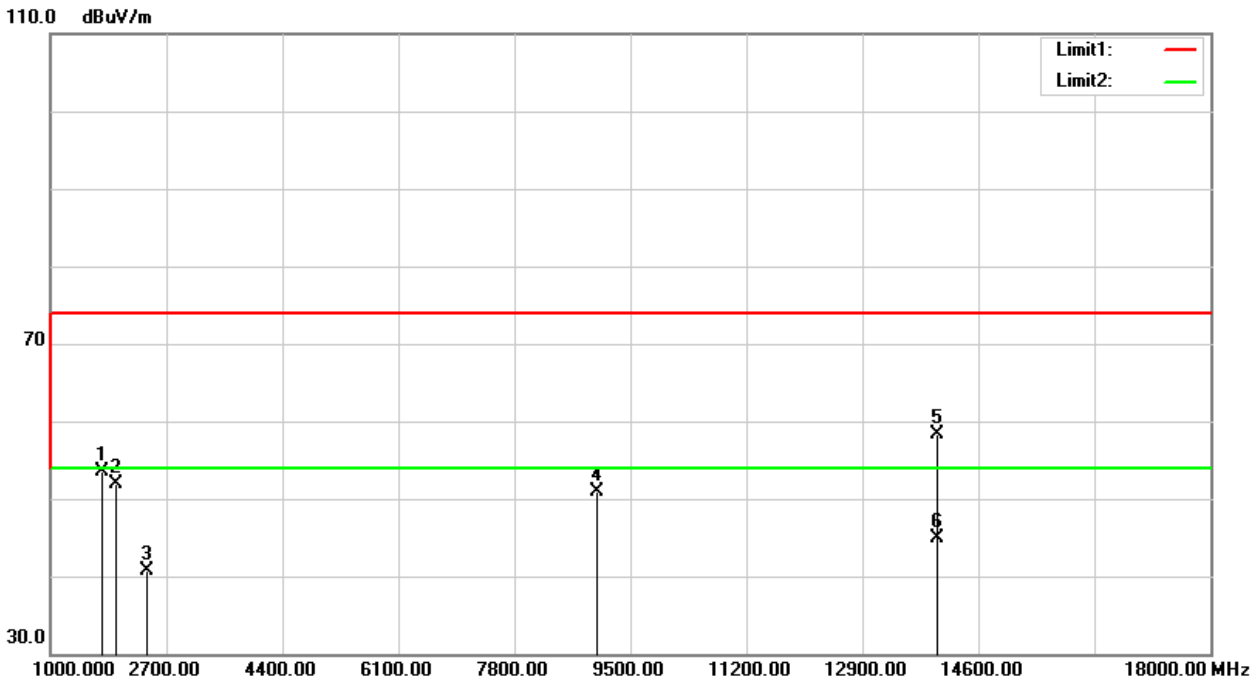
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
20372.000	35.15	16.18	51.33	84.00	-32.67	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	1GHz-18GHz	Test Date	October 19, 2017
Polarize	Horizontal	Test Engineer	Jerry Chuang
Detector	Peak and Average	Test Voltage:	12Vdc



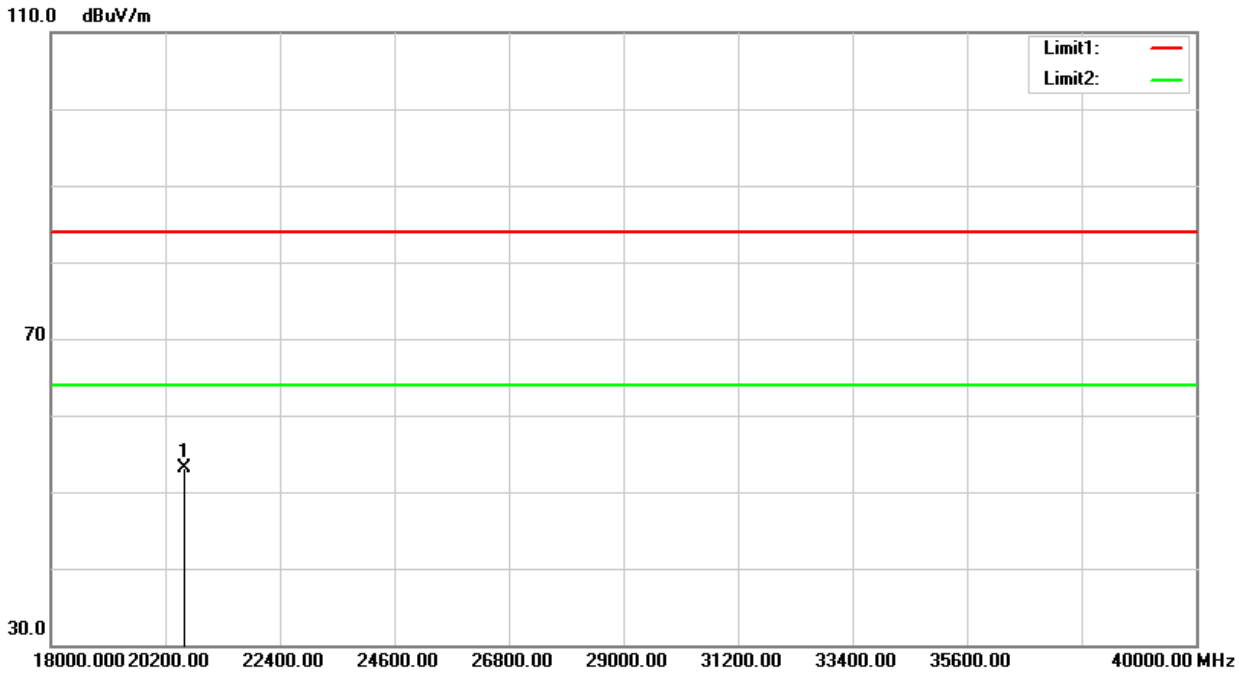
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1756.000	56.72	-3.29	53.43	74.00	-20.57	peak
1966.000	53.98	-2.04	51.94	74.00	-22.06	peak
2414.000	41.21	-0.52	40.69	74.00	-33.31	peak
9020.000	34.24	16.73	50.97	74.00	-23.03	peak
14010.000	35.04	23.30	58.34	74.00	-15.66	peak
14010.000	21.51	23.30	44.81	54.00	-9.19	AVG

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	18GHz- 40GHz	Test Date	October 19, 2017
Polarize	Horizontal	Test Engineer	Jerry Chuang
Detector	Peak and Average	Test Voltage:	12Vdc



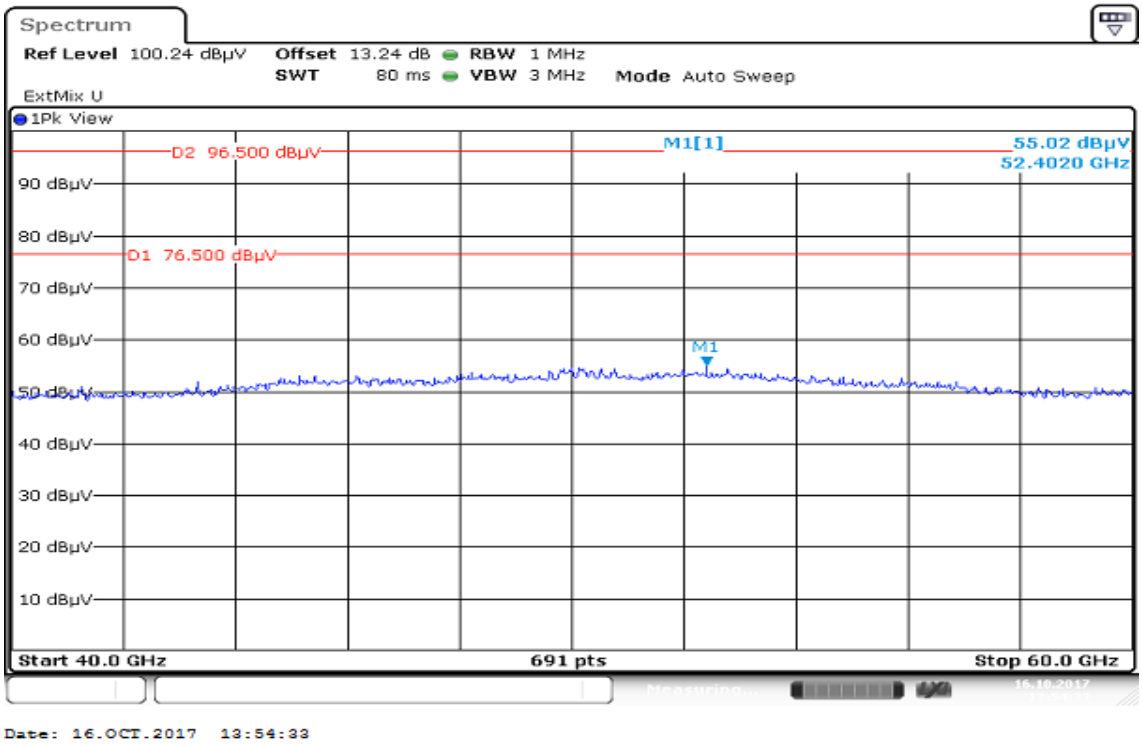
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
20564.000	36.74	16.32	53.06	84.00	-30.94	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	40GHz-60GHz	Test Date	October 16, 2017
Polarize	Vertical/Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc

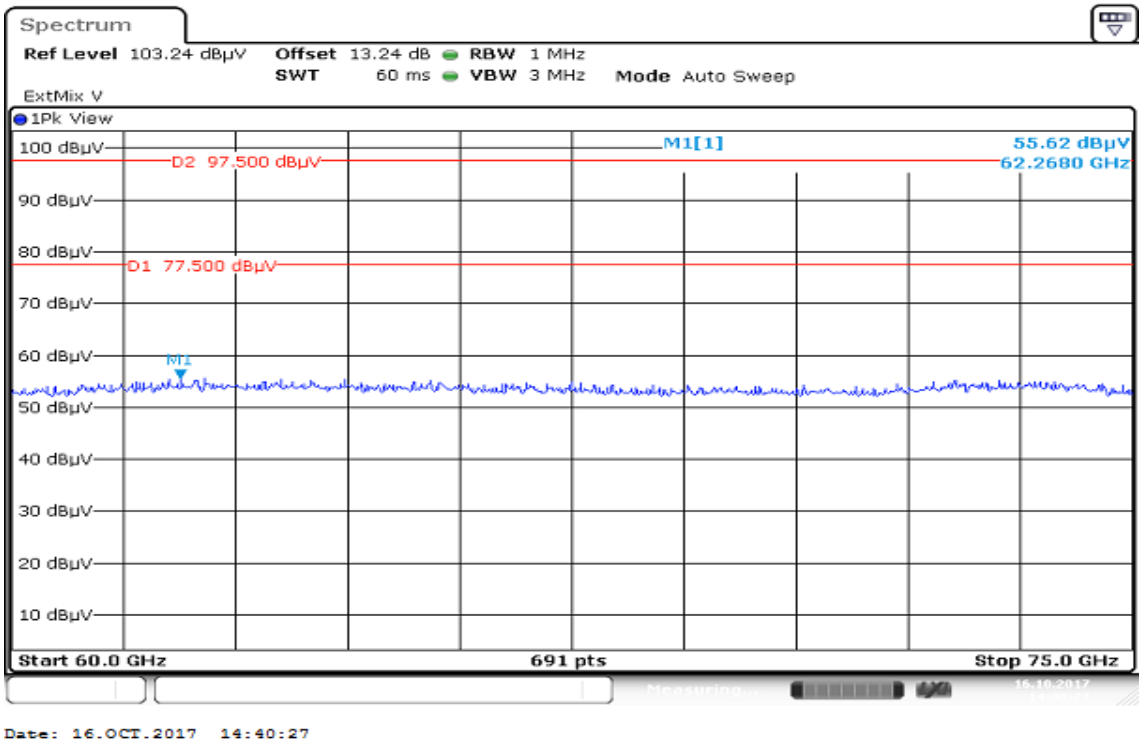


Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	60GHz-75GHz	Test Date	October 16, 2017
Polarize	Vertical/Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc

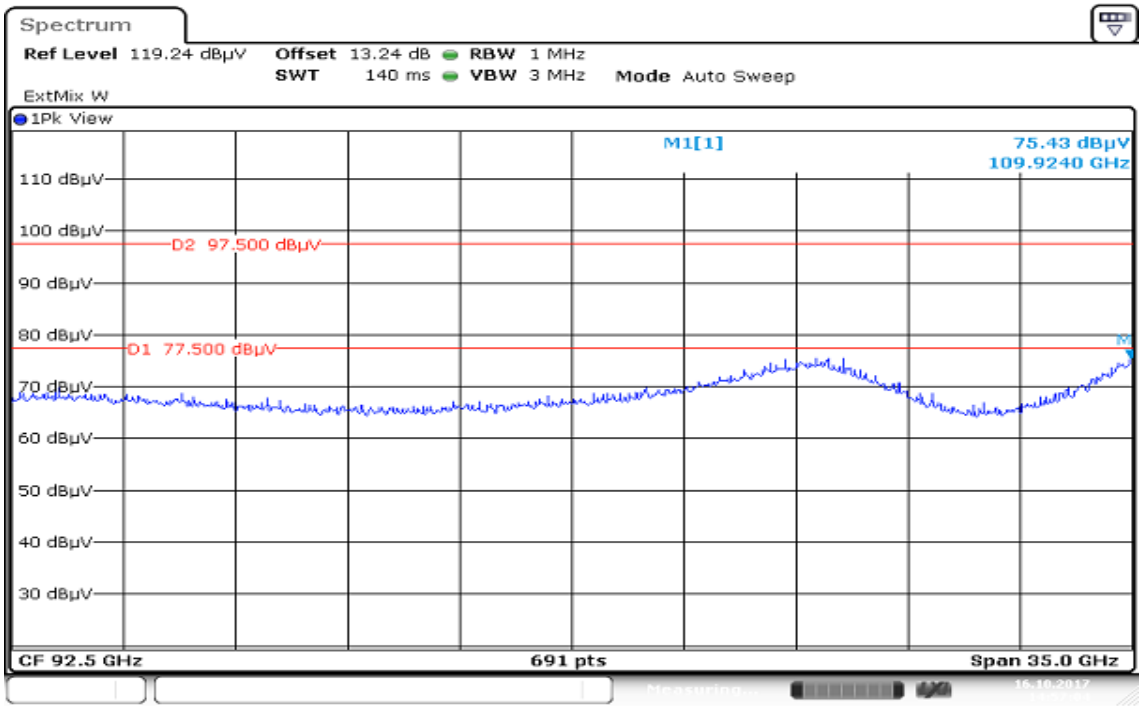


Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	75GHz-110GHz	Test Date	October 16, 2017
Polarize	Vertical/Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc

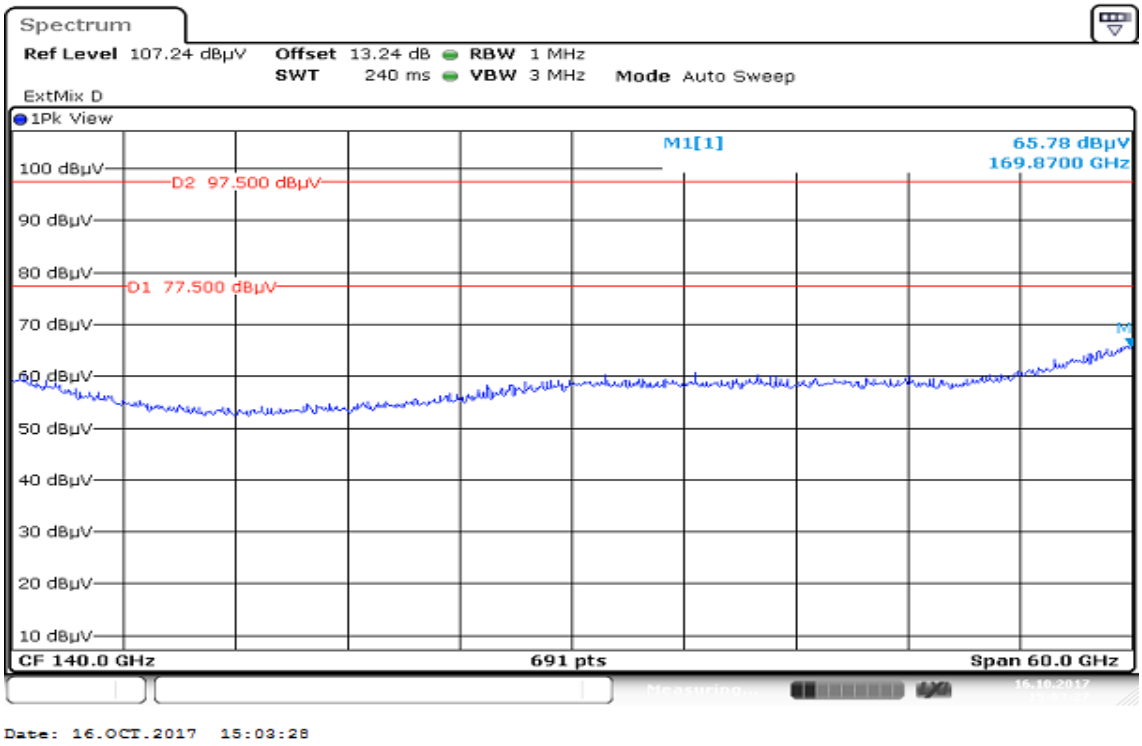


Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	110GHz-170GHz	Test Date	October 16, 2017
Polarize	Vertical/Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc

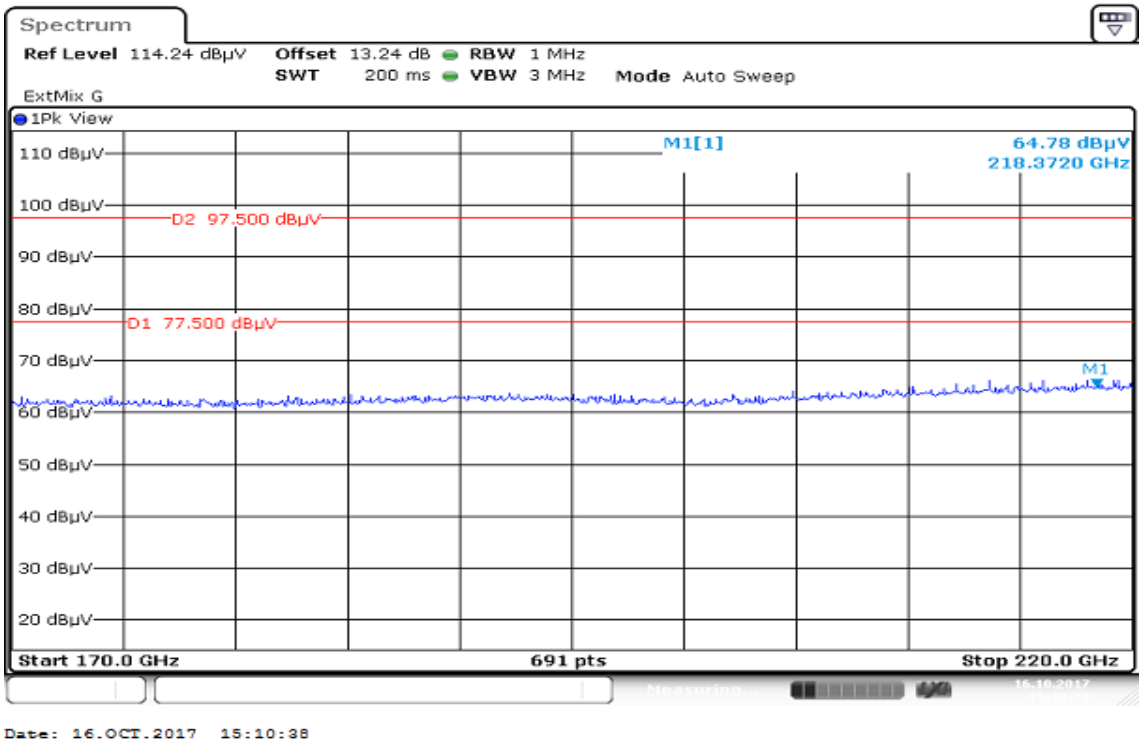


Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	170GHz-220GHz	Test Date	October 16, 2017
Polarize	Vertical/Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc

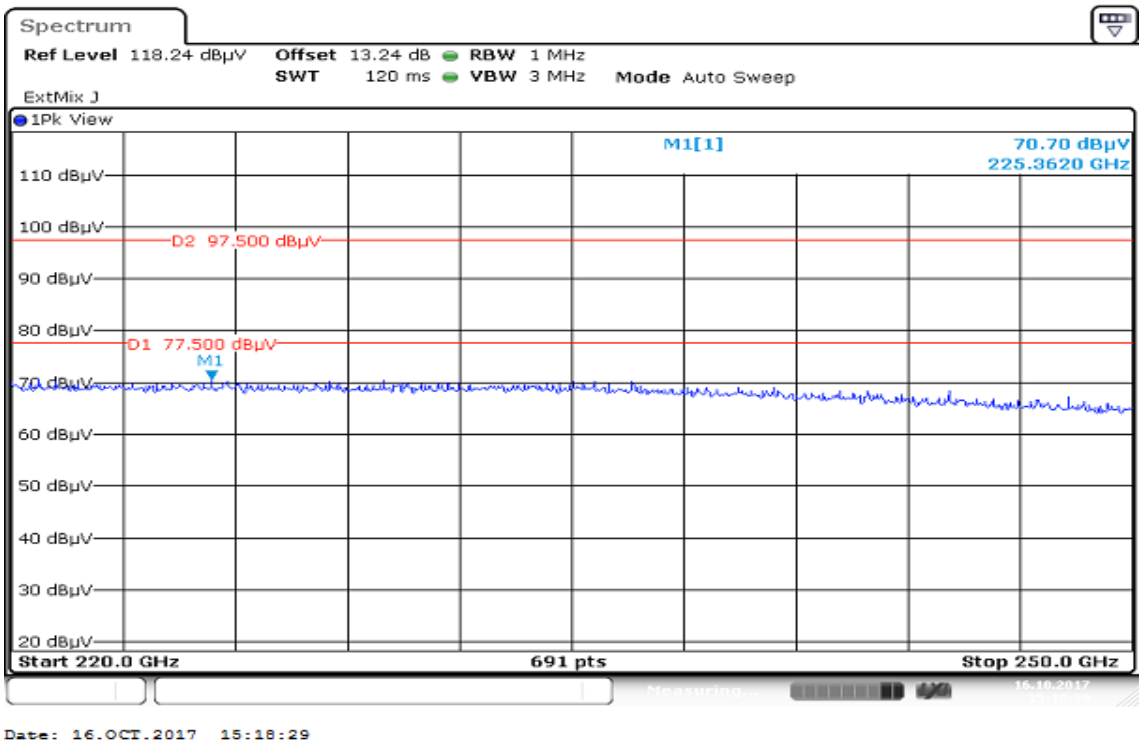


Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Test Mode:	TX-24GHz	Temp/Hum	24(℃)/ 33%RH
Test Item	220GHz-250GHz	Test Date	October 16, 2017
Polarize	Vertical/Horizontal	Test Engineer	Kevin Kuo
Detector	Peak and Average	Test Voltage:	12Vdc



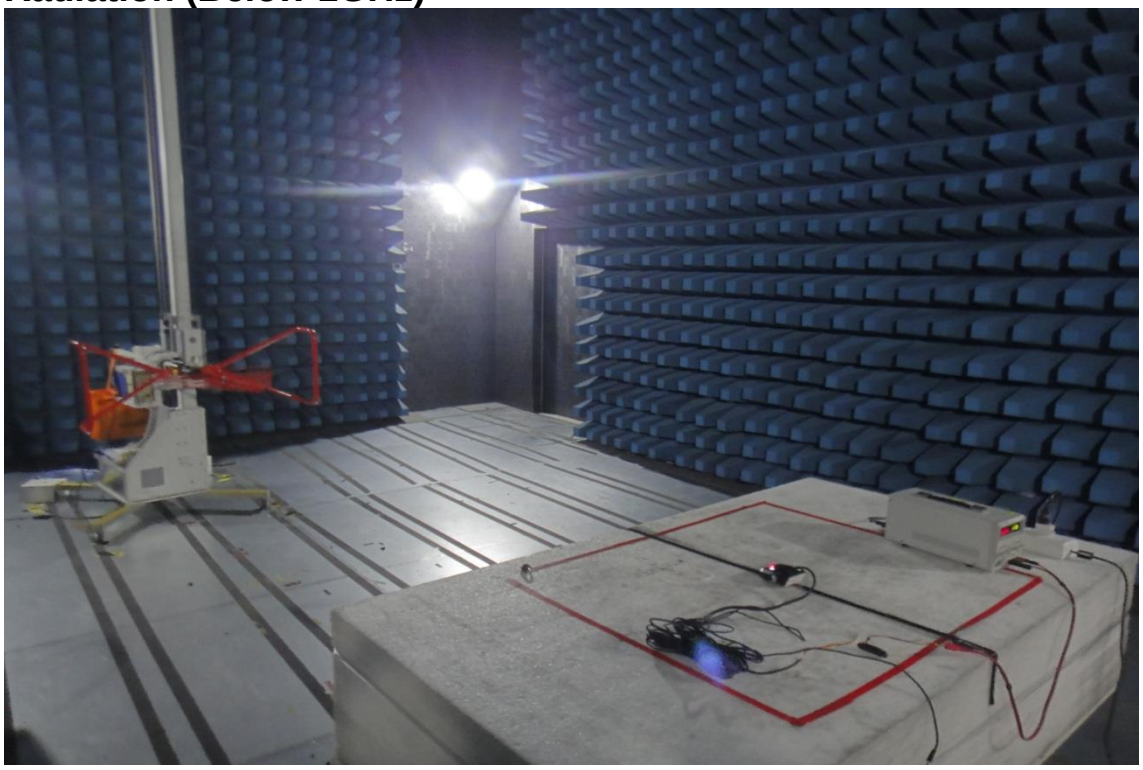
Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*
3. *Above 220G, noise floor is higher than EUT signal..*

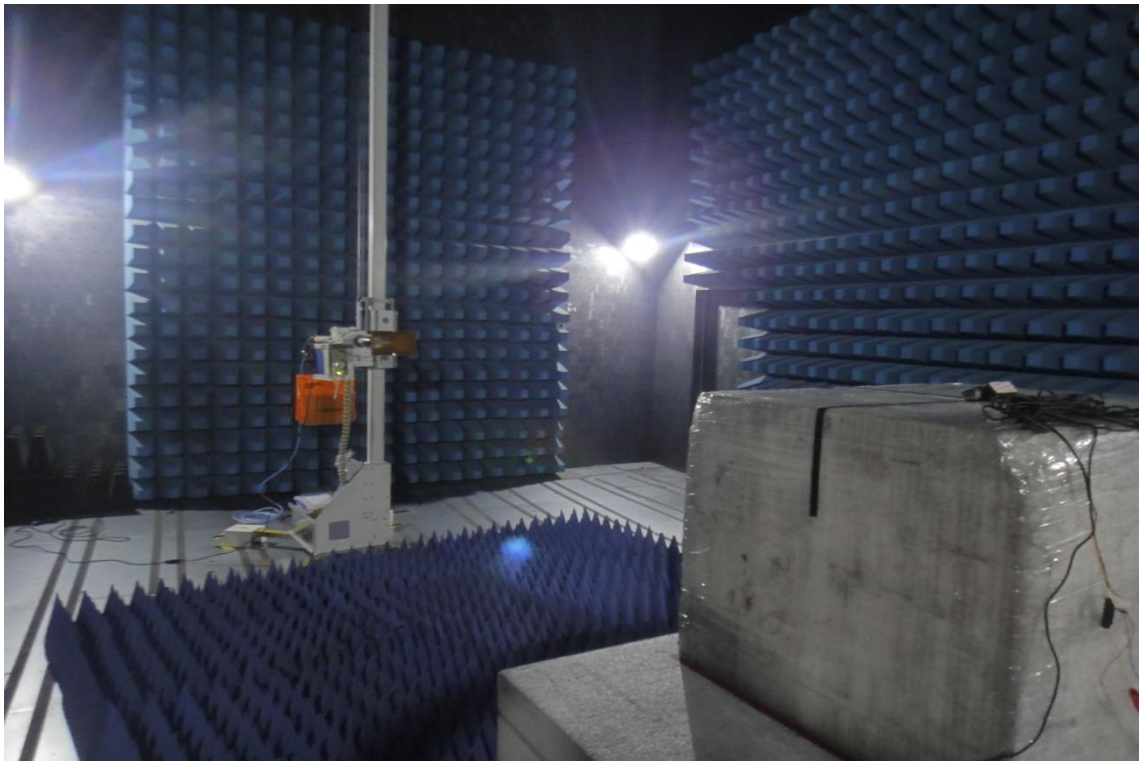
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

APPENDIX-1 Test Photo

Radiation (Below 1GHz)

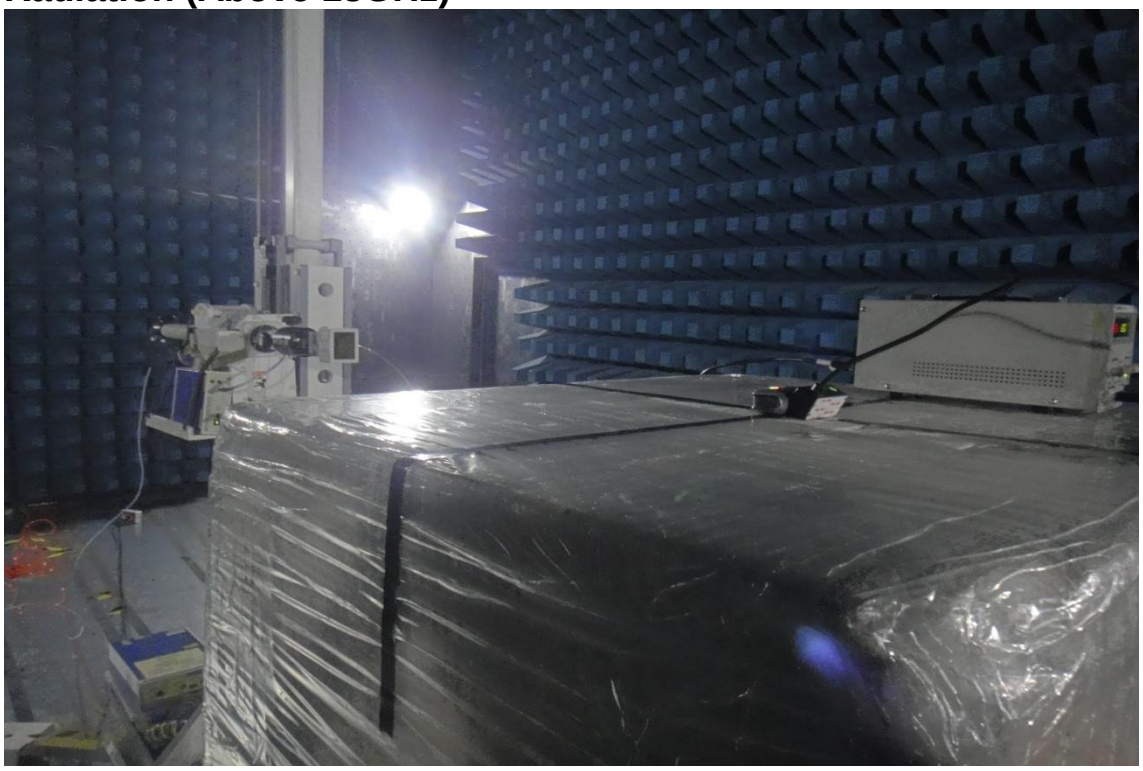


Radiation (Above 1GHz)
1-18GHz



This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

Radiation (Above 18GHz)



This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.

CONDUCTED EMISSIONS SETUP PHOTOS

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services.