

TEST REPORT

Report No.: SHATBL2306004W01

Applicant : Furspark Technology Co., Ltd.

Product Name : Smart Pet Feeder

Brand Name : Furspark

Model Name : Furspark Big Eye

FCC ID : 2BCAD-BIGEYE

Test Standard : FCC Part15.247

Date of Test : 2023.06.19-2023.06.26

Report Prepared by :

Jack Suo

(Jack Suo)

Report Approved by :

Ghost Li.

(Ghost Li)

Authorized Signatory :

Terry Yang

(Terry Yang)



"Shanghai ATBL Technology Co., Ltd." hereby certifies that according to actual testing conditions. The test results or observations are provided in accordance with measured value, without taking risks caused by uncertainty into account. Without explicit stipulation in special agreements, standards, or regulations, ATBL shall not assume any responsibility. The test results or observations are applicable only to tested sample. Client shall be responsible for representativeness of the sample and authenticity of the material. This report will be void without authorized signature or special seal for testing report. Do not copied without authorization.

GENERAL DESCRIPTION

Applicant's Name.....: Furspark Technology Co., Ltd.
Address.....: South Side, 8th Floor, East Building, No. 399 Chuangqiang Road, Xindai Town, Pinghu City, Jiaxing City, Zhejiang Province.

Manufacture's Name.....: Furspark Technology Co., Ltd.
Address.....: South Side, 8th Floor, East Building, No. 399 Chuangqiang Road, Xindai Town, Pinghu City, Jiaxing City, Zhejiang Province.

Factory's Name.....: Furspark Technology Co., Ltd.
Address.....: South Side, 8th Floor, East Building, No. 399 Chuangqiang Road, Xindai Town, Pinghu City, Jiaxing City, Zhejiang Province.

Product Description

Product Name.....: Smart Pet Feeder

Brand Name: Furspark

Model Name.....: Furspark Big Eye

Series Model.....: N/A

Test Standards.....: FCC Part15.247

Test Procedure.....: ANSI C63.10-2013

The device has been tested by ATBL, and the test results show that the equipment under test (EUT) is in compliance with the FCC Part15.247 requirements. And it is applicable only to the tested sample identified in the report.

This report shall not be reproduced except in full, without the written approval of ATBL, this document only be altered or revised by ATBL, personal only, and shall be noted in the revision of the document.

Date of receipt of test item.....: 2023.06.02

Date (s) of performance of tests.....: 2023.06.19-2023.06.26

Date of Issue.....: 2023.06.27

Test Result.....: **Pass**

TABLE OF CONTENTS

1. SUMMARY OF TEST RESULTS	6
2. GENERAL INFORMATION	7
2.1 GENERAL DESCRIPTION OF THE EUT	7
2.2 DESCRIPTION OF THE TEST MODES	8
2.3 TEST SOFTWARE AND POWER LEVEL	9
2.5 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS	10
2.6 LABORATORY INFORMATION	10
2.7 MEASUREMENT UNCERTAINTY	10
2.8 EQUIPMENTS LIST	11
3. EMC EMISSION TEST	12
3.1 CONDUCTED EMISSION MEASUREMENT	12
3.2 TEST PROCEDURE	13
3.3 TEST SETUP	13
3.4 EUT OPERATING CONDITIONS	13
3.5 TEST RESULTS	14
4. RADIATED EMISSION MEASUREMENT	16
4.1 RADIATED EMISSION LIMITS	16
4.2 TEST PROCEDURE	18
4.3 TEST SETUP	19
4.4 EUT OPERATING CONDITIONS	19
4.5 FIELD STRENGTH CALCULATION	20
4.6 TEST RESULTS	20
5. CONDUCTED SPURIOUS & BAND EDGE EMISSION	33
5.1 LIMIT	33
5.2 TEST PROCEDURE	33
5.3 TEST SETUP	33
5.4 EUT OPERATION CONDITIONS	33
5.5 TEST RESULTS	34
6. POWER SPECTRAL DENSITY TEST	35
6.1 LIMIT	35
6.2 TEST PROCEDURE	35
6.3 TEST SETUP	35
6.4 EUT OPERATION CONDITIONS	35
6.5 TEST RESULTS	36
7. BANDWIDTH TEST	37
7.1 LIMIT	37
7.2 TEST PROCEDURE	37
7.3 TEST SETUP	37

7.4 EUT OPERATION CONDITIONS	37
7.5 TEST RESULTS	38
8. PEAK OUTPUT POWER TEST	39
8.1 LIMIT	39
8.2 TEST PROCEDURE	39
8.3 TEST SETUP	39
8.4 EUT OPERATION CONDITIONS	39
8.5 TEST RESULTS	40
9. ANTENNA REQUIREMENT	41
9.1 STANDARD REQUIREMENT	41
9.2 EUT ANTENNA	41
10. APPENDIX- PHOTOS OF TEST SETUP	42

Revision History

Rev.	Issue Date	Revisions	Revised by
00	2023.06.27	Initial Release	Ghost Li

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:
KDB 558074 D01 15.247 Meas Guidance v05r02.

FCC Part 15.247, Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	PASS	--
15.247 (a)(2)	6dB&99% Bandwidth	PASS	--
15.247 (b)(3)	Output Power	PASS	--
15.247(d) & 15.209 & 15.205	Radiated Spurious Emission	PASS	--
15.247(d) & 15.205	Conducted Spurious & Band Edge Emission	PASS	--
15.247 (e)	Power Spectral Density	PASS	--
15.205	Restricted bands of operation	PASS	--
15.203	Antenna Requirement	PASS	--

NOTE:

- (1) 'N/A' denotes test is not applicable in this Test Report.
- (2) All tests are according to ANSI C63.10-2013.

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Smart Pet Feeder	
Trade Name	Furspark	
Model Name	Furspark Big Eye	
Series Model	N/A	
Model Difference	N/A	
Product Description	The EUT is Smart Pet Feeder	
	Operation Frequency:	2400~2483.5 MHz
	Modulation Type:	GFSK
	Radio Technology:	BLE
	Bluetooth Version:	4.1
	Bluetooth Configuration:	BLE(Support 1M PHY)
	Number Of Channel:	40
	Antenna Designation:	FPC Antenna
	Antenna Gain (dBi)	3.01 dBi
Channel List	Please refer to the Note 2.	
Power Input	DC5V 2A	
Battery	N/A	
Hardware version number	CPP MB V1.5	
Software version number	V7.2	
Connecting I/O Port(s)	Please refer to the Note 1.	

Note:

- For a more detailed features description, please refer to the manufacturer's specifications or the User Manual.
- The general information of EUT in this report is provided by the customer or manufacture, ATBL is only responsible for the test data but not for the information provided by the customer or manufacture.

2.

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

3.

Table for Filed Antenna

Ant.	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
0	N/A	FPC Antenna	N/A	3.01dBi	BLE ANT

2.2 DESCRIPTION OF THE TEST MODES

For conducted test items and radiated spurious emissions

Each of these EUT operation mode(s) or test configuration mode(s) mentioned below was evaluated respectively.

Worst Mode	Description	Data/Modulation
Mode 1	TX CH00(2402MHz)	1Mbps/GFSK
Mode 2	TX CH19(2440MHz)	1Mbps/GFSK
Mode 3	TX CH39(2480MHz)	1Mbps/GFSK

Note:

(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

For Conducted Emission

Test Case	
Conducted Emission	Mode 4:Keeping BT TX

2.3 TEST SOFTWARE AND POWER LEVEL

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level.

RF Function	Type	Mode Or Modulation type	Ant Gain(dBi)	Power Class	Software For Testing
BLE	BLE	GFSK	3.01	15	Provided by the customer

2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission Test



Conduction Test Set



2.5 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

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.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-2	Adapter	Moveforest	MF-05001000SA1	N/A	N/A
C-1	USB	N/A	20cm	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model	Type No.	Note
E-3	Notebook	Lenovo	DESKTOP-USDEO09	00326-10000-00000-AA636	N/A
C-2	USB	N/A	100cm	N/A	N/A

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.

2.6 LABORATORY INFORMATION

Company Name:	Shanghai ATBL Technology Co., Ltd.
Address:	Building 8, No. 160, Basheng Road, Waigaoqiao Free Trade Zone, Pudong New Area, Shanghai
Telephone:	+86(0)21-51298625

2.7 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, 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	RF output power, conducted	$\pm 0.962\text{dB}$
2	Conducted spurious emissions	$\pm 2.986\text{dB}$
3	All emissions, radiated 30MHz-1GHz	$\pm 2.49\text{dB}$
4	All emissions, radiated 1GHz-18GHz	$\pm 3.50\text{dB}$
5	Occupied bandwidth	$\pm 23.36\text{Hz}$
6	Power spectral density	$\pm 0.866\text{dB}$

2.8 EQUIPMENTS LIST

2.8.1 Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Management number	Calibrated until
Test Receiver	R&S	ESCI	100469	SHATBL-E003	2024.05.09
Spectrum Analyzer	Agilent	N9020A	MY50200811	SHATBL-E017	2024.05.09
Bilog Antenna	SCHWARZBECK	VLUB 9168	01174	SHATBL-E008	2024.05.12
Horn Antenna	SCHWARZBECK	BBHA 9120D	02014	SHATBL-E009	2024.05.12
Active circular antenna(9kHz-30MHz)	R&S	ZN30900C	20077	SHATBL-E042	2024.05.09
Pre-Amplifier (0.1M-3GHz)	JPT	JPA-10M1G35	21010100035001	SHATBL-E005	2024.05.09
Pre-Amplifier (1G-18GHz)	JPT	JPA0118-55-303A	1910001800055000	SHATBL-E006	2024.05.09
Horn Antenna With Amplifier(18-40G)	Daze	ZN30900C	10100008	SHATBL-E043	2024.05.09
Temperature & Humidity	DeLi	DeLi	N/A	SHATBL-E016	2023.09.20
Antenna/Turntable Controller	Brilliant	N/A	N/A	SHATBL-E007	N/A
Test SW	FALA	EMC-RI(Ver.4A2)		SHATBL-E046	N/A

2.8.2 Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Management number	Calibration date
Test Receiver	R&S	ESPI	101679	SHATBL-E012	2024.05.09
LISN	R&S	ENV216	101300	SHATBL-E013	2024.05.30
LISN	R&S	ENV216	100333	SHATBL-E041	2024.05.09
Temperature & Humidity	DeLi	DeLi	N/A	SHATBL-E015	2023.09.20
Test SW	FALA	EZ-EMC(Ver.EMC-CON3A1.1)		SHATBL-E044	N/A

2.8.3 RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	equipment number	Calibrated until
Power meter (with pulse power sensor)	Anritsu	ML2496A	1935001	SHATBL-W030	2023.09.27
Pulse power sensor (with power meter)	Anritsu	MA2411B	1911006	SHATBL-W031	2023.09.27
Signal Analyzer	Agilent	N9020A	MY57300196	SHATBL-W004	2023.09.27
Signal Generator	Agilent	N5182B	MY46240556	SHATBL-W005	2023.09.27
Wireless Communications Test Set	R&S	CMW500	101331	SHATBL-W007	2023.09.27
Temperature & Humidity	Deli	deli	N/A	SHATBL-W011	2023.09.27
Attenuator	Agilent	8494B	DC-18G	SHATBL-W009	2023.09.27
Attenuator	Agilent	8496B	DC-18G	SHATBL-W010	2023.09.27
power splitter	MNK	MPD-DC/6-2S	62315 G51	SHATBL-W015	2023.09.27
			62315 G52	SHATBL-W016	2023.09.27
Filter	Chengdu kangmaiwei	ZBSF-C2400 -2483.5-T3	N/A	SHATBL-W021	N/A
Constant temperature and humidity box	KSON	THS-B6C-150	6159K	SHATBL-W019	2024.01.16
Test SW	FALA	LZ-RF(Ver.LzRF-03A3.1)		SHATBL-W020	N/A

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

Operating frequency band. In case the emission fall within the restricted band specified on Part 207(a) limit in the table below has to be followed.

FREQUENCY (MHz)	Conducted Emission limit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

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.

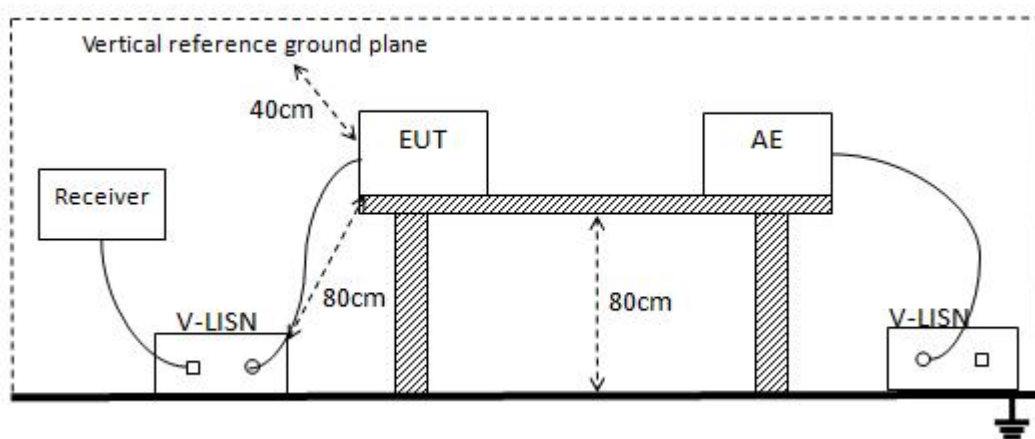
The following table is the setting of the receiver

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

3.2 TEST PROCEDURE

- The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- 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.
- 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.
- LISN is at least 80 cm from the nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.3 TEST SETUP



3.4 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.

3.5 TEST RESULTS

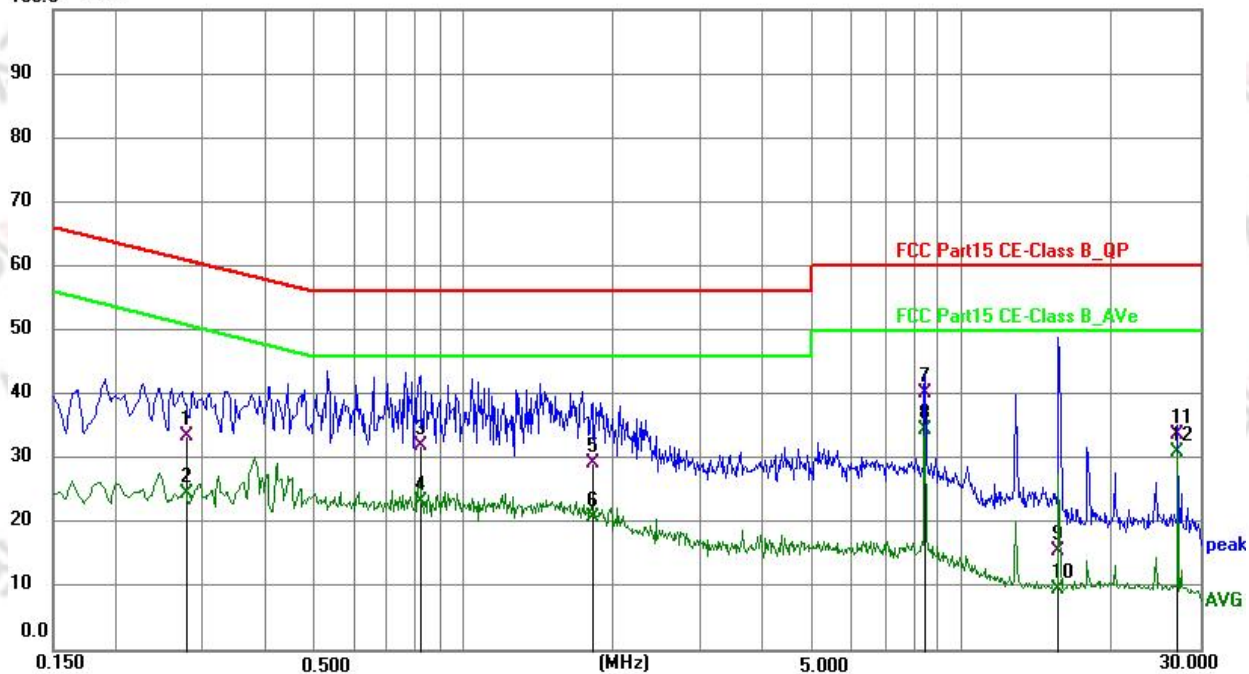
Temperature:	23.4°C	Relative Humidity:	55%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 4		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	0.2781	22.59	10.93	33.52	60.87	-27.35	QP
2	0.2781	13.52	10.93	24.45	50.87	-26.42	AVG
3	0.8213	20.68	11.22	31.90	56.00	-24.10	QP
4	0.8213	12.13	11.22	23.35	46.00	-22.65	AVG
5	1.8197	18.30	11.00	29.30	56.00	-26.70	QP
6	1.8197	9.67	11.00	20.67	46.00	-25.33	AVG
7	8.4139	29.19	10.86	40.05	60.00	-19.95	QP
8	8.4139	23.59	10.86	34.45	50.00	-15.55	AVG
9	15.6066	4.36	11.14	15.50	60.00	-44.50	QP
10	15.6066	-1.64	11.14	9.50	50.00	-40.50	AVG
11	27.0010	21.94	11.80	33.74	60.00	-26.26	QP
12	27.0010	19.17	11.80	30.97	50.00	-19.03	AVG

Remark:

1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result = Reading + Factor) - Limit.
3. Factor = LISN factor + Cable loss + Limiter (10dB)

100.0 dBuV



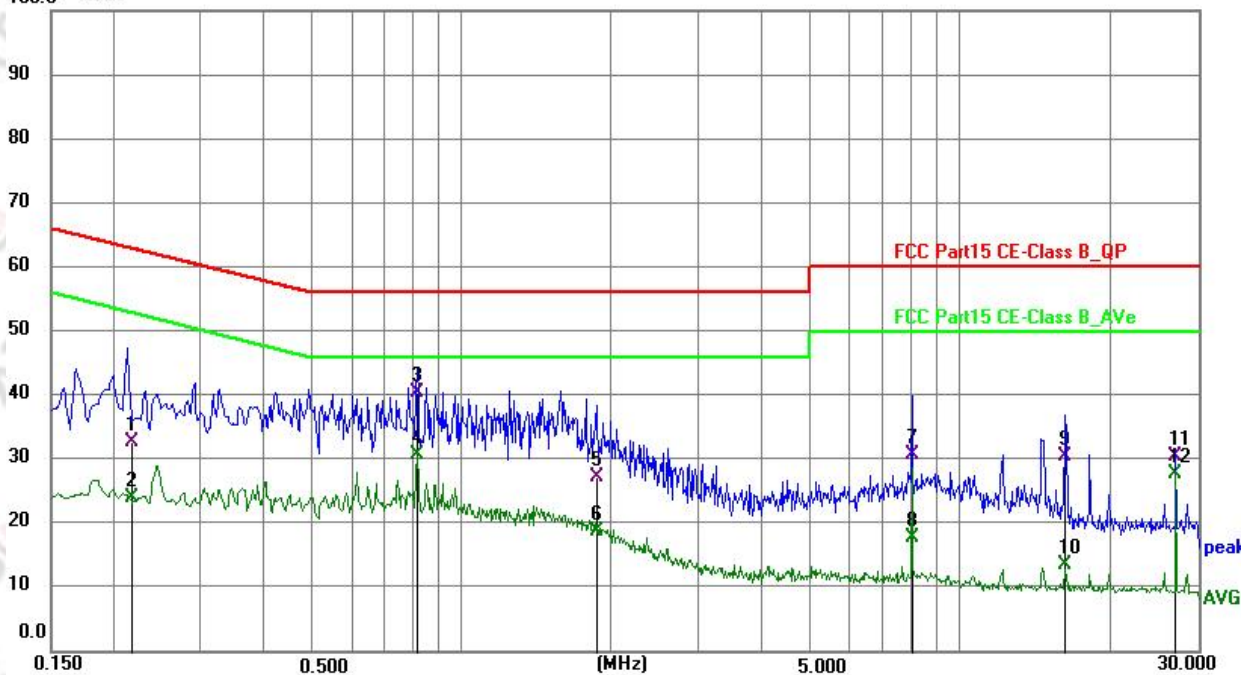
Temperature:	23.4°C	Relative Humidity:	55%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 4		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	0.2174	21.95	10.82	32.77	62.92	-30.15	QP
2	0.2174	13.13	10.82	23.95	52.92	-28.97	AVG
3	0.8164	29.25	11.13	40.38	56.00	-15.62	QP
4	0.8164	19.55	11.13	30.68	46.00	-15.32	AVG
5	1.8753	16.43	10.83	27.26	56.00	-28.74	QP
6	1.8753	7.92	10.83	18.75	46.00	-27.25	AVG
7	8.0084	19.90	10.90	30.80	60.00	-29.20	QP
8	8.0084	6.95	10.90	17.85	50.00	-32.15	AVG
9	16.2463	18.76	11.72	30.48	60.00	-29.52	QP
10	16.2463	1.80	11.72	13.52	50.00	-36.48	AVG
11	26.9997	18.30	12.11	30.41	60.00	-29.59	QP
12	26.9997	15.54	12.11	27.65	50.00	-22.35	AVG

Remark:

1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result = Reading + Factor) - Limit.
3. Factor = LISN factor + Cable loss + Limiter (10dB)

100.0 dBuV



4. RADIATED EMISSION MEASUREMENT

4.1 RADIATED EMISSION LIMITS

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed.

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

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)	(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).

LIMITS OF RESTRICTED FREQUENCY BANDS

FCC:

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

For Radiated Emission

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP/AV
Start Frequency	9 kHz/150kHz(Peak/QP/AV)
Stop Frequency	150kHz/30MHz(Peak/QP/AV)
RB / VB (emission in restricted band)	200Hz (From 9kHz to 0.15MHz)/ 9kHz (From 0.15MHz to 30MHz); 200Hz (From 9kHz to 0.15MHz)/ 9kHz (From 0.15MHz to 30MHz)

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/QP
Start Frequency	30 MHz(Peak/QP)
Stop Frequency	1000 MHz (Peak/QP)
RB / VB (emission in restricted band)	120 kHz / 300kHz

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/AV
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier harmonic(Peak/AV)
RB / VB (emission in restricted band)	1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG)

For Restricted band

Spectrum Parameter	Setting
Detector	Peak/AV
Start/Stop Frequency	2310MHz to 2500MHz
RB / VB	1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG)

Receiver Parameter	Setting
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

4.2 TEST PROCEDURE

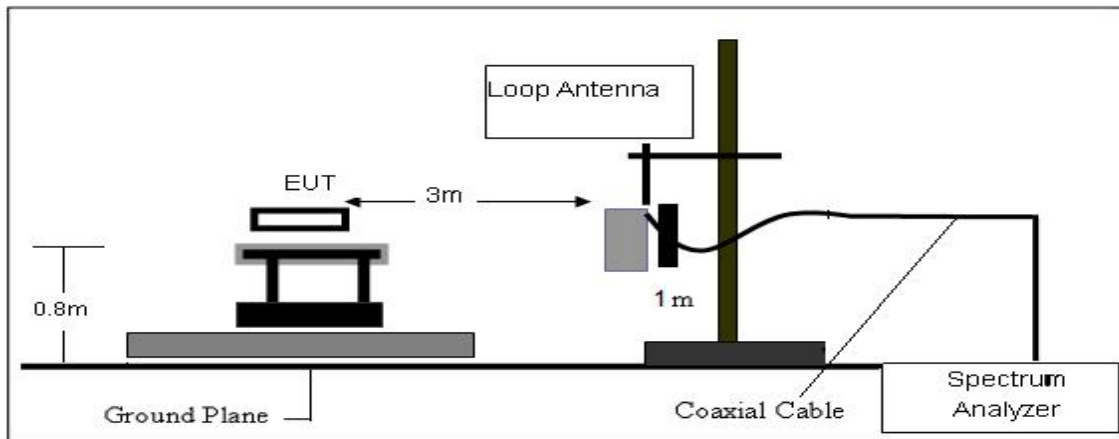
- The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
- The EUT was placed on the top of a rotating table 0.8 meters(above 1GHz is 1.5 m) above the ground at a 3 meter an echoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The height of the equipment shall be 0.8 m(above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarization of the antenna are set to make the measurement.
- The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

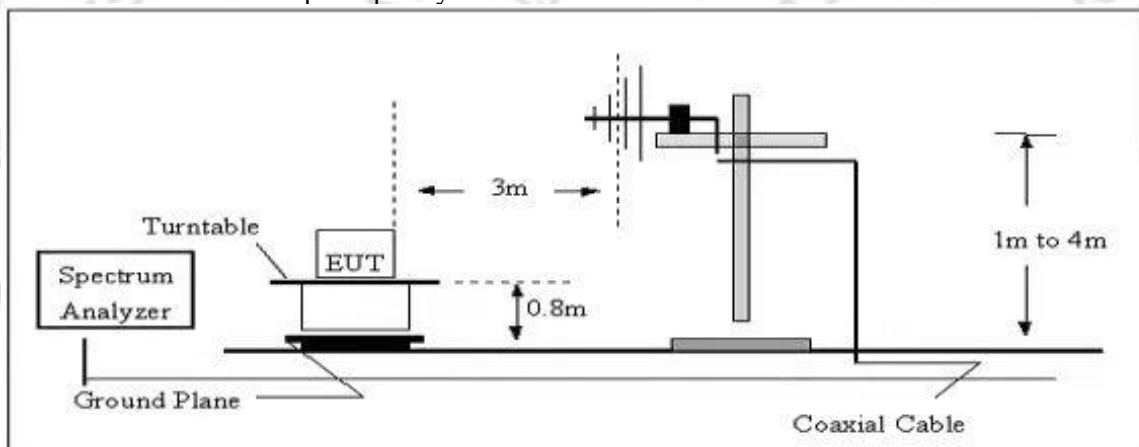
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

4.3 TEST SETUP

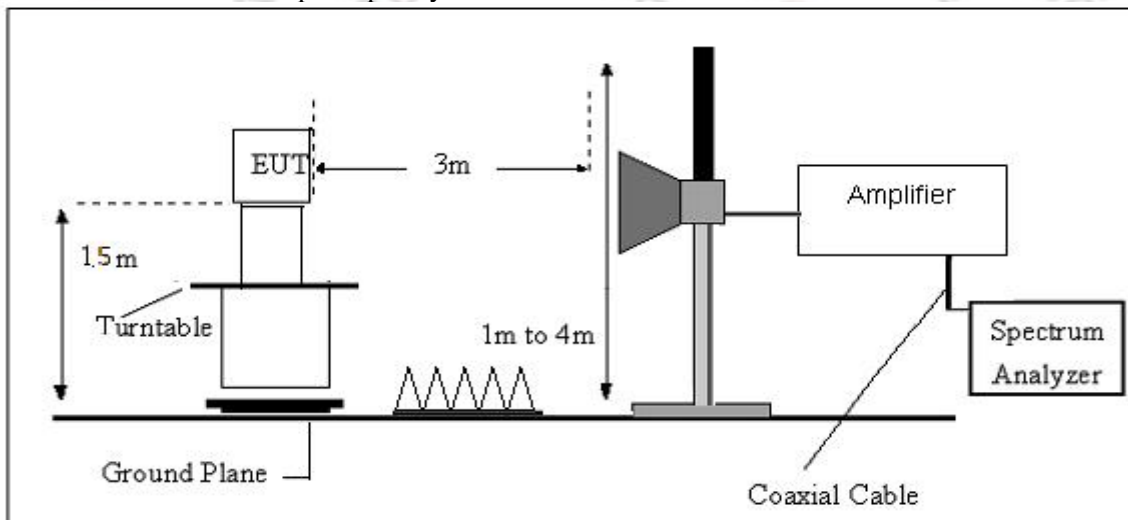
(A) Radiated Emission Test-Up Frequency Below 30MHz



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



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



4.4 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.

4.5 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

Frequency	FS	RA	AF	CL	AG	Factor
(MHz)	(dBμV/m)	(dBμV/m)	(dB)	(dB)	(dB)	(dB)
300	40	58.1	12.2	1.6	31.9	-18.1

$$\text{Factor} = \text{AF} + \text{CL} - \text{AG}$$

4.6 TEST RESULTS

(9kHz -30MHz)

Temperature:	23.4°C	Relative Humidity	55%RH
Test Voltage:	DC5V	Polarization:	
Test Mode:	TX Mode		

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 = $40 \log (\text{specific distance/test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.

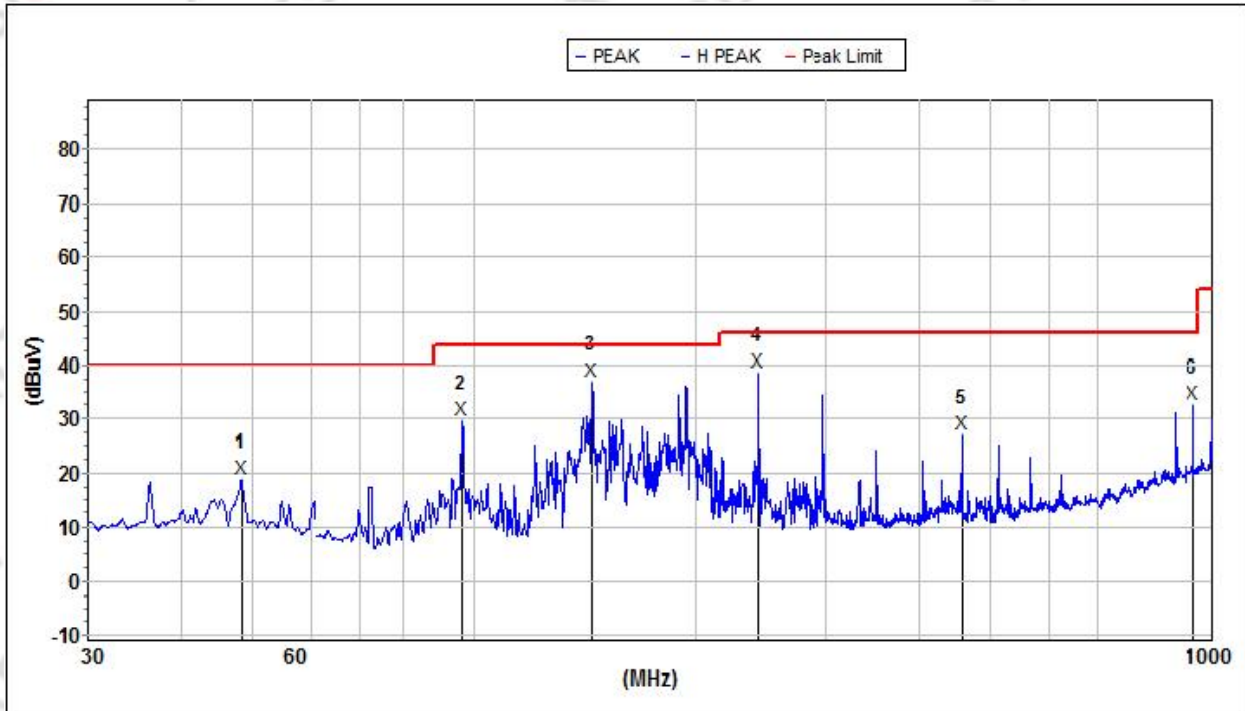
(30MHz -1000MHz)

Temperature:	23.4°C	Relative Humidity:	55%RH
Test Voltage:	DC 5V	Phase:	H
Test Mode:	TX Mode 1		

Remark:

1. Margin = Result (Result =Reading + Factor)-Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

Mode 1 Horizontal



Mk.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Peak								
1	48.416591	18.8	40.0	21.2	13.6	32.6	0.8	H
2	96.436153	29.9	43.5	13.6	9.9	32.9	1.3	H
3	144.841766	37.0	43.5	6.5	13.8	32.9	1.3	H
4	242.525265	38.8	46.0	7.2	11.5	32.8	2.5	H
5	459.114404	27.2	46.0	18.8	14.4	32.4	2.8	H
6	943.783761	32.8	46.0	13.2	20.2	31.3	3.7	H

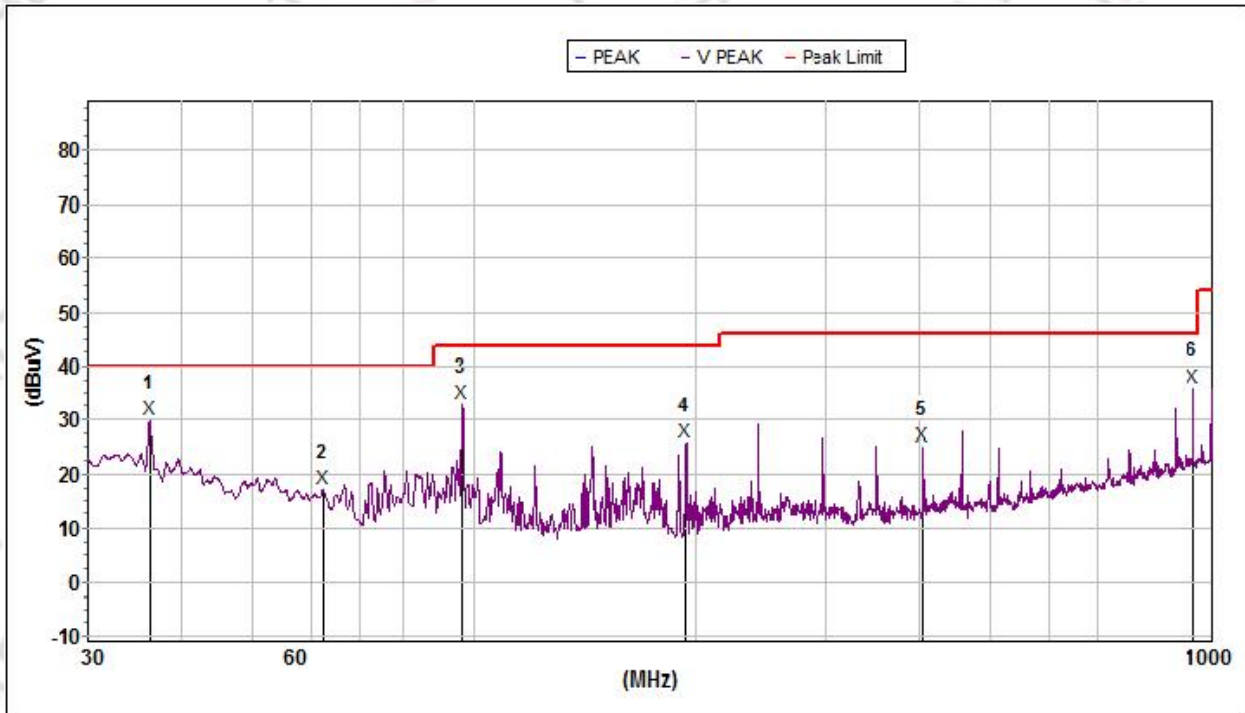
(30MHz -1000MHz)

Temperature:	23.4°C	Relative Humidity:	55%RH
Test Voltage:	DC 5V	Phase:	Vertical
Test Mode:	TX Mode 1		

Remark:

1. Margin = Result (Result =Reading + Factor)-Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

Mode 1 Vertical



Mk.	Freq.(MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Peak								
1	36.254065	30.0	40.0	10.0	13.6	32.3	0.8	V
2	62.431377	17.3	40.0	22.7	12.3	32.8	0.8	V
3	96.436153	33.1	43.5	10.4	9.9	32.9	1.3	V
4	193.094484	25.9	43.5	17.6	10.3	32.8	2.2	V
5	404.666528	25.2	46.0	20.8	14.9	32.3	2.7	V
6	943.783761	36.2	46.0	9.8	22.1	31.3	3.7	V

(30MHz -1000MHz)

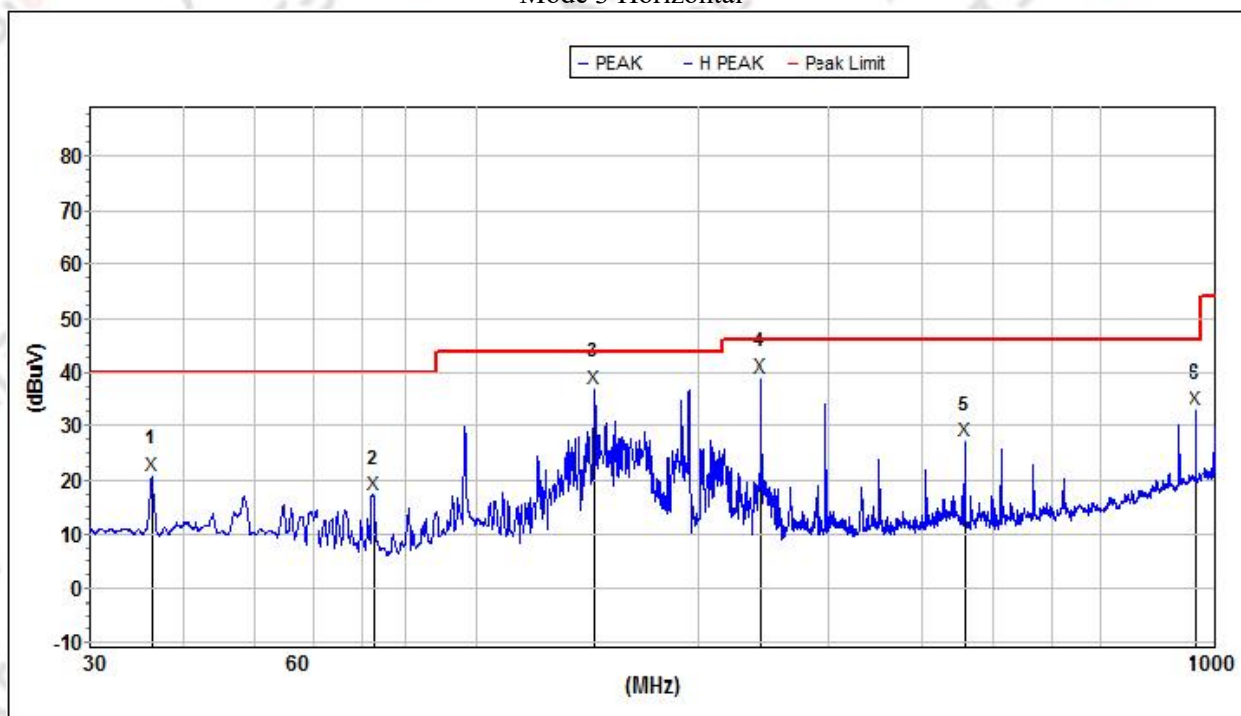
Temperature:	23.4°C	Relative Humidity:	55%RH
Test Voltage:	DC 5V	Phase:	Horizontal
Test Mode:	TX Mode 3		

Remark:

1. Margin = Result (Result =Reading + Factor)-Limit

2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

Mode 3 Horizontal



Mk.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Peak								
1	36.254065	20.8	40.0	19.2	13.6	32.3	0.8	H
2	72.591655	17.4	40.0	22.6	10.4	32.8	0.9	H
3	144.841766	37.1	43.5	6.4	13.8	32.9	1.3	H
4	242.525265	38.9	46.0	7.1	11.5	32.8	2.5	H
5	459.114404	27.2	46.0	18.8	14.4	32.4	2.8	H
6	943.783761	33.0	46.0	13.0	20.2	31.3	3.7	H

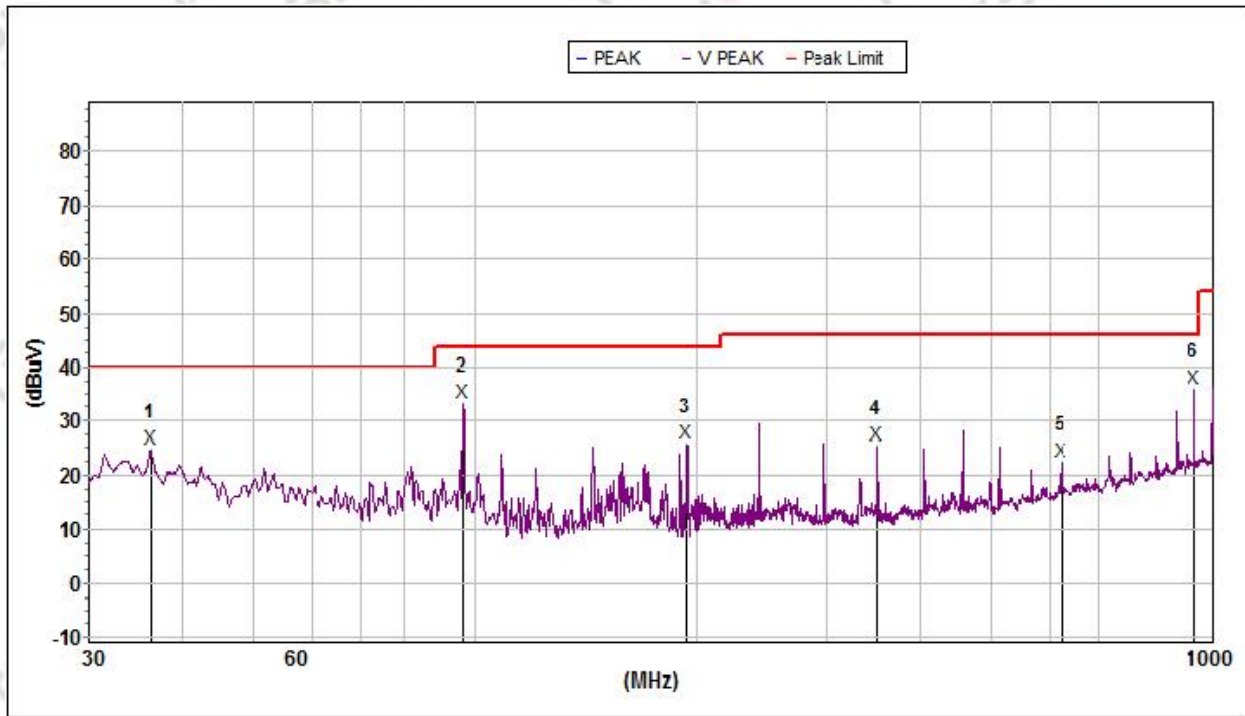
(30MHz -1000MHz)

Temperature:	23.4°C	Relative Humidity:	55%RH
Test Voltage:	DC 5V	Phase:	Vertical
Test Mode:	TX Mode 3		

Remark:

1. Margin = Result (Result =Reading + Factor)-Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

Mode 3 Vertical



Mk.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Peak								
1	36.254065	24.8	40.0	15.2	13.6	32.3	0.8	V
2	96.436153	33.4	43.5	10.1	9.9	32.9	1.3	V
3	192.756232	25.7	43.5	17.8	10.3	32.8	2.2	V
4	350.476784	25.6	46.0	20.4	13.8	32.5	2.7	V
5	620.709640	22.5	46.0	23.5	18.8	32.3	3.4	V
6	943.783761	36.2	46.0	9.8	22.1	31.3	3.7	V

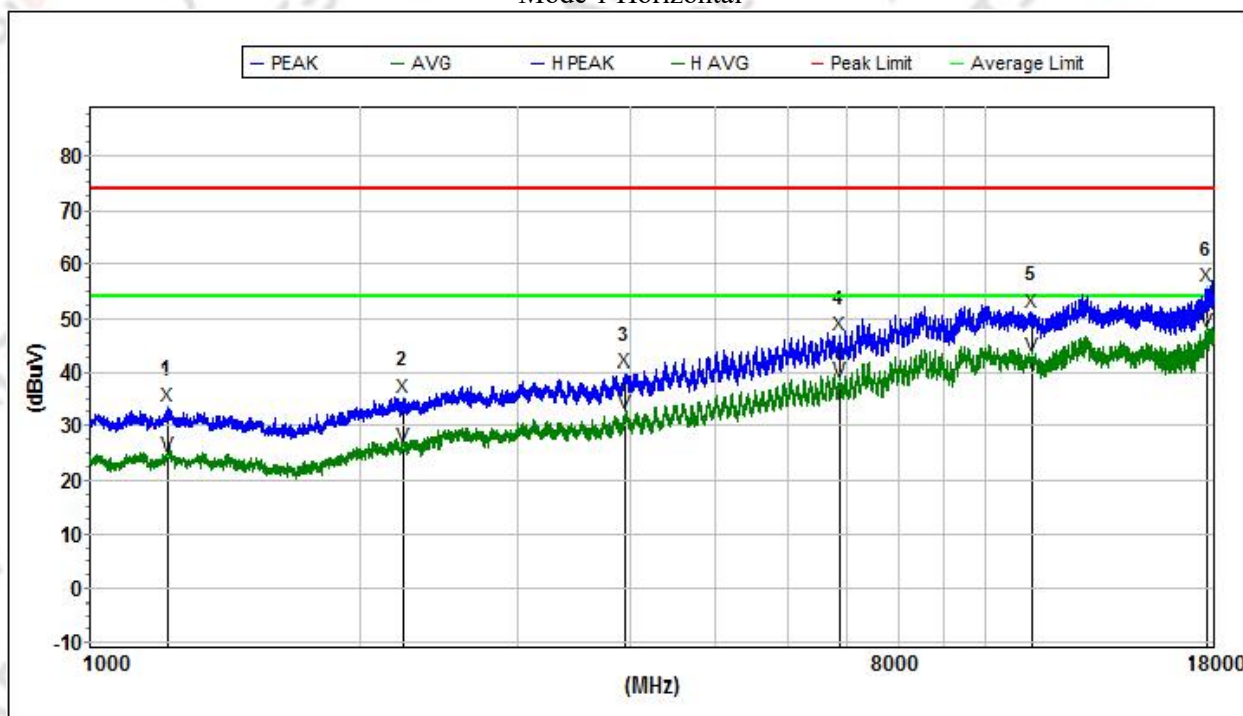
(1000MHz -18000MHz)

Temperature:	23.4°C	Relative Humidity:	55%RH
Test Voltage:	DC 5V	Phase:	Horizontal
Test Mode:	TX Mode 1		

Remark:

1. Margin = Result (Result =Reading + Factor)-Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

Mode 1 Horizontal



Mk.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Peak:								
1	1221.000000	33.7	74.0	40.3	25.7	60.9	2.3	H
2	2229.950000	35.5	74.0	38.5	27.2	60.4	2.8	H
3	3952.050000	40.0	74.0	34.0	30.8	58.5	3.2	H
4	6874.350000	47.0	74.0	27.0	35.8	58.6	4.3	H
5	11239.100000	51.3	74.0	22.7	39.0	61.1	5.7	H
6	17688.050000	55.7	74.0	18.3	40.4	57.9	6.9	H
Avg								
1	1221.000000	24.4	54.0	29.6	25.7	60.9	2.3	H
2	2229.950000	26.3	54.0	27.7	27.2	60.4	2.8	H
3	3952.050000	32.3	54.0	21.7	30.8	58.5	3.2	H
4	6874.350000	38.4	54.0	15.6	35.8	58.6	4.3	H
5	11239.100000	42.8	54.0	11.2	39.0	61.1	5.7	H
6	17688.050000	47.7	54.0	6.3	40.4	57.9	6.9	H

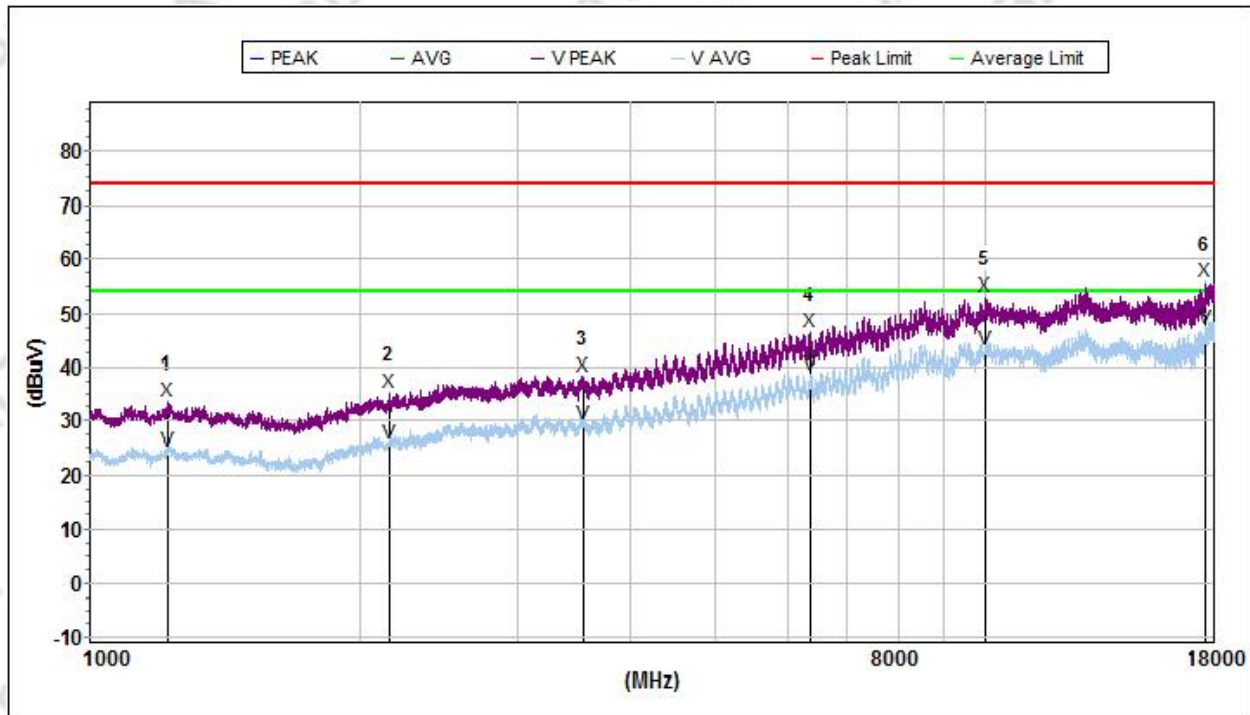
(1000MHz -18000MHz)

Temperature:	23.4°C	Relative Humidity:	55%RH
Test Voltage:	DC 5V	Phase:	Vertical
Test Mode:	TX Mode 1		

Remark:

1. Margin = Result (Result =Reading + Factor)-Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

Mode 1 Vertical



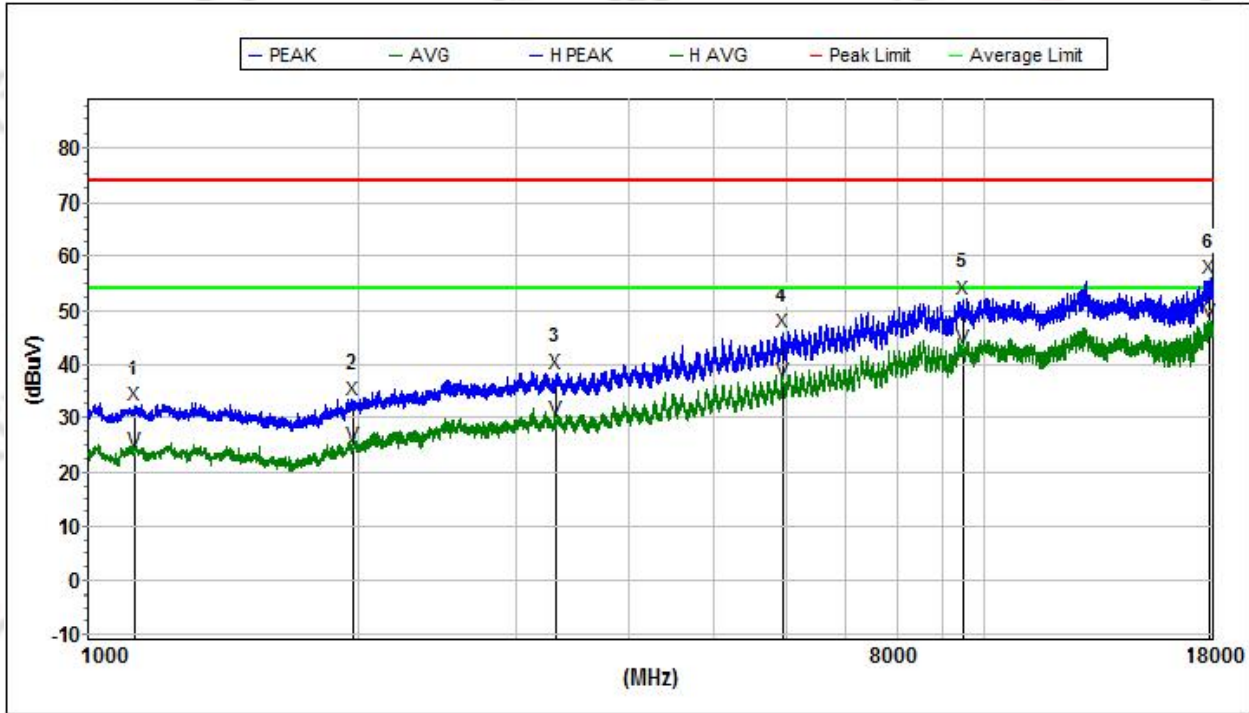
Mk.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Peak								
1	1220.150000	33.6	74.0	40.4	25.7	60.9	2.3	V
2	2153.450000	35.5	74.0	38.5	27.2	60.7	2.7	V
3	3552.550000	38.3	74.0	35.7	29.5	59.0	3.2	V
4	6366.050000	46.7	74.0	27.3	34.5	58.0	4.2	V
5	10012.550000	53.2	74.0	20.8	38.6	60.2	5.4	V
6	17587.750000	55.8	74.0	18.2	39.8	58.0	6.9	V
Avg								
1	1220.150000	24.4	54.0	29.6	25.7	60.9	2.3	V
2	2153.450000	25.8	54.0	28.2	27.2	60.7	2.7	V
3	3552.550000	29.6	54.0	24.4	29.5	59.0	3.2	V
4	6366.050000	38.6	54.0	15.4	34.5	58.0	4.2	V
5	10012.550000	43.2	54.0	10.8	38.6	60.2	5.4	V
6	17587.750000	47.2	54.0	6.8	39.8	58.0	6.9	V

(1000MHz -18000MHz)

Temperature:	23.4°C	Relative Humidity:	55%RH
Test Voltage:	DC 5V	Phase:	Horizontal
Test Mode:	TX Mode 3		

Remark:

1. Margin = Result (Result =Reading + Factor)-Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain
Mode 3 Horizontal



Mk.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Peak:								
1	1128.350000	32.5	74.0	41.5	25.5	60.7	2.2	H
2	1971.550000	33.5	74.0	40.5	26.2	60.9	2.7	H
3	3323.050000	38.5	74.0	35.5	29.6	58.2	3.1	H
4	5940.200000	46.0	74.0	28.0	34.0	58.0	4.1	H
5	9466.850000	52.3	74.0	21.7	38.6	59.7	5.4	H
6	17804.500000	55.7	74.0	18.3	41.1	57.8	7.0	H
Avg								
1	1128.350000	23.8	54.0	30.2	25.5	60.7	2.2	H
2	1971.550000	25.0	54.0	29.0	26.2	60.9	2.7	H
3	3323.050000	29.8	54.0	24.2	29.6	58.2	3.1	H
4	5940.200000	36.9	54.0	17.1	34.0	58.0	4.1	H
5	9466.850000	43.1	54.0	10.9	38.6	59.7	5.4	H
6	17804.500000	47.8	54.0	6.2	41.1	57.8	7.0	H

(1000MHz -18000MHz)

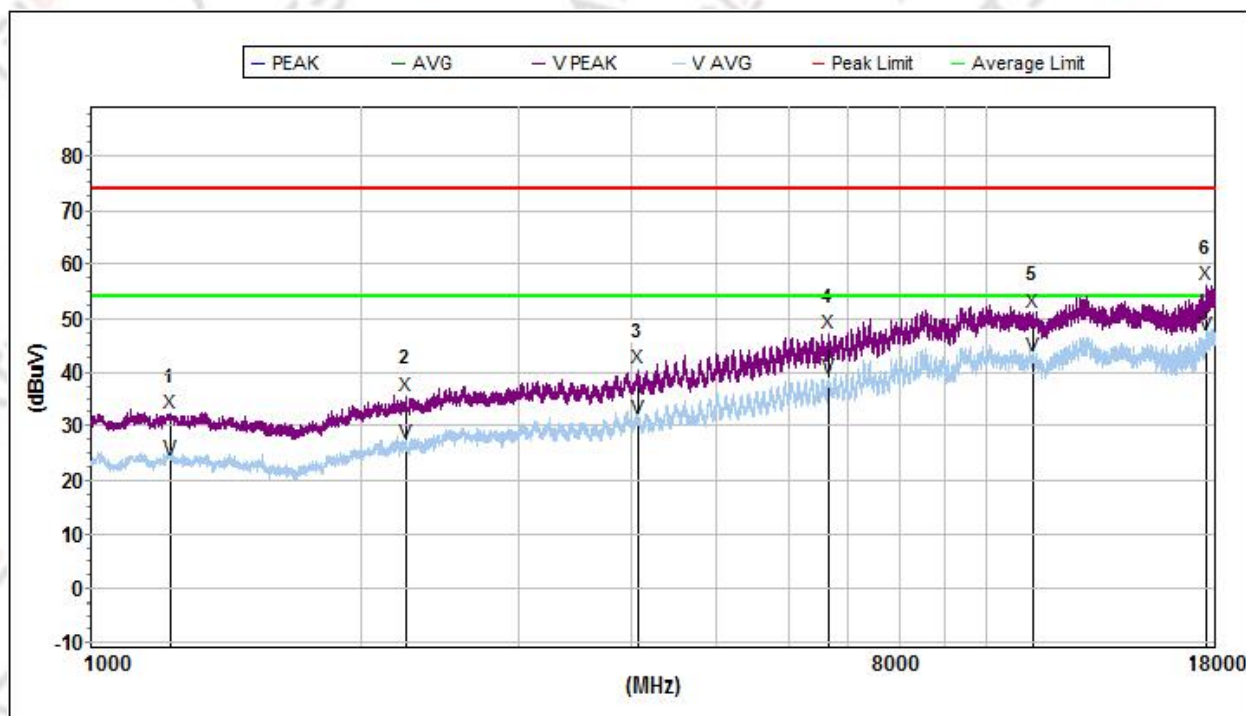
Temperature:	25.3°C	Relative Humidity:	52%RH
Test Voltage:	DC 5V	Phase:	Vertical
Test Mode:	TX Mode 3		

Remark:

1. Margin = Result (Result =Reading + Factor)-Limit

2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain

Mode 3 Vertical



Mk.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Peak:								
1	1221.850000	32.3	74.0	41.7	25.7	60.9	2.3	V
2	2246.950000	35.6	74.0	38.4	27.2	60.3	2.8	V
3	4074.450000	40.5	74.0	33.5	30.8	58.3	3.3	V
4	6673.750000	47.3	74.0	26.7	35.7	58.1	4.3	V
5	11249.300000	51.3	74.0	22.7	39.0	61.1	5.7	V
6	17599.650000	56.2	74.0	17.8	39.9	58.0	6.9	V
Avg								
1	1221.850000	23.9	54.0	30.1	25.7	60.9	2.3	V
2	2246.950000	26.9	54.0	27.1	27.2	60.3	2.8	V
3	4074.450000	31.4	54.0	22.6	30.8	58.3	3.3	V
4	6673.750000	39.0	54.0	15.0	35.7	58.1	4.3	V
5	11249.300000	43.0	54.0	11.0	39.0	61.1	5.7	V
6	17599.650000	46.8	54.0	7.2	39.9	58.0	6.9	V

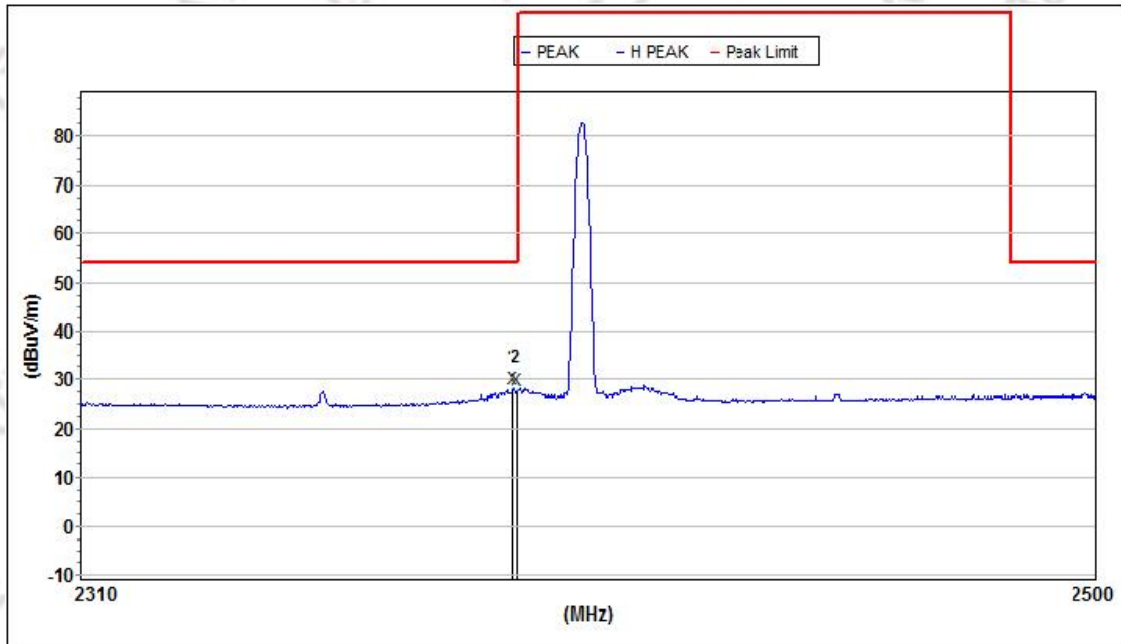
Note:

1.All TX Mode, the worst case is mode1&3, only show the worst case.

2.Other 18G-25G Emission detected are more than 20dB below the limit.

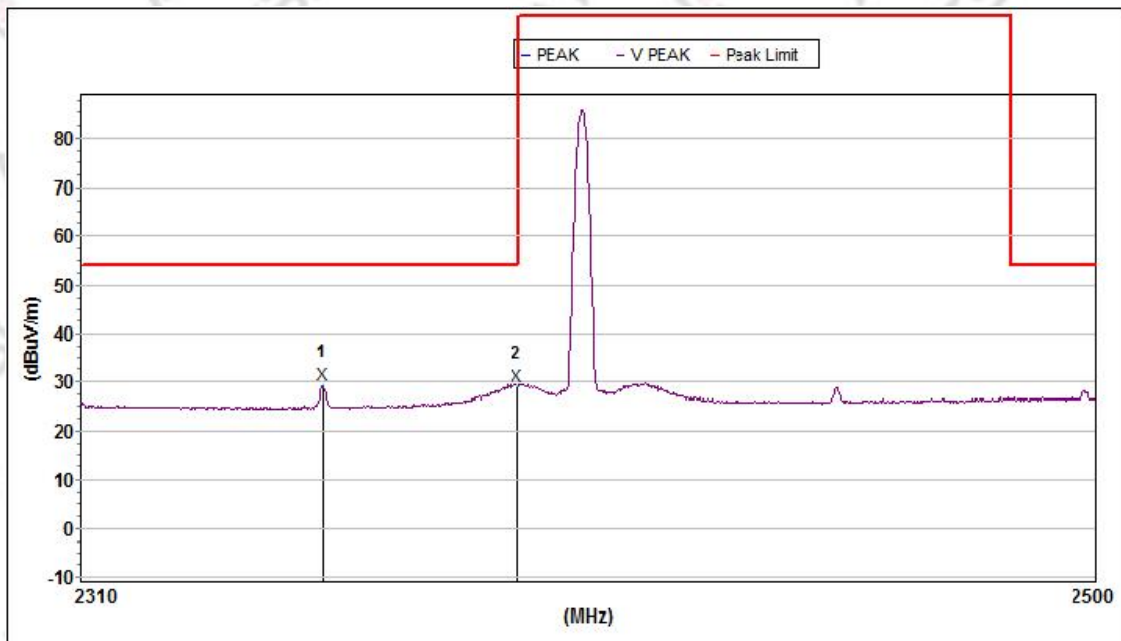
4.6 TEST RESULTS (Restricted Bands Requirements)

GFSK-Low Mode 1 Horizontal



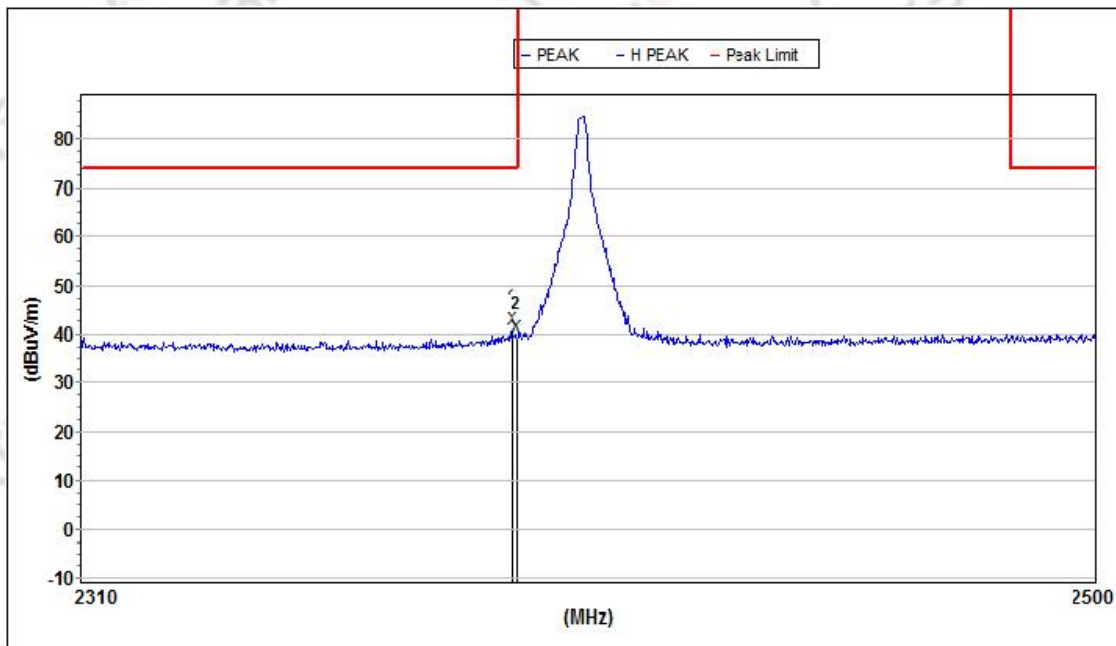
Mk.	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Avg								
1	2389.107657	28.1	54.0	25.9	27.3	59.6	2.8	H
2	2390.000000	27.9	54.0	26.1	27.3	59.6	2.8	H

Mode 1 Vertical



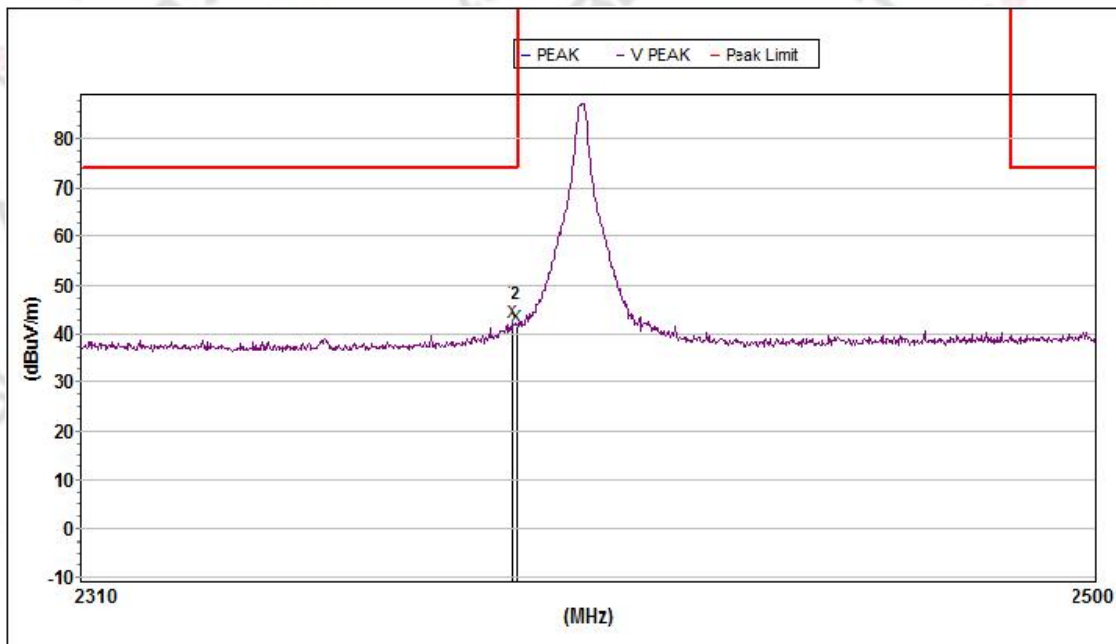
Mk.	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Avg								
1	2353.867707	29.3	54.0	24.7	27.3	59.7	2.8	V
2	2390.000000	29.2	54.0	24.8	27.3	59.6	2.8	V

GFSK-Low Mode 1 Horizontal



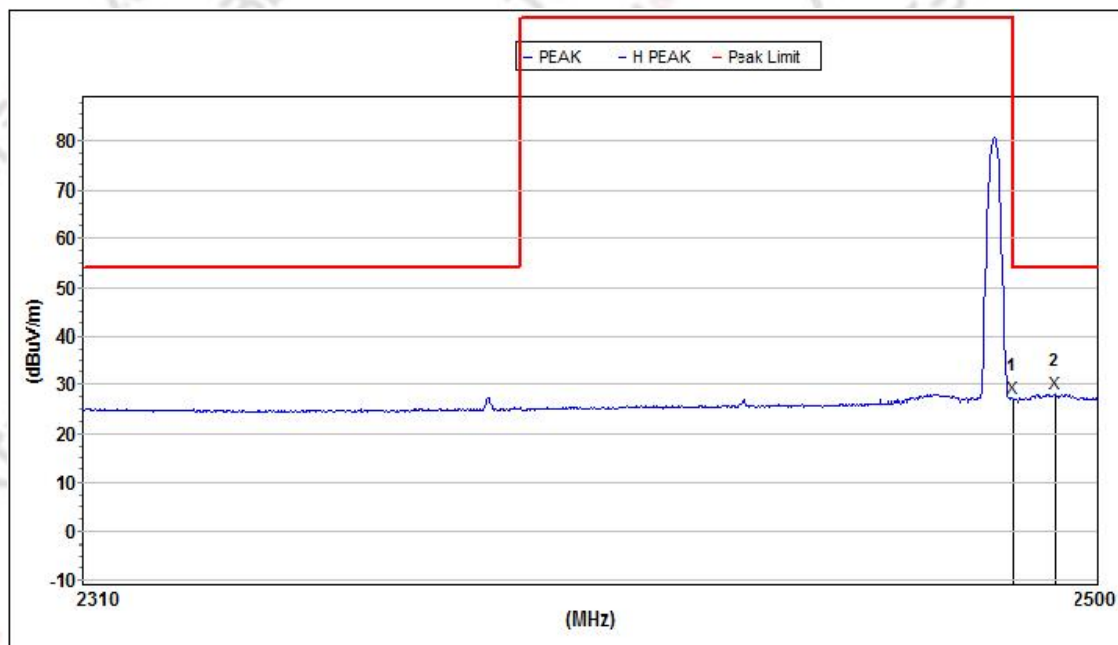
Mk.	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Peak:								
1	2388.918822	41.1	74.0	32.9	27.3	59.6	2.8	H
2	2390.000000	39.3	74.0	34.7	27.3	59.6	2.8	H

Mode 1 Vertical



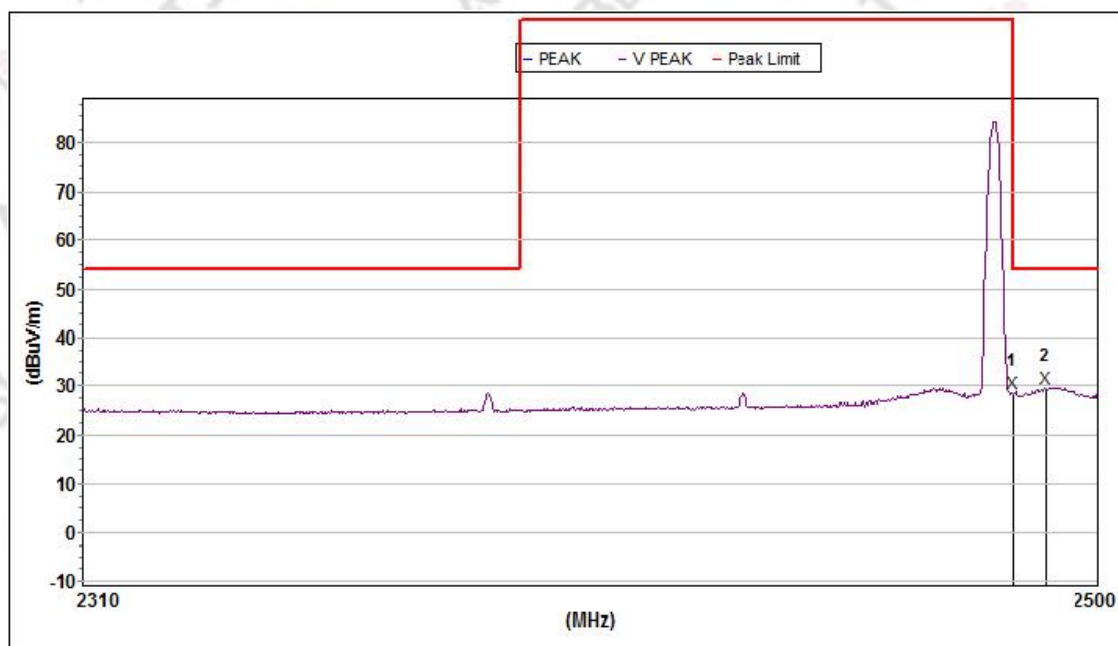
Mk.	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Peak:								
1	2389.107657	42.3	74.0	31.7	27.3	59.6	2.8	V
2	2390.000000	41.4	74.0	32.6	27.3	59.6	2.8	V

GFSK-High Mode 3 Horizontal



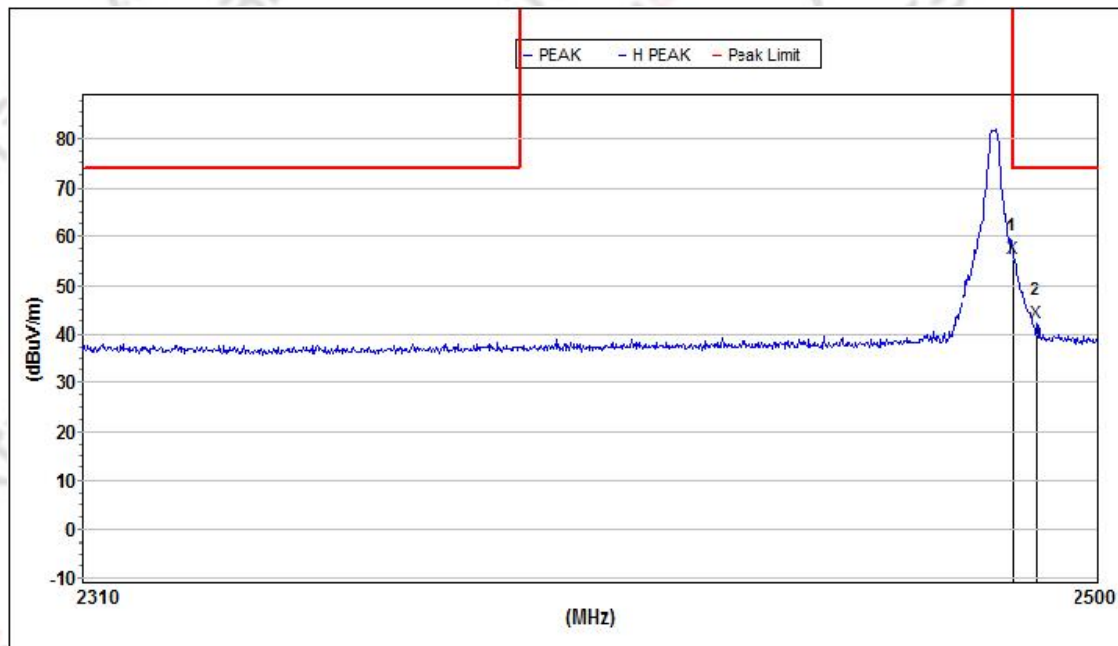
Mk.	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Avg								
1	2483.501000	27.0	54.0	27.0	27.7	58.9	2.8	H
2	2491.714224	28.0	54.0	26.0	27.7	58.8	2.8	H

Mode 3 Vertical



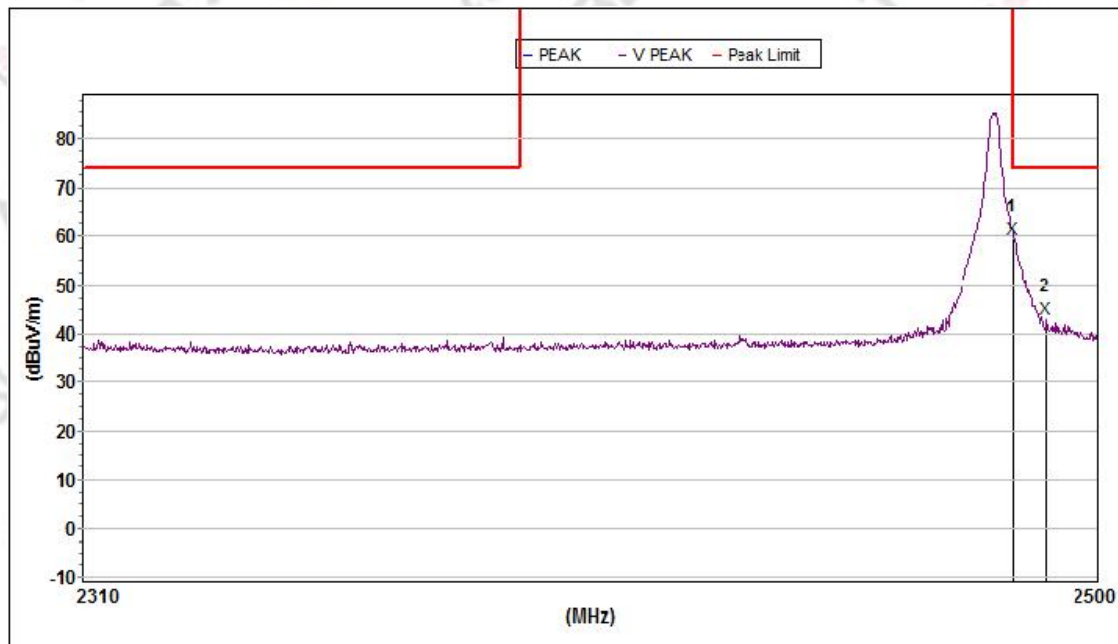
Mk.	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Avg								
1	2483.501000	28.4	54.0	25.6	27.7	58.9	2.8	V
2	2489.745472	29.5	54.0	24.5	27.7	58.9	2.8	V

GFSK- High Mode 3 Horizontal



Mk.	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Peak:								
1	2483.501000	55.3	74.0	18.7	27.7	58.9	2.8	H
2	2487.974924	42.4	74.0	31.6	27.7	58.9	2.8	H

Mode 3 Vertical



Mk.	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.F/G. (dB/m)	Amp.G. (dB)	Cbl.L. (dB)	Pol.
Peak:								
1	2483.501000	59.5	74.0	14.5	27.7	58.9	2.8	V
2	2489.942277	42.9	74.0	31.1	27.7	58.9	2.8	V

Note: All TX Mode, the worst case is model&3, only show the worst case.

5. CONDUCTED SPURIOUS & BAND EDGE EMISSION

5.1 LIMIT

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

5.2 TEST PROCEDURE

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 kHz/300 kHz
Trace-Mode:	Max hold

For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	Lower Band Edge: 2300 – 2450 MHz Upper Band Edge: 2430 – 2580 MHz
RB / VB (emission in restricted band)	100 kHz/300 kHz
Trace-Mode:	Max hold

5.3 TEST SETUP



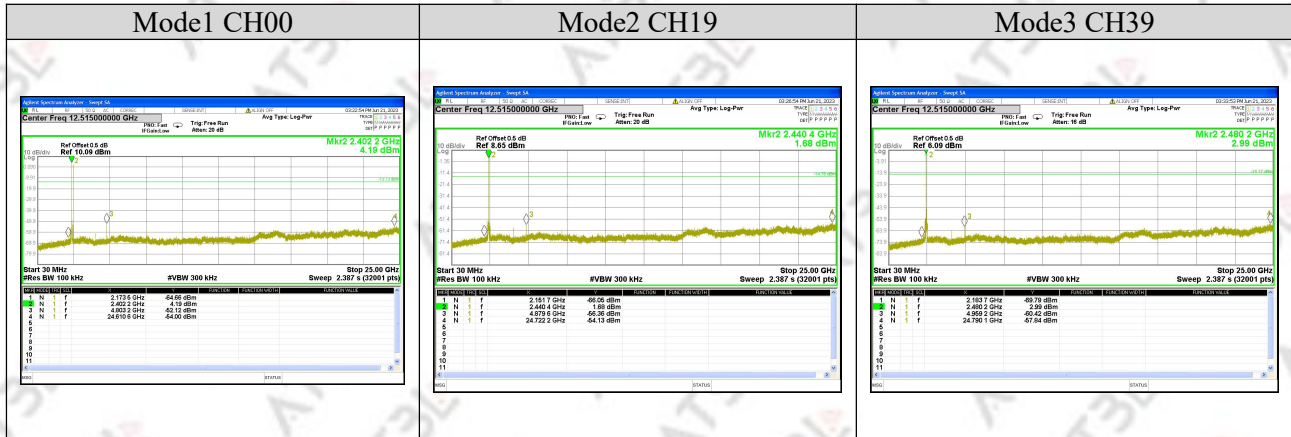
The EUT which is powered by the Battery, is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50 Ohm; the path loss as the factor is calibrated to correct the reading. Make the measurement with the spectrum analyzer's resolution bandwidth(RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

5.4 EUT OPERATION CONDITIONS

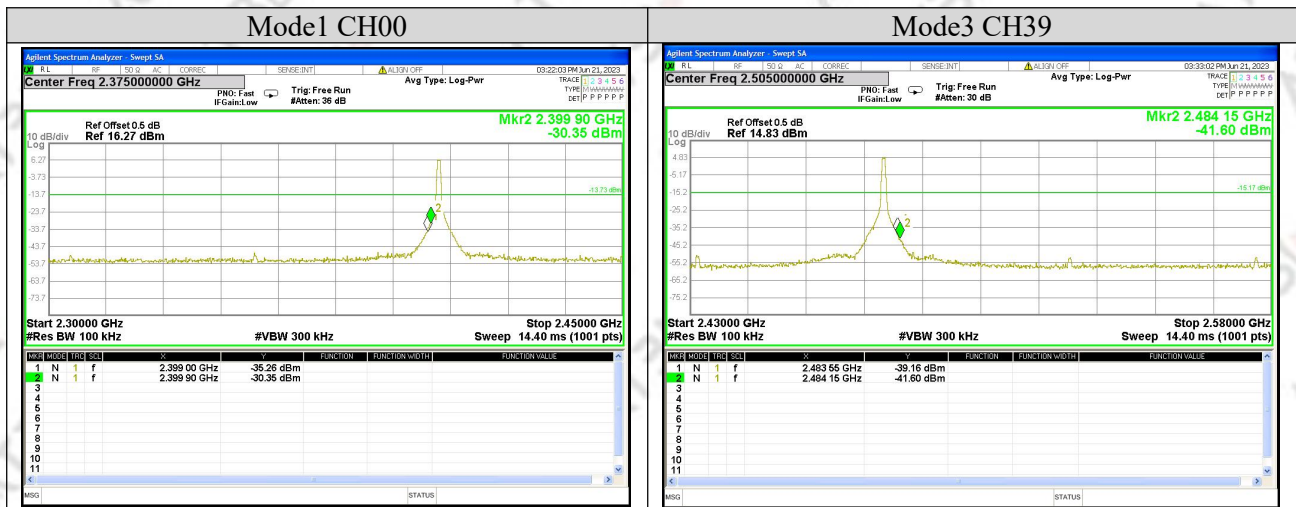
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

5.5 TEST RESULTS

Temperature:	23.4 °C	Relative Humidity:	55%RH
Test Voltage:	DC 5V	Test Mode:	TX Mode 1/2/3



For Band edge(it's also the reference level for conducted spurious emission)



6. POWER SPECTRAL DENSITY TEST

6.1 LIMIT

FCC Part 15.247, Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(e)	Power Spectral Density	$\leq 8\text{dBm}$ ($\text{RBW} \geq 3\text{kHz}$)	2400-2483.5	PASS

6.2 TEST PROCEDURE

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

6.3 TEST SETUP



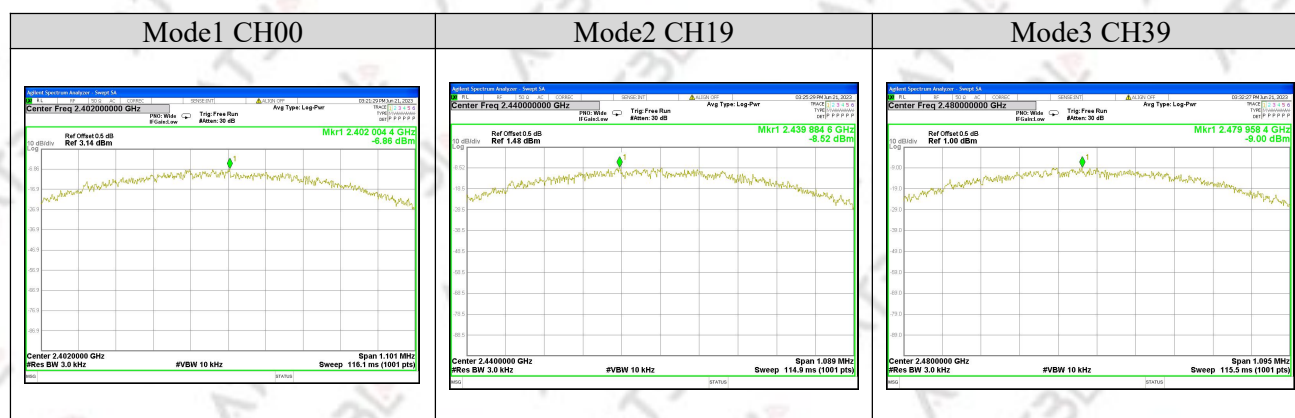
6.4 EUT OPERATION CONDITIONS

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.

6.5 TEST RESULTS

Temperature:	23.4 °C	Relative Humidity:	55%RH
Test Voltage:	DC 5V	Test Mode:	TX Mode1/2/3

Frequency		Power Density	Limit (3kHz/dBm)	Result
		(dBm/3kHz)		
1M bps	2402 MHz	-6.86	≤8	PASS
	2440 MHz	-8.52	≤8	PASS
	2480 MHz	-9.00	≤8	PASS



7. BANDWIDTH TEST

7.1 LIMIT

FCC Part 15.247, Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	$\geq 500\text{kHz}$ (6dB bandwidth)	2400-2483.5	PASS

7.2 TEST PROCEDURE

Connect the UUT to the spectrum analyzer and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	For 6 dB Bandwidth : 100kHz For 99% Bandwidth : 1% to 5% of the occupied bandwidth
VBW	For 6dB Bandwidth : $\geq 3 \times \text{RBW}$ For 99% Bandwidth : approximately $3 \times \text{RBW}$
Trace	Max hold
Sweep	Auto

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB and 99% relative to the maximum level measured in the fundamental emission.

7.3 TEST SETUP



7.4 EUT OPERATION CONDITIONS

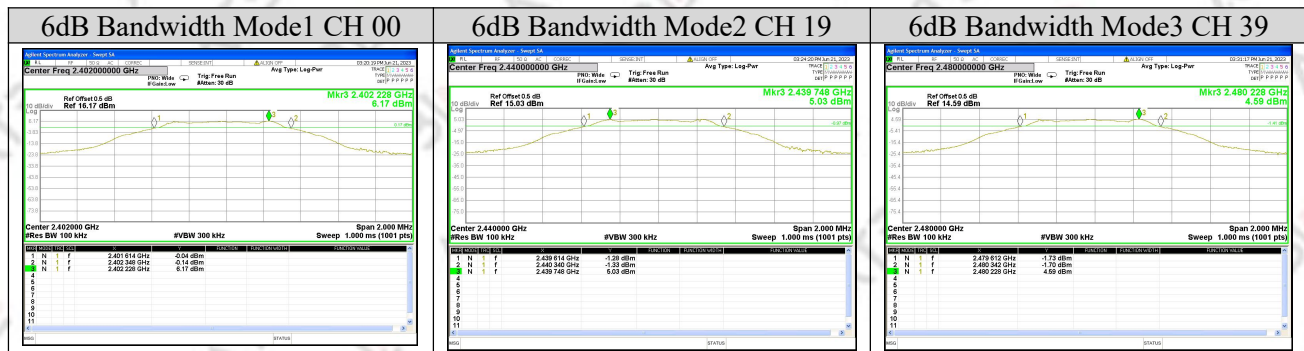
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

7.5 TEST RESULTS

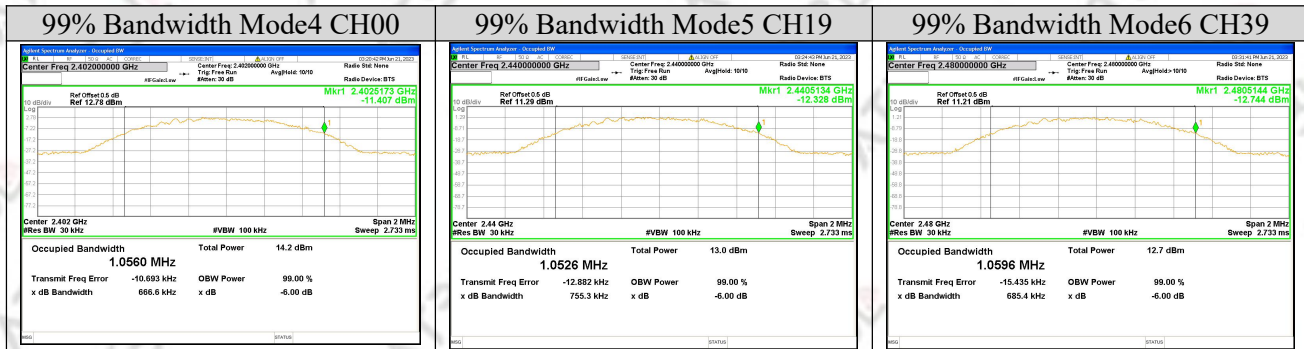
Temperature:	23.4°C	Relative Humidity:	55%RH
Test Voltage:	DC 5V	Test Mode:	TX Mode1/2/3

	Frequency	6dB Bandwidth (kHz)	99% Bandwidth (MHz)	6dB Bandwidth Limit(kHz)	Result
1M bps	2402 MHz	734.0	1.0560	≥500kHz	PASS
	2440 MHz	726.0	1.0526	≥500kHz	PASS
	2480 MHz	730.0	1.0596	≥500kHz	PASS

6dB Bandwidth



99% Bandwidth



8. PEAK OUTPUT POWER TEST

8.1 LIMIT

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

8.2 TEST PROCEDURE

PKPM1 Peak power meter method:

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall use a fast-responding diode detector.

8.3 TEST SETUP



8.4 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.

8.5 TEST RESULTS

Temperature:	23.4 °C	Relative Humidity:	55%RH
Test Voltage:	DC 5V	Test Mode:	TX Mode1/2/3

Test Channel	Frequency	Average Conducted Output Power	Peak Conducted Output Power	LIMIT
	(MHz)	(dBm)	(dBm)	dBm
Mode1 CH00	2402	3.92	4.37	30
Mode2 CH19	2440	3.50	3.86	30
Mode3 CH39	2480	2.57	2.98	30

EIRP Power

Test Channel	Frequency	Peak Conducted Output Power	Antenna Gain	EIRP Power	LIMIT
	(MHz)	(dBm)	(dBi)	(dBm)	dBm
Mode1 CH00	2402	4.37	3.01	7.38	36
Mode2 CH19	2440	3.86	3.01	6.87	36
Mode3 CH39	2480	2.98	3.01	5.99	36

Note: Our power sensor test AVG power has no duty cycle display. The power sensor measures AVG power is Burst power. The software has considered the factor of the duty cycle factor, so it is unnecessary to add it again.

9. ANTENNA REQUIREMENT

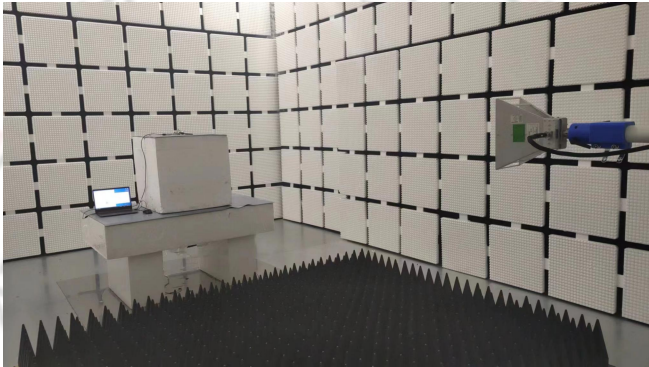
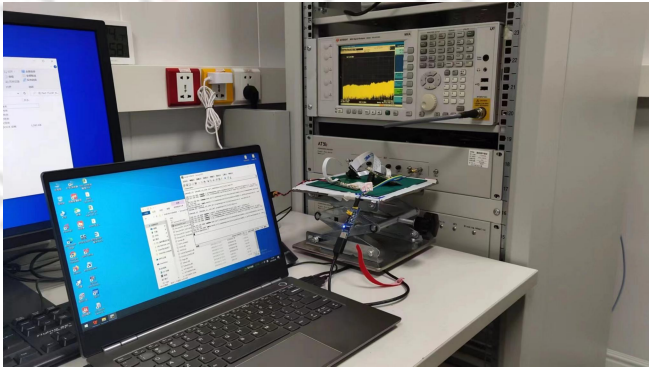
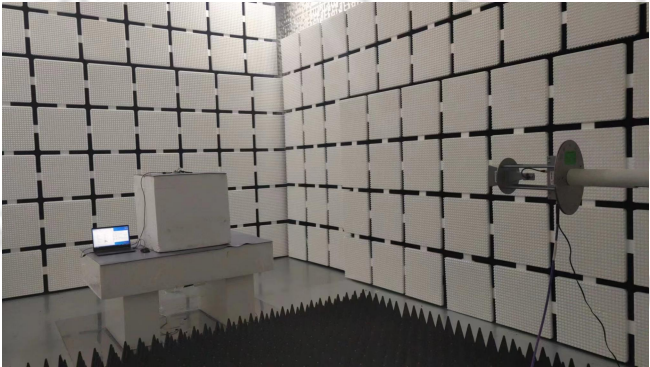
9.1 STANDARD REQUIREMENT

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.

9.2 EUT ANTENNA

The EUT antenna is FPC Antenna. It comply with the standard requirement.

10. APPENDIX- PHOTOS OF TEST SETUP

Radiated Emissions for 30MHz~1GHz 	Radiated Emissions for 1GHz~18GHz 
Radiated Emissions for 9kHz~30MHz 	Conducted for RF 
Radiated Emissions for above 18GHz 	AC Power Line Conducted Emissions 

※※※※END OF THE REPORT※※※※※