FCC RADIO TEST REPORT
FCC 47 CFR PART 15 SUBPART C

Test Standard	**FCC Part 15.249**
FCC ID	**2AE77DGUBSDGEN20**
Brand name	**SsangYong Motors**
Product name	**Car BSD**
Model No.	**DGU-BSD-GEN2.0**
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 andcompliance 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).

The sample selected for test was production product and was provided by manufacturer.

Testing Laboratory
1309

Approved by:

Sam Chuang
Manager

Reviewed by:

Ed Chiang
Engineer

Revision History

Rev.	Issue Date	Revisions	Revised By
00	March 28, 2017	Initial Issue	Angel Cheng
01	April 26, 2017	1. Revise section 1.6 in page 7. 2. Revise section 4.2.1 in page 12. 3. Revise Above 1GHz Data in page 22-23.	Angel Cheng
02	May 2, 2017	1. Revise section 4.2.1 in page 12. 2. Revise section 4.2.2 in page 14 3. Revise section 4.2.3 in page 17	Angel Cheng
03	May 09, 2017	1. Revise section 4.2.3 in page 16 2. Revise section 4.2.4 in page 23-27	Angel Cheng
04	May 12, 2017	1. Revise test date in page 4. 2. Revise section 4.2.4 in page 23-26 3. Revise remark in page 27-29	Angel Cheng
05	May 17, 2017	1. Add Remark in page 25-26 2. Revise test limit of section4.2.1 in page 12 3. Revise limits in page 25-29	Angel Cheng
06	May 18,2017	1. Revise remark EIRP to Field Strength in page 27-29.	Angel Cheng

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APPENDIX 1 - PHOTOGRAPHS OF EUT

1. GENERAL INFORMATION

1.1 EUT INFORMATION

Applicant	DIGEN CO., LTD. 89, Seongseo4chacheomdan-ro, Dalseo-gu, Daegu, 704-801, Korea
Equipment	Car BSD
Model Name	DGU-BSD-GEN2.0
Model Discrepancy	N/A
EUT Functions	24GHz Vehicle Radar
Received Date	February 8, 2017
Date of Test	February 20 ~May 12, 2017
Output Power	113.98 dBuV/m
Power Operation	☐ AC 120V/60Hz ☐ Adapter(Not for sale) ☐ PoE(Not for sale) ☒ DC Type : ☒ Battery 12V ☐ DC Power Supply ☐ External DC adapter ☐ From host system

.

1.2 EUT CHANNEL INFORMATION

Frequency Range	24.05 GHz ~ 24.25GHz
Modulation Type	FMCW

Remark:
Refer as ANSI 63.10:2013 clause 5.6.1 Table 4 for test channels

Number of frequencies to be tested

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
☐ 1 MHz or less	1	Middle
☐ 1 MHz to 10 MHz	2	1 near top and 1 near bottom
☒ More than 10 MHz	3	1 near top, 1 near middle, and 1 near bottom

1.3 ANTENNA INFORMATION

Antenna Category	☒ Integral: antenna permanently attached ☐ External dedicated antennas ☐ ExternalUnique antenna connector
Antenna Type	☐ PIFA ☒ Array ☐ Dipole ☐ Printed ☐ Coils
Antenna Gain	13.7dBi

1.4 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	+/- 1.2575
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.

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	EdChiang	

***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 966 Chamber Test Site					
Equipment	**Manufacturer**	**Model**	**S/N**	**Cal Date**	**Cal Due**
Bilog Antenna	Sunol Sciences	JB3	A030105	07/03/2016	07/02/2017
Horn Antenna	EMCO	3117	00055165	02/20/2017	02/19/2018
Horn Antenna	ETS LINDGREN	3116	00026370	01/12/2017	01/11/2018
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	MITEQ	AMF-6F-260400-40-8P	985646	01/10/2017	01/09/2018
Pre-Amplifier	EMCI	EMC 012635	980151	06/23/2016	06/22/2017
Pre-Amplifier	EMEC	EM330	060609	06/08/2016	06/07/2017
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
Bilog Antenna	Sunol Sciences	JB3	A030105	07/03/2016	07/02/2017
Horn Antenna	EMCO	3117	00055165	02/20/2017	02/19/2018
Horn Antenna	ETS LINDGREN	3116	00026370	01/12/2017	01/11/2018
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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
Harmonic Mixer	ROHDE&SCHWARZ	FH-PP-75 / FS-Z75	10001 / 100162	04/22/2016	04/21/2018
Harmonic Mixer	ROHDE&SCHWARZ	FH-PP-110 / FS-Z110	10003 / 100096	04/24/2016	04/23/2018
Harmonic Mixer	A-INFO / ROHDE&SCHWARZ	LB-19-20-A / FS-Z60	J202020872 / 100142	04/17/2016	04/16/2018

AC Conducted Emissions Test Site				
Equipment	**Manufacturer**	**Model**	**S/N**	**Cal Due**
N/A				

Remark: *Each piece of equipment is scheduled for calibration once a year.*

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 12V Battery	YUASA	75D23L	N/A	N/A

1.8 Test methodology and applied standards

The test methodology, setups and results comply with all requirementsin accordance with ANSI C63.10:2013, FCC Part 2, FCC Part 15.249,

1.9 Table of accreditations and listings

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3M Semi Anechoic Chamber (FCC MRA: TW1039) to perform FCC Part 15 measurements	FCC MRA: TW1039
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	Canada IC 2324G-1 IC 2324G-2

2. TEST SUMMERY

FCC Standard Sec.	Chapter	Test Item	Result
15.207(a)	4.1	AC Conducted Emission	N/A
15.249(a)	4.2	Field strength of emissions	PASS

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	**12V DC**
Test Mode	**Mode 1:EUT power by Battery.**
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	**12V DC**
Test Mode	**Mode 1:EUT power by Battery.**
Worst Mode	☒ **Mode 1** ☐ **Mode 2** ☐ **Mode 3** ☐ **Mode 4**

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(Y-Plane and Vertical) were recorded in this report

.

4. TEST RESULT

4.1 AC POWER LINE CONDUCTED EMISSION

4.1.1 Test Limit

According to §15.207(a)

Frequency Range (MHz)	Limits(dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

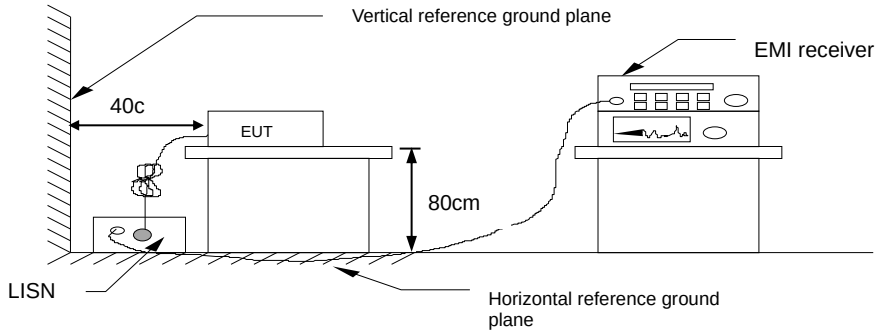
* Decreases with the logarithm of the frequency.

4.1.2 Test Procedure

Test method Refer as ANSI 63.10:2013 clause 6.2,

1. The EUT was placed on a non-conducted table, which is 0.8m above horizontal ground plane and 0.4m above vertical ground plane.
2. EUT connected to the line impedance stabilization network (LISN)
3. Receiver set RBW of 9kHz and Detector Peak, and note as quasi-peak and average.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Recorded Line for Neutral and Line.

4.1.3 Test Setup



4.1.4 Test Result

Pass

Test Data

Not applicable, because EUT not connect to AC Main Source direct.

4.2 FIELD STRENGTH OF EMISSIONS

4.2.1 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 1 meters

Fundamental LimitConversion		
Average (mV/m) at 3M	Average (dBuV/m) at 3M	Average & Peak (dBuV/m) at 1M
250	107.96	Fundamental Limit Average at 1M : 117.5 dBuV/m Peak at 1M: 137.5 dBuV/m

HarmonicLimitConversion		
Average (uV/m) at 3M	Average (dBuV/m) at 3M	Average & Peak (dBuV/m) at 1M
2500	67.96	Harmonic Limit Average at 1M : 77.5 dBuV/m Peak at 1M: 97.5 dBuV/m

*(Limit=20LOG(2500)=67.96dBuV/m))

(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)	Measurement Distance (metres)
9-490 kHz	2,400/F (F in kHz)	300
490-1,705 kHz	24,000/F (F in kHz)	30
1.705-30 MHz	30	30

Above 30 MHz

Frequency	Field Strength (microvolts/m)	Measurement Distance (metres)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

4.2.2 Test Procedure

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m and below 1 GHz 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 1m away from the receiving antenna, which is scanned from 1m to 4mabove 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 band edge be performed the lower edge only, because the higher edge is more away the restricted band at 31.2GHz according Part 15.205.

4. The SA setting following：

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

(2) Above 1G：

(2.1) For Peak measurement：RBW = 1MHz, VBW ≥ 3 RBW, Sweep = Auto, Detector = Peak, Trace = Max hold.

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

- If Duty Cycle ≥98%, VBW=10Hz.
- If Duty Cycle <98%, VBW=1/T.

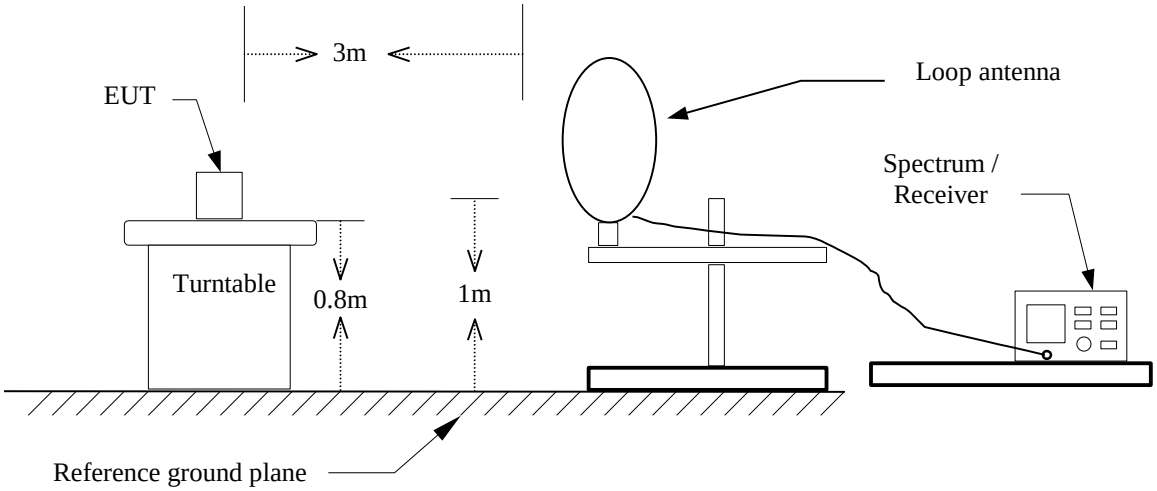
(3) Above 40GHz:

RBW = 1 MHz, VBW= 3 MHz,

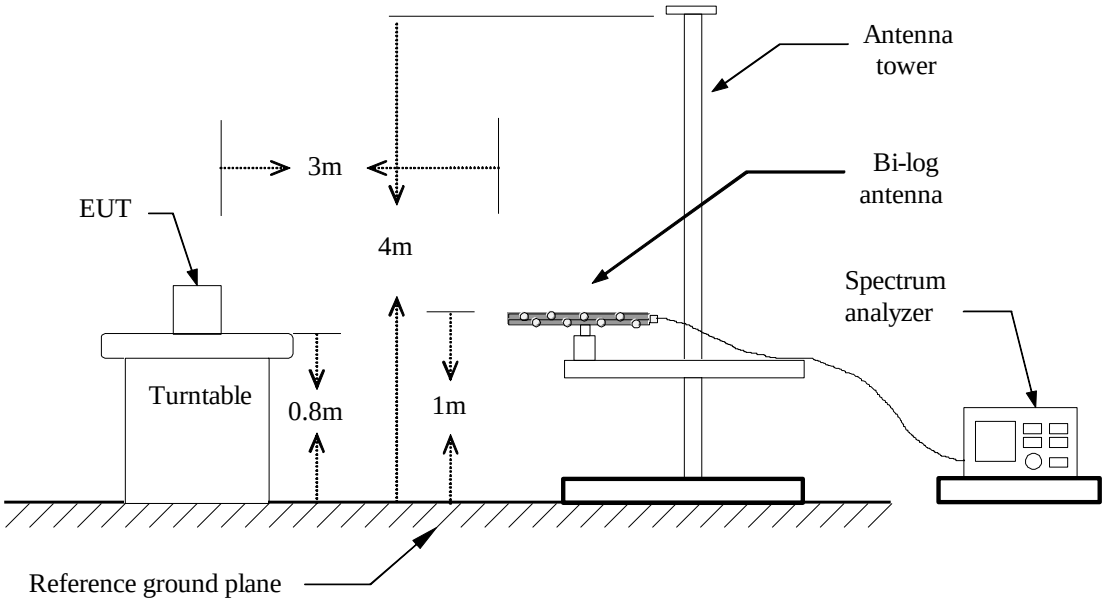
Detector = Peak, Trace mode = max hold, Sweep = AUTO.

4.2.3 Test Setup

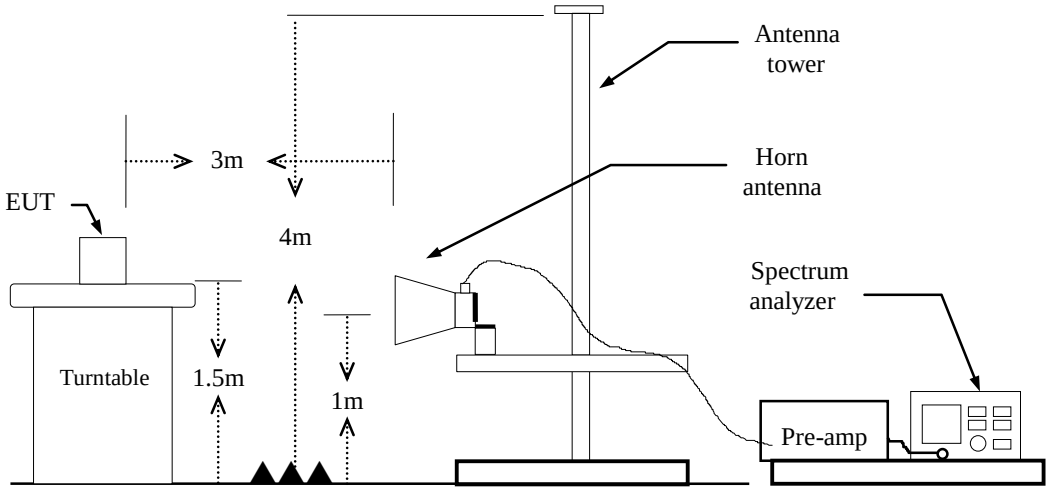
9kHz ~ 30MHz



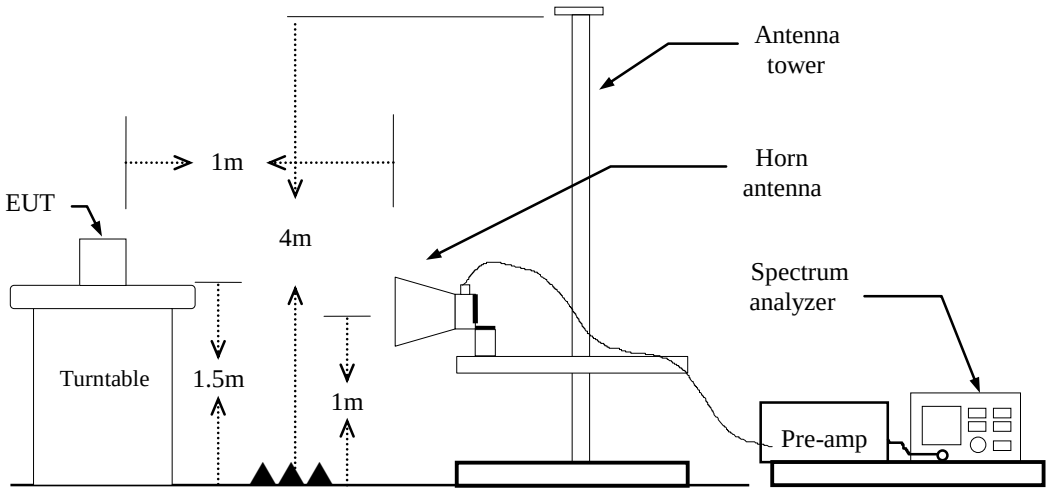
30MHz ~ 1GHz



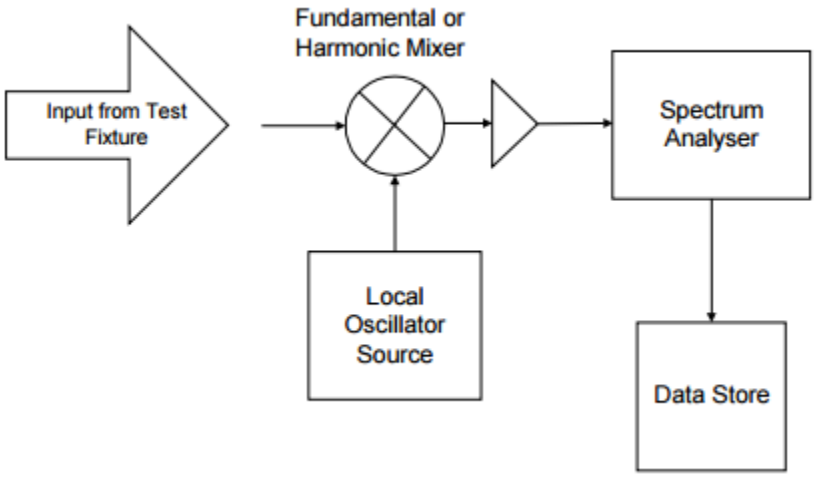
1 GHz~18 GHz



Field strength of Fundamental and Band Edge (Above 18GHz)



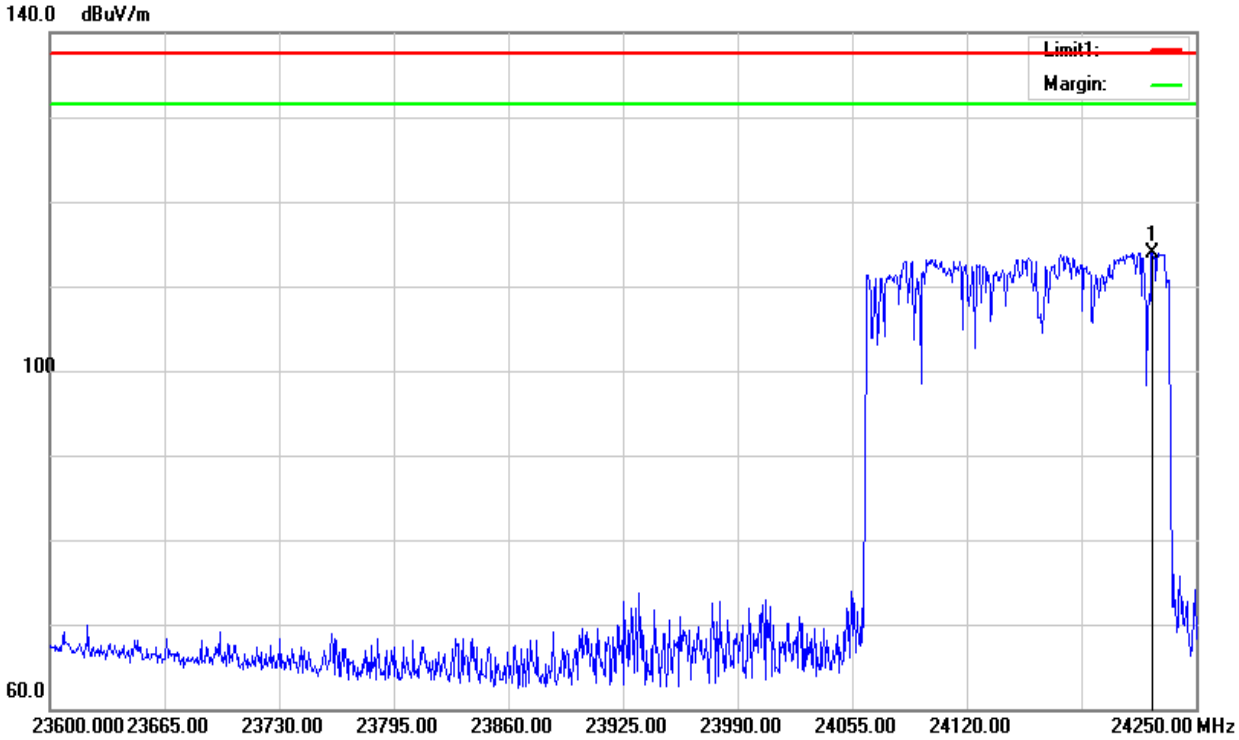
Above 40 GHz



4.2.4 Test Result

Field strength of Fundamental

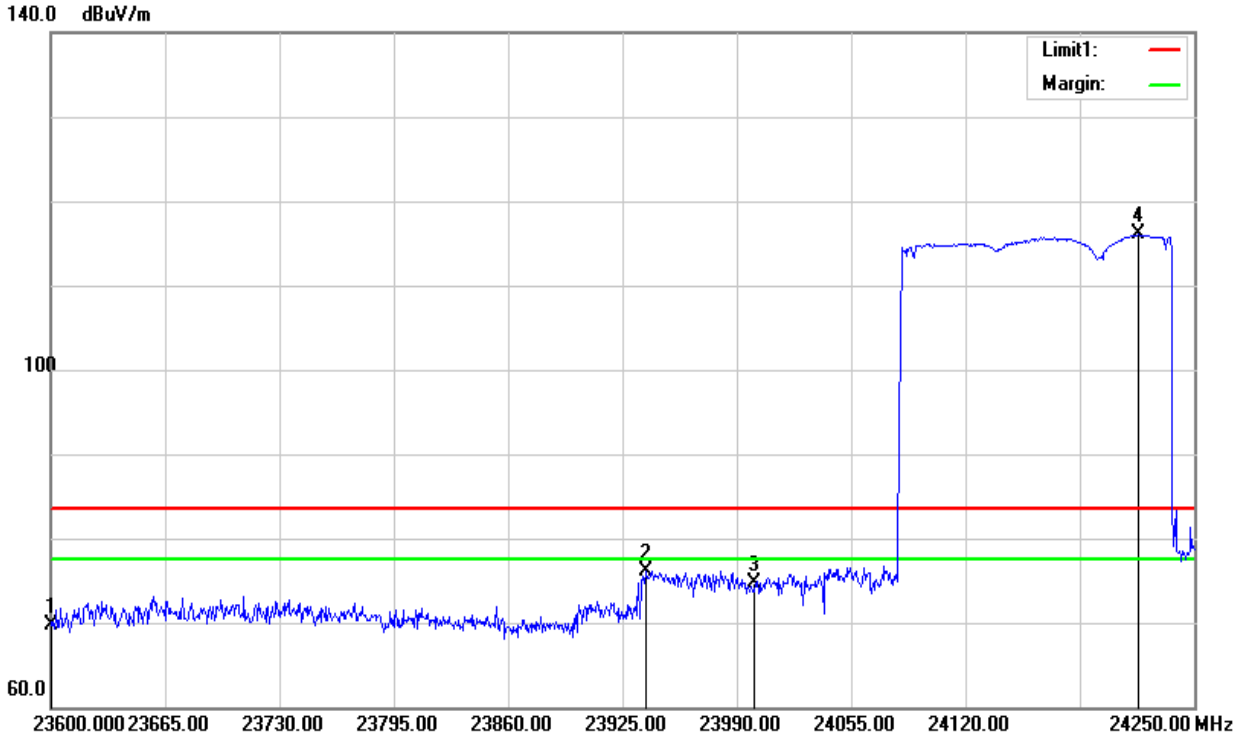
Test Mode:	Mode 1	Temp/Hum	20(℃)/ 52%RH
Test Item	Field strength of Fundamental	Test Date	2017/3/8
Polarize	Vertical	Test Engineer	Ed Chiang
Detector	Peak		



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
24225.300	82.18	31.80	113.98	137.5	-23.52	peak

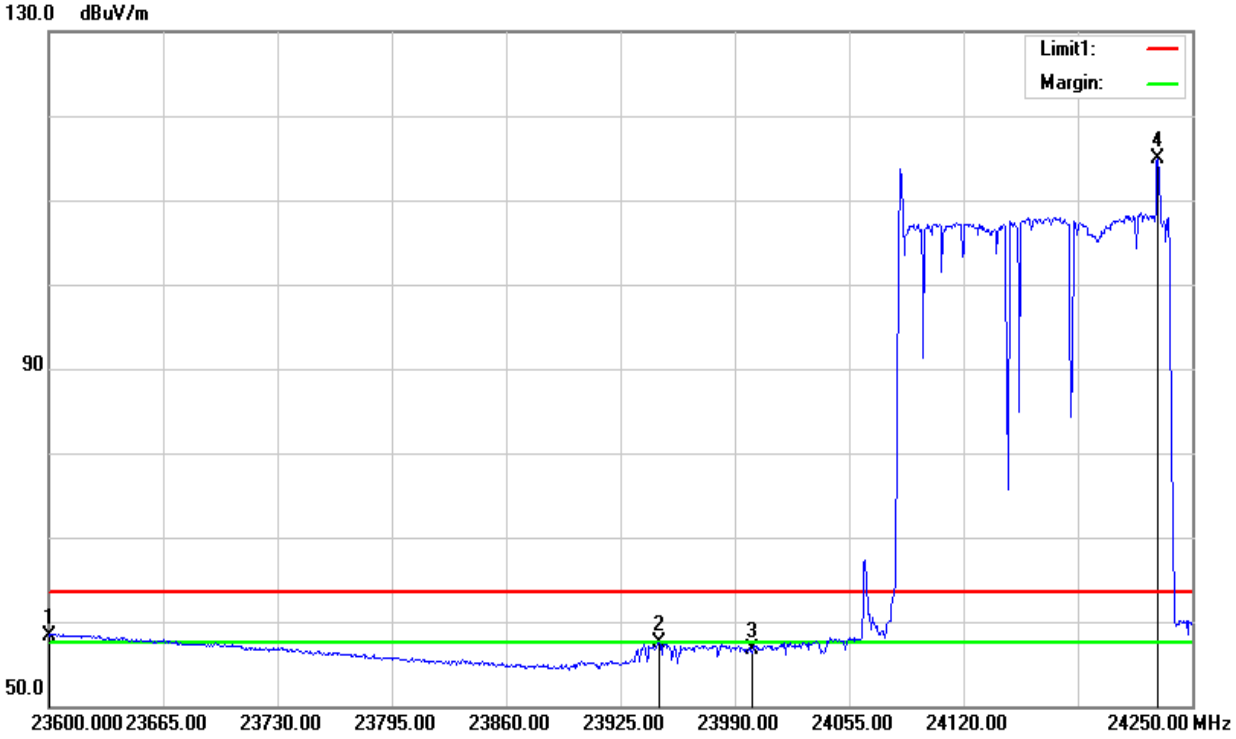
Band Edge

Test Mode:	Mode 1	Temp/Hum	20(℃)/ 52%RH
Test Item	Band Edge	Test Date	2017/3/8
Polarize	Vertical	Test Engineer	Ed Chiang
Detector	Peak		



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
23600.000	37.65	32.04	69.69	83.50	-13.81	peak
23938.650	44.82	31.32	76.14	83.50	-7.36	peak
24000.000	43.58	31.19	74.77	83.50	-8.73	peak
24218.150	84.23	31.78	116.01	-	-	peak

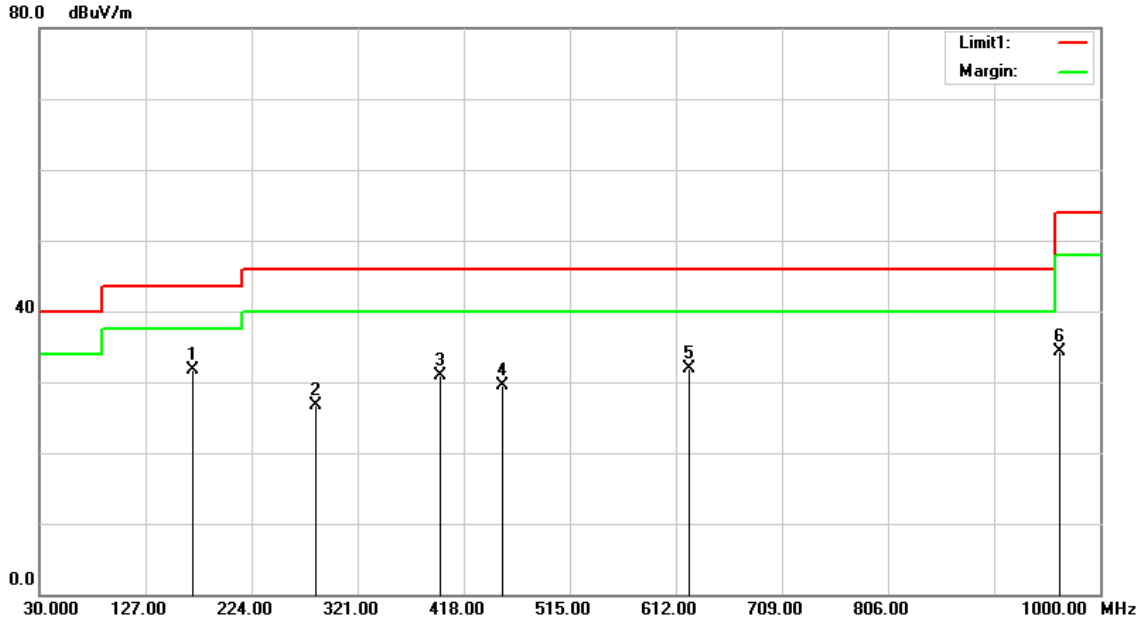
Test Mode:	Mode 1	Temp/Hum	20(℃)/ 52%RH
Test Item	Bandedge	Test Date	2017/3/8
Polarize	Vertical	Test Engineer	Ed Chiang
Detector	Avg		



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
23600.000	26.35	32.04	58.39	63.50	-5.11	AVG
23947.100	26.16	31.30	57.46	63.50	-6.04	AVG
24000.000	25.61	31.19	56.80	63.50	-6.70	AVG
24230.500	83.18	31.81	114.99	-	-	AVG

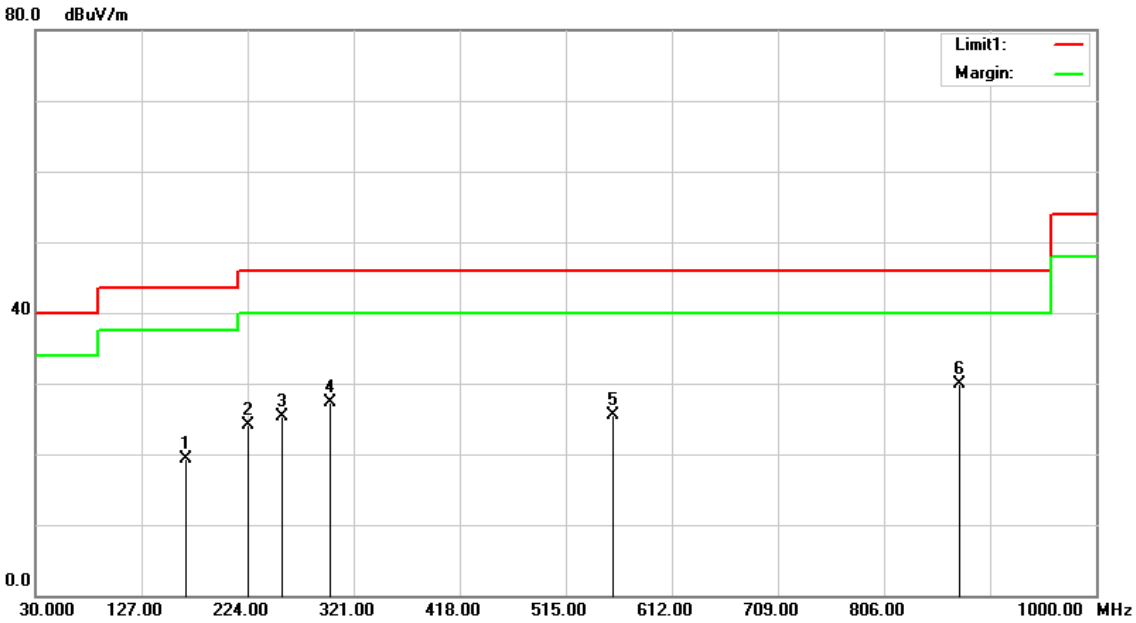
Below 1G Test Data

Test Mode:	Mode 1	Temp/Hum	27(℃)/ 53%RH
Test Item	30MHz-1GHz	Test Date	2017/2/20
Polarize	Vertical	Test Engineer	Ed Chiang
Detector	Peak		



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
169.6800	48.57	-16.83	31.74	43.50	-11.76	peak
283.1700	41.35	-14.55	26.80	46.00	-19.20	peak
396.6600	42.65	-11.78	30.87	46.00	-15.13	peak
452.9200	39.65	-10.13	29.52	46.00	-16.48	peak
623.6400	39.19	-7.20	31.99	46.00	-14.01	peak
963.1400	36.41	-2.18	34.23	54.00	-19.77	peak

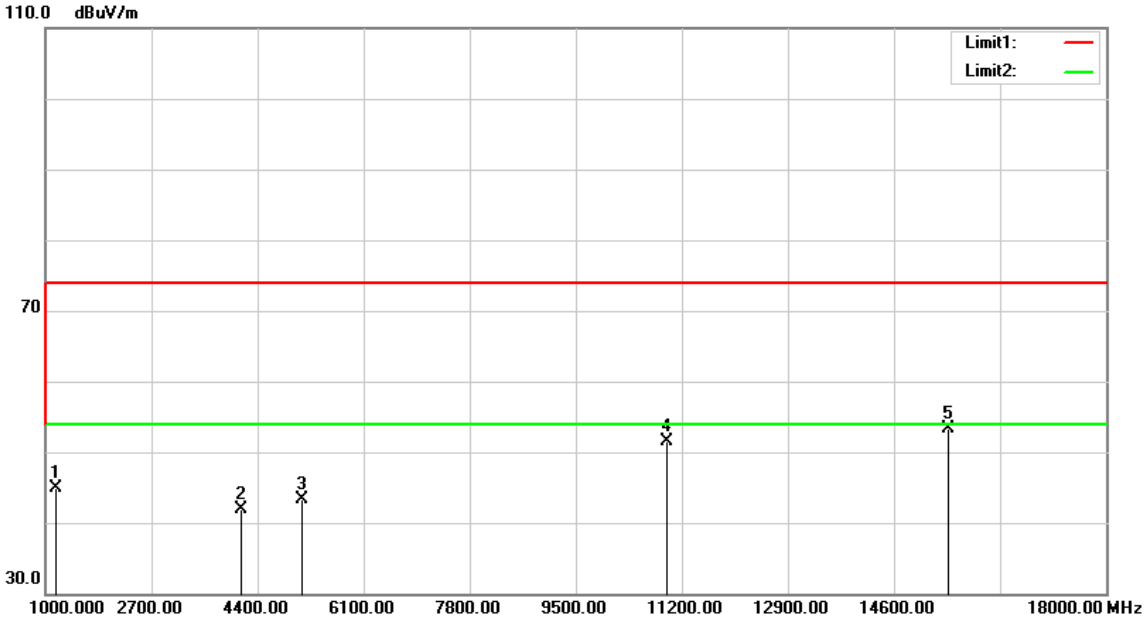
Test Mode:	Mode 1	Temp/Hum	27(℃)/ 53%RH
Test Item	30MHz-1GHz	Test Date	2017/2/20
Polarize	Horizontal	Test Engineer	Ed Chiang
Detector	Peak		



Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
167.7400	35.97	-16.74	19.23	43.50	-24.27	peak
224.9700	40.91	-16.85	24.06	46.00	-21.94	peak
255.0400	41.14	-15.91	25.23	46.00	-20.77	peak
299.6600	41.58	-14.25	27.33	46.00	-18.67	peak
558.6500	33.82	-8.36	25.46	46.00	-20.54	peak
874.8700	33.31	-3.49	29.82	46.00	-16.18	peak

Above 1G Test Data

Test Mode:	1GHz -18GHz	Temp/Hum	22(℃)/ 35%RH
Test Item	Harmonic	Test Date	2017/5/12
Polarize	Vertical	Test Engineer	Ed Chiang
Detector	Peak		

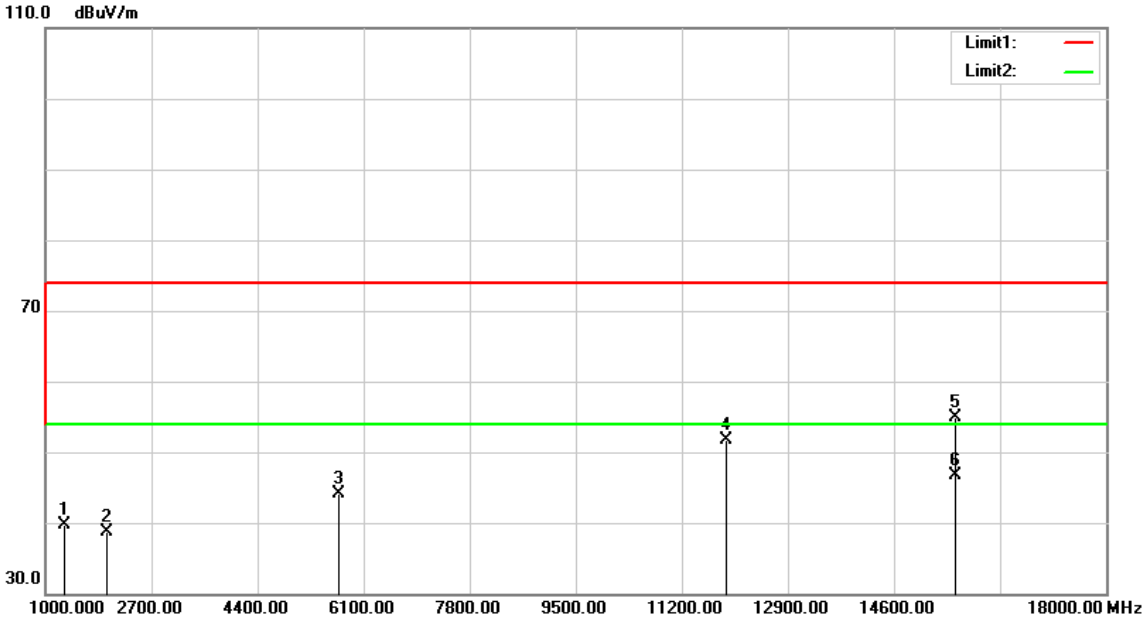


Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1175.000	52.32	-7.33	44.99	74.00	-29.01	peak
4150.000	38.84	3.05	41.89	74.00	-32.11	peak
5116.000	37.42	5.79	43.21	74.00	-30.79	peak
10960.000	33.39	18.06	51.45	74.00	-22.55	peak
15470.000	32.94	20.42	53.36	74.00	-20.64	peak

Remark:

1. *Measuring frequencies from 1 GHz to the 100GHz harmonic.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*

Test Mode:	1GHz -18GHz	Temp/Hum	22(℃)/ 35%RH
Test Item	Harmonic	Test Date	2017/5/12
Polarize	Horizontal	Test Engineer	Ed Chiang
Detector	Peak and AVG		

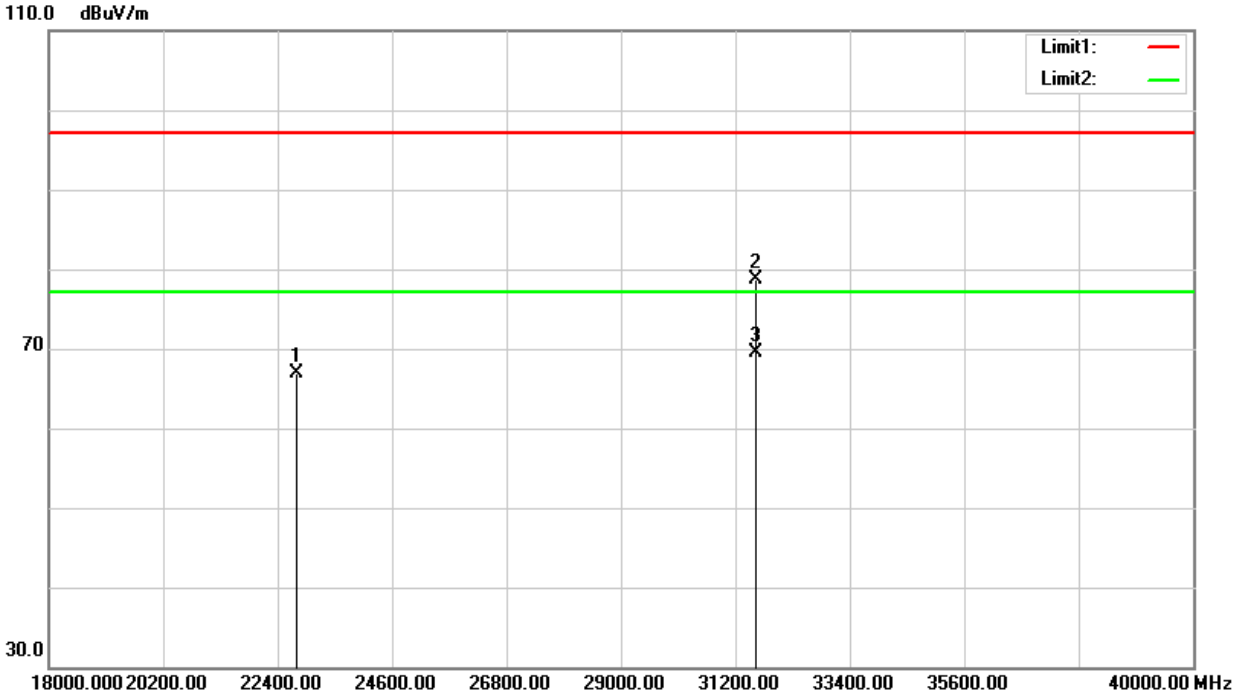


Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1301.000	46.55	-6.89	39.66	74.00	-34.34	peak
1980.000	42.33	-3.70	38.63	74.00	-35.37	peak
5704.000	36.93	7.17	44.10	74.00	-29.90	peak
11910.000	33.47	18.23	51.70	74.00	-22.30	peak
15590.000	34.04	20.78	54.82	74.00	-19.18	peak
15590.000	25.94	20.78	46.72	54.00	-7.28	AVG

Remark:

1. *Measuring frequencies from 1 GHz to the 100GHz harmonic.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*

Test Mode:	18GHz -40GHz	Temp/Hum	22(℃)/ 35%RH
Test Item	Harmonic	Test Date	2017/5/12
Polarize	Vertical	Test Engineer	Ed Chiang
Detector	Peak and AVG		

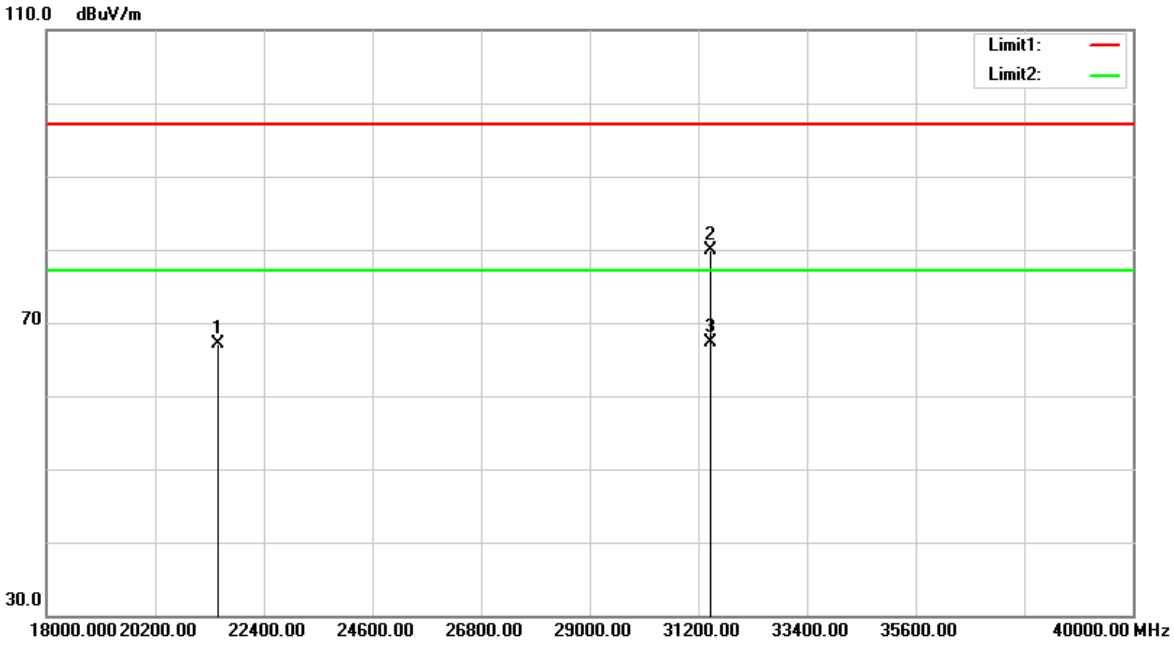


Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
22780.000	35.16	31.81	66.97	97.5	-30.53	peak
31600.000	39.12	39.66	78.78	97.5	-18.72	peak
31600.000	29.75	39.66	69.41	77.5	-8.09	AVG

Remark:

1. *Measuring frequencies from 1 GHz to the 100GHz harmonic.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*
3. *The limits of 77.5 /97.5 dBuv/m at 1m.*

Test Mode:	18GHz -40GHz	Temp/Hum	22(℃)/ 35%RH
Test Item	Harmonic	Test Date	2017/5/12
Polarize	Horizontal	Test Engineer	Ed Chiang
Detector	Peak and AVG		

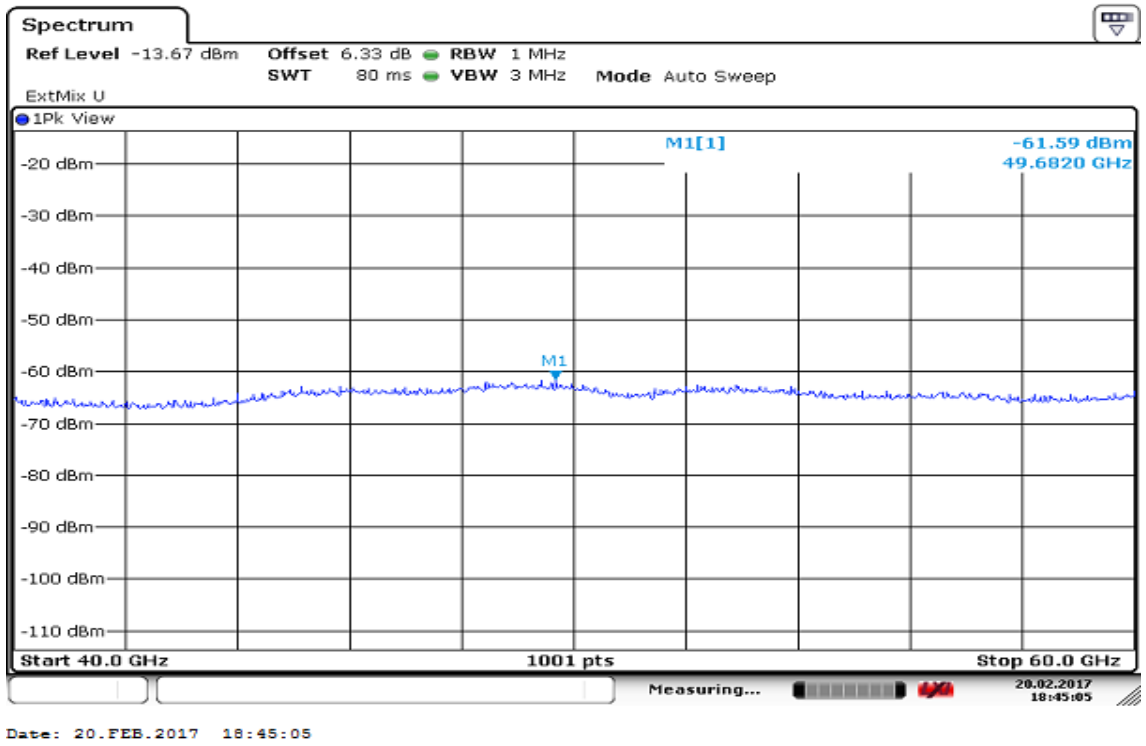


Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
21468.000	35.34	31.73	67.07	97.5	-30.43	peak
31460.000	40.32	39.49	79.81	97.5	-17.69	peak
31460.000	27.75	39.49	67.24	77.5	-10.26	AVG

Remark:

1. *Measuring frequencies from 1 GHz to the 100GHz harmonic.*
2. *For above 1GHz,the EUT peak value was under average limit, therefore the Average value compliance with the average limit*
3. *The limits of 77.5 /97.5 dBuv/m at 1m.*

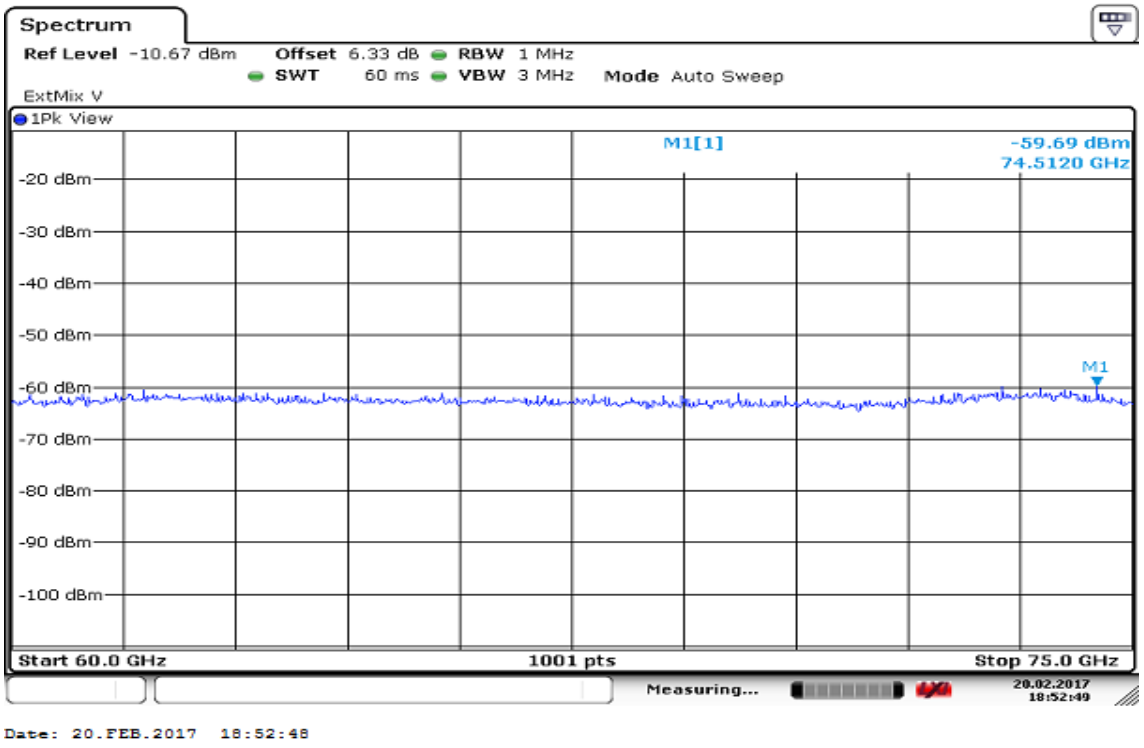
Test Mode:	40GHz-60GHz	Temp/Hum	27(℃)/ 53%RH
Test Item	Harmonic	Test Date	2017/2/20
Detector	Peak and Average	Test Engineer	Ed Chiang



Remark:

1. *Measuring frequencies from 1 GHz to the 100GHz harmonic.*
2. *The limit is 77.5 dBuV/m(-29.5 dBm) at 1m test distance.*
   Field Strength(dBm)=E(dBuv/m)-107

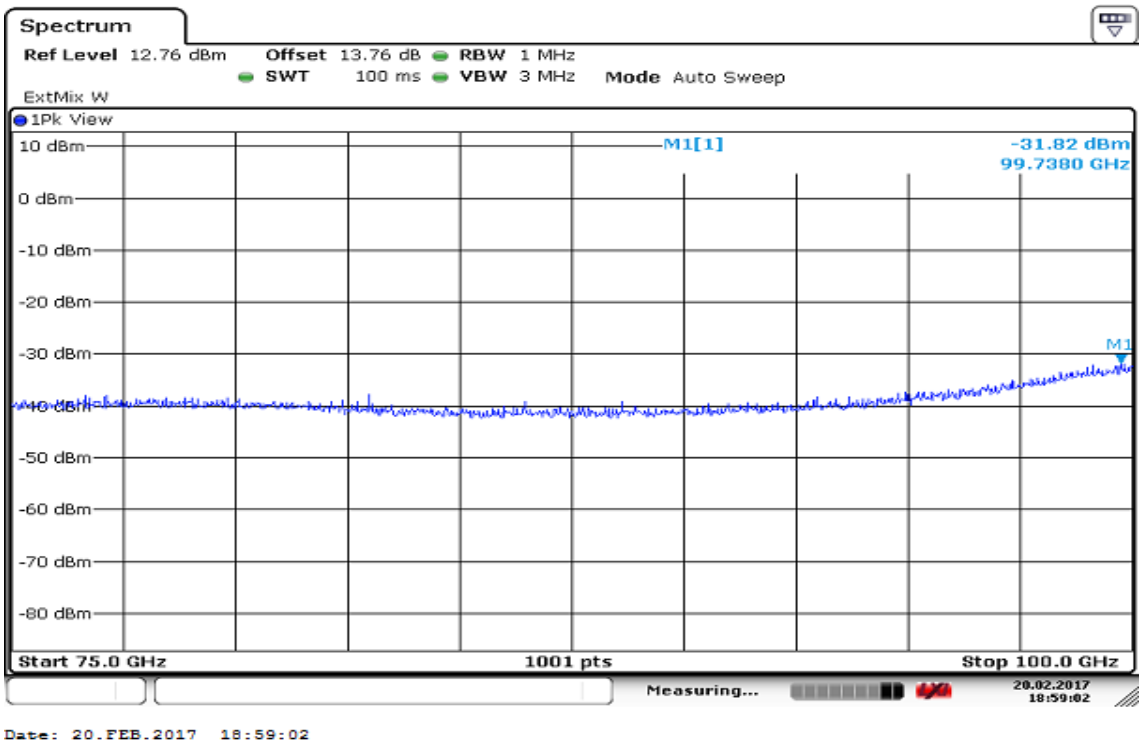
Test Mode:	60GHz-75GHz	Temp/Hum	27(℃)/ 53%RH
Test Item	Harmonic	Test Date	2017/2/20
Detector	Peak and Average	Test Engineer	Ed Chiang



Remark:

1. *Measuring frequencies from 1 GHz to the 100GHz harmonic.*
2. *The limit is 77.5 dBuV/m(-29.5 dBm) at 1m test distance.*
   Field Strength (dBm)=E(dBuv/m)-107

Test Mode:	75GHz-100GHz	Temp/Hum	27(℃)/ 53%RH
Test Item	Harmonic	Test Date	2017/2/20
Detector	Peak and Average	Test Engineer	Ed Chiang



Remark:

1. *Measuring frequencies from 1 GHz to the 100GHz harmonic.*
2. *The limit is 77.5 dBuV/m(-29.5 dBm) at 1m test distance.*
   Field Strength (dBm)=E(dBuv/m)-107