FCC TEST REPORT
FCC ID:2BBONYW500TLL331541

Report Number.....:	ZHT-230522037E-1
Date of Test.....	May 22, 2023 to July 26, 2023
Date of issue.....:	July 26, 2023
Test Result .....:	PASS
Testing Laboratory.....:	**Guangdong Zhonghan Testing Technology Co., Ltd.**
Address .....:	Room 104, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Applicant's name .....:	**Shenzhen ONEJ Technology Co., Ltd.**
Address .....:	B309, Huiju Xinqiao 107, Chuangzhi Park, Xinqiao Street, Baoan District, Shenzhen
Manufacturer's name .....:	**Shenzhen ONEJ Technology Co., Ltd.**
Address .....:	B309, Huiju Xinqiao 107, Chuangzhi Park, Xinqiao Street, Baoan District, Shenzhen
Test specification:	
Standard.....:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Test procedure.....:	KDB558074 D01 15.247 Meas Guidance v05r02 ANSI C63.10:2013
Non-standard test method .....:	N/A

This device described above has been tested by ZHT, 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.
This report shall not be reproduced except in full, without the written approval of ZHT, this document may be altered or revised by ZHT, personal only, and shall be noted in the revision of the document.

Product name.....:	Window Cleaning Robot
Trademark .....:	/
Model/Type reference.....:	YW500 TLL331541, YW203, YW200, YW201, YW202, YW204, YW205, YW206, YW207, YW208, YW209, YW300, YW301, YW302, YW303, YW304, YW305, YW306, YW307, YW308, YW309, YW310, YW501, YW502, YW503, YW504, YW505, YW506, YW507, YW508, YW509, YW600, YW601, YW602, YW603, YW604, YW605, YW606, YW607, YW608, YW609, YW700, YW701, YW702, YW703, YW704, YW705, YW706, YW707, YW708, YW709
Ratings.....:	Input: 100-240V~50/60Hz 1.5A, Max Output: 24.0V⎓3.0A 72W

Testing procedure and testing location:

Testing Laboratory.....:	**Guangdong Zhonghan Testing Technology Co., Ltd.**
Address.....:	Room 104, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Tested by (name + signature).....:	Leon Li
Reviewer (name + signature).....:	Baret Wu
Approved (name + signature).....:	Levi Lee

Table of Contents **Page**

1.VERSION **5**

2. SUMMARY OF TEST RESULTS **6**

2.1 TEST FACILITY 7

2.2 MEASUREMENT UNCERTAINTY 7

3. GENERAL INFORMATION **8**

3.1 GENERAL DESCRIPTION OF EUT 8

3.2 DESCRIPTION OF TEST MODES 9

3.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED 9

3.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE) 10

3.5 EQUIPMENTS LIST FOR ALL TEST ITEMS 11

4. EMC EMISSION TEST **13**

4.1 CONDUCTED EMISSION MEASUREMENT 13

4.1.1 POWER LINE CONDUCTED EMISSION Limits 13

4.1.2 TEST PROCEDURE 13

4.1.3 DEVIATION FROM TEST STANDARD 13

4.1.4 TEST SETUP 14

4.1.5 EUT OPERATING CONDITIONS 14

4.1.6 TEST RESULTS 15

4.2 RADIATED EMISSION MEASUREMENT 17

4.2.1 RADIATED EMISSION LIMITS 17

4.2.2 TEST PROCEDURE 18

4.2.3 DEVIATION FROM TEST STANDARD 18

4.2.4 TEST SETUP 18

4.2.5 EUT OPERATING CONDITIONS 19

5.RADIATED BAND EMISSION MEASUREMENT **28**

5.1 TEST REQUIREMENT: 28

5.2 TEST PROCEDURE 28

5.3 DEVIATION FROM TEST STANDARD 28

5.4 TEST SETUP 29

5.5 EUT OPERATING CONDITIONS 29

5.6 TEST RESULT 30

6.POWER SPECTRAL DENSITY TEST **34**

6.1 APPLIED PROCEDURES / LIMIT 34

6.2 TEST PROCEDURE 34

6.3 DEVIATION FROM STANDARD 34

6.4 TEST SETUP 34

Table of Contents **Page**

6.5 EUT OPERATION CONDITIONS 34
6.6 TEST RESULTS 35

7. CHANNEL BANDWIDTH 37
7.1 APPLIED PROCEDURES / LIMIT 37
7.2 TEST PROCEDURE 37
7.3 DEVIATION FROM STANDARD 37
7.4 TEST SETUP 37
7.5 EUT OPERATION CONDITIONS 37
7.6 TEST RESULTS 38

8.PEAK OUTPUT POWER TEST 40
8.1 APPLIED PROCEDURES / LIMIT 40
8.2 TEST PROCEDURE 40
8.3 DEVIATION FROM STANDARD 40
8.4 TEST SETUP 40
8.5 EUT OPERATION CONDITIONS 40
8.6 TEST RESULTS 41

9. CONDUCTED BAND EDGE AND SPURIOUS EMISSION 42
9.1 APPLICABLE STANDARD 42
9.2 TEST PROCEDURE 42
9.3 DEVIATION FROM STANDARD 42
9.4 TEST SETUP 42
9.5 EUT OPERATION CONDITIONS 42

10.ANTENNA REQUIREMENT 46

11. TEST SETUP PHOTOS 47

12. EUT CONSTRUCTIONAL DETAILS 47

1.VERSION

Report No.	Version	Description	Approved
ZHT-230522037E-1	Rev.01	Initial issue of report	July 26, 2023

2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15 (15.247) , Subpart C			
Standard Section	Test Item	Judgment	Remark
FCC part 15.203/15.247 (b)(4)	Antenna requirement	PASS	
FCC part 15.207	AC Power Line Conducted Emission	PASS	
FCC part 15.247 (b)(3)	Conducted Peak Output Power	PASS	
FCC part 15.247 (a)(2)	Channel Bandwidth& 99% OCB	PASS	
FCC part 15.247 (e)	Power Spectral Density	PASS	
FCC part 15.247(d)	Band Edge	PASS	
FCC part 15.205/15.209	Spurious Emission	PASS	

NOTE:

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

2.1 TEST FACILITY

Guangdong Zhonghan Testing Technology Co., Ltd.
Add. : Room 104, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

FCC Registration Number:255941
Designation Number: CN0325
IC Registered No.: 29832
CAB identifier: CN0143

2.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ± U · where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2 · providing a level of confidence of approximately 95 %。

No.	Item	Uncertainty
1	Conducted Emission Test	±1.38dB
2	RF power conducted	±0.16dB
3	Spurious emissions conducted	±0.21dB
4	All emissions radiated(9k-30MHz)	±4.68dB
5	All emissions radiated(<1G)	±4.68dB
6	All emissions radiated(>1G)	±4.89dB
7	Temperature	±0.5°C
8	Humidity	±2%
9	Occupied Bandwidth	±4.96dB

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Product Name:	Window Cleaning Robot
Model No.:	YW500 TLL331541, YW203, YW200, YW201, YW202, YW204, YW205, YW206, YW207, YW208, YW209, YW300, YW301, YW302, YW303, YW304, YW305, YW306, YW307, YW308, YW309, YW310, YW501, YW502, YW503, YW504, YW505, YW506, YW507, YW508, YW509, YW600, YW601, YW602, YW603, YW604, YW605, YW606, YW607, YW608, YW609, YW700, YW701, YW702, YW703, YW704, YW705, YW706, YW707, YW708, YW709
Model Different:	All models use the same circuit and RF module, and the only difference is the model name. The model YW500 is the tested sample.
Hardware Version:	V1.0
Software Version:	V1.0
Sample(s) Status:	Engineer sample
Operation Frequency:	2402MHz~2480MHz
Channel Numbers:	40
Channel Separation:	2MHz
Modulation Type:	GFSK
Antenna Type:	PCB Antenna
Antenna gain:	2.5dBi
Power supply:	Input: 100-240V~50/60Hz 1.5A, Max Output: 24.0V⎓3.0A 72W

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402 MHz	11	2422 MHz	21	2442 MHz	31	2462 MHz
2	2404 MHz	12	2424 MHz	22	2444 MHz	32	2464 MHz
3	2406 MHz	13	2426 MHz	23	2446 MHz	33	2466 MHz
4	2408 MHz	14	2428 MHz	24	2448 MHz	34	2468 MHz
5	2410 MHz	15	2430 MHz	25	2450 MHz	35	2470 MHz
6	2412 MHz	16	2432 MHz	26	2452 MHz	36	2472 MHz
7	2414 MHz	17	2434 MHz	27	2454 MHz	37	2474 MHz
8	2416 MHz	18	2436 MHz	28	2456 MHz	38	2476 MHz
9	2418 MHz	19	2438 MHz	29	2458 MHz	39	2478 MHz
10	2420 MHz	20	2440 MHz	30	2460 MHz	40	2480 MHz

Note:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2402MHz
The middle channel	2440MHz
The Highest channel	2480MHz

3.2 DESCRIPTION OF TEST MODES

Transmitting mode	Keep the EUT in continuously transmitting mode
Remark: EUT use new battery during the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.	

3.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Emission

Adapter → EUT

Conducted Spurious

Adapter → EUT

3.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Window Cleaning Robot	N/A	YW500	N/A	EUT
E-2	Adapter	N/A	BZ065-240300-E2	N/A	EUT

Item	Shielded Type	Ferrite Core	Length	Note

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.

3.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation Test equipment

Item	Equipment	Manufacturer	Model	Last Cal.	Next Cal.
1	Receiver	R&S	ESCI	Mar 12, 2023	Mar 11, 2024
2	Loop antenna	EMCI	LAP600	Mar 12, 2023	Mar 11, 2024
3	Amplifier	Schwarzbeck	BBV 9743 B	Mar 12, 2023	Mar 11, 2024
4	Amplifier	Schwarzbeck	BBV 9718 B	Mar 12, 2023	Mar 11, 2024
5	Bilog Antenna	Schwarzbeck	VULB9162	Mar 17, 2023	Mar 16, 2024
6	Horn Antenna	Schwarzbeck	BBHA9120D	Mar 17, 2023	Mar 16, 2024
7	Horn Antenna	A.H.SYSTEMS	SAS574	Mar 12, 2023	Mar 11, 2024
8	Amplifier	AEROFLEX	100KHz-40GHz	Mar 12, 2023	Mar 11, 2024
9	Spectrum Analyzer	R&S	FSV40	Mar 12, 2023	Mar 11, 2024
10	CDNE	Schwarzbeck	CDNE M2 + CDNE M3	Aug. 09, 2022	Aug. 08, 2023
11	966 Anechoic Chamber	EMToni	9m6m6m	Nov. 25, 2021	Nov. 24, 2024
12	Spectrum Analyzer	KEYSIGHT	N9020A	Mar 12, 2023	Mar 11, 2024
13	WIDBAND RADIO COMMUNICATI ON TESTER	R&S	CMW500	Mar 12, 2023	Mar 11, 2024
14	Single Generator	Agilent	N5182A	Mar 12, 2023	Mar 11, 2024
15	Power Sensor	MWRFtest	MW100-RFCB	Mar 12, 2023	Mar 11, 2024
16	Audio analyzer	R&S	UPL	Mar 12, 2023	Mar 11, 2024
17	Single Generator	R&S	SMB100A	Mar 12, 2023	Mar 11, 2024
18	Power Amplifier Shielding Room	EMToni	2m3m3m	Nov. 25, 2021	Nov. 24, 2024

Conduction Test equipment

Equipment	Manufacturer	Model	Last Cal.	Next Cal.
Receiver	R&S	ESCI	Mar 12, 2023	Mar 11, 2024
LISN	R&S	ENV216	Mar 12, 2023	Mar 11, 2024
ISN CAT 6	Schwarzbeck	NTFM 8158	Mar 12, 2023	Mar 11, 2024
ISN CAT 5	Schwarzbeck	CAT5 8158	Mar 12, 2023	Mar 11, 2024
Capacitive Voltage Probe	Schwarzbeck	CVP 9222 C	Mar 12, 2023	Mar 11, 2024
Current Transformer Clamp	Schwarzbeck	SW 9605	Mar 12, 2023	Mar 11, 2024
CE Shielding Room	EMToni	9m4m3m	Nov. 25, 2021	Nov. 24, 2024

4. EMC EMISSION TEST

4.1 CONDUCTED EMISSION MEASUREMENT

Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.10:2013
Test Frequency Range:	150KHz to 30MHz
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto

4.1.1 POWER LINE CONDUCTED EMISSION Limits

FREQUENCY (MHz)	Limit (dBuV)		Standard
	QP	AVG	
0.15 -0.5	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	56.00	46.00	FCC
5.0 -30.0	60.00	50.00	FCC

Note:

(1) *Decreases with the logarithm of the frequency.

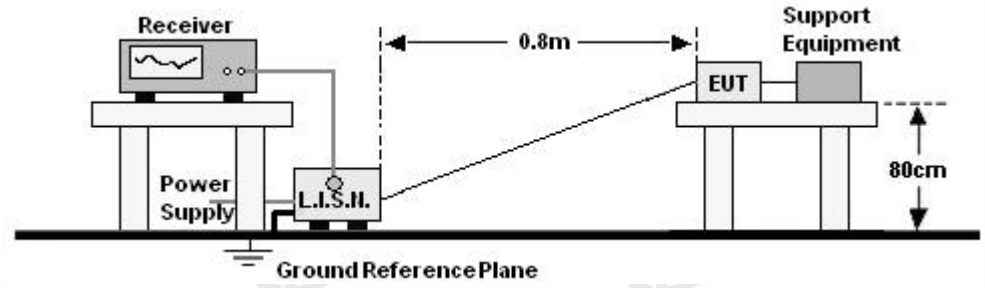
4.1.2 TEST PROCEDURE

a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.1.3 DEVIATION FROM TEST STANDARD

No deviation

4.1.4 TEST SETUP

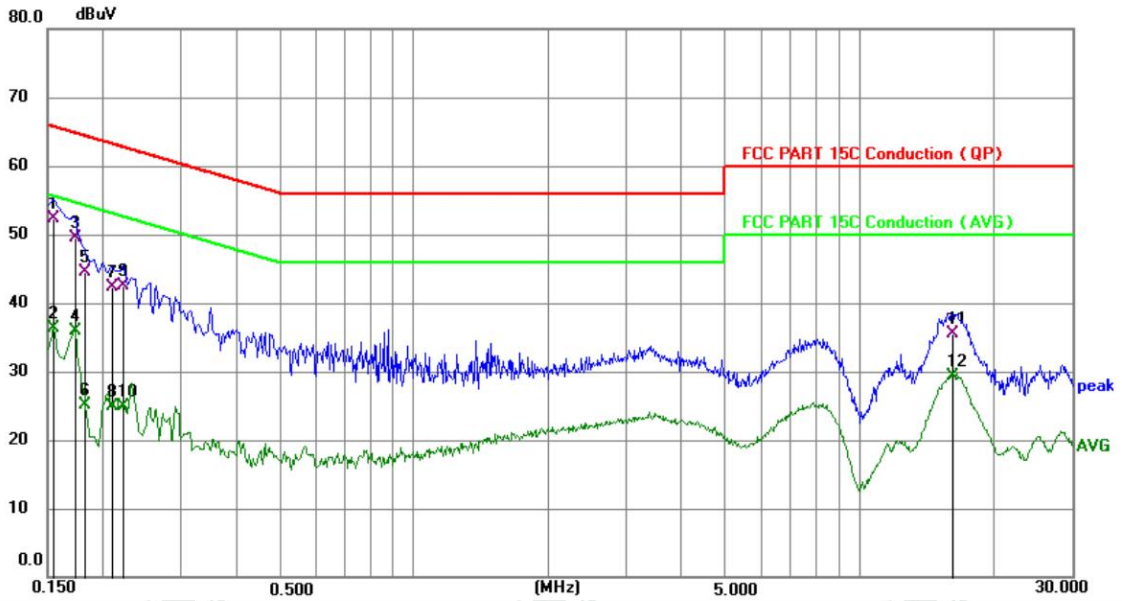


4.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

4.1.6 TEST RESULTS

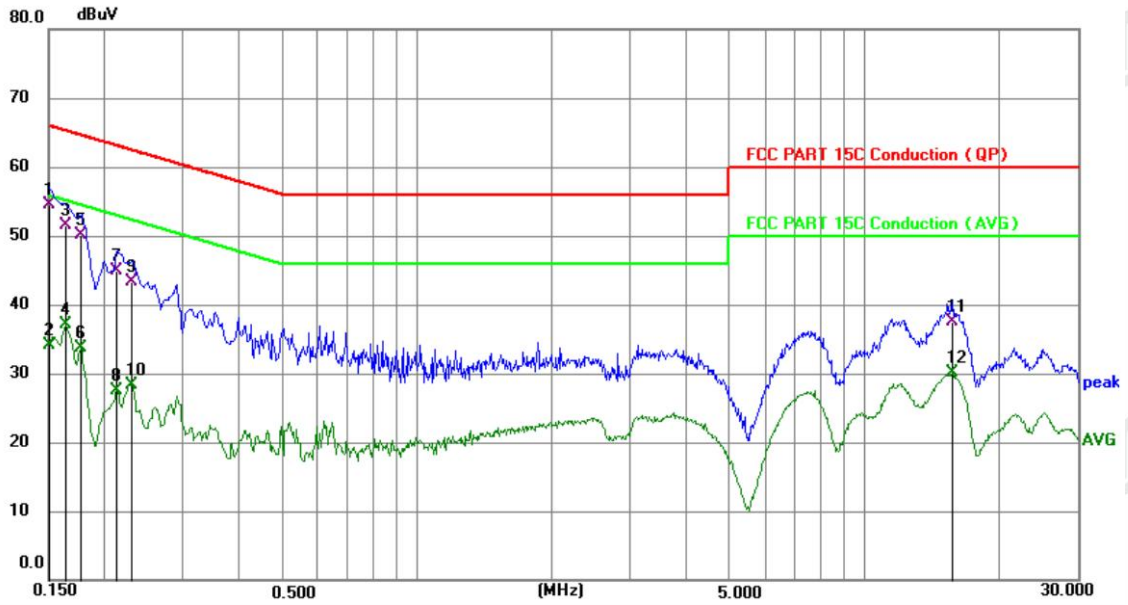
Temperature:	25.1℃	Relative Humidity :	50%
Pressure:	101kPa	Phase :	L
Test Voltage:	AC 120V/60Hz		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1 *	0.1544	42.41	9.89	52.30	65.76	-13.46	QP	P
2	0.1544	26.50	9.89	36.39	55.76	-19.37	AVG	P
3	0.1724	39.68	9.90	49.58	64.84	-15.26	QP	P
4	0.1724	26.10	9.90	36.00	54.84	-18.84	AVG	P
5	0.1824	34.51	9.90	44.41	64.38	-19.97	QP	P
6	0.1824	15.27	9.90	25.17	54.38	-29.21	AVG	P
7	0.2084	32.42	9.91	42.33	63.27	-20.94	QP	P
8	0.2084	14.92	9.91	24.83	53.27	-28.44	AVG	P
9	0.2220	32.53	9.92	42.45	62.74	-20.29	QP	P
10	0.2220	15.08	9.92	25.00	52.74	-27.74	AVG	P
11	16.2240	25.47	10.10	35.57	60.00	-24.43	QP	P
12	16.2240	19.19	10.10	29.29	50.00	-20.71	AVG	P

Notes:
1.An initial pre-scan was performed on the line and neutral lines with peak detector.
2.Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3.Mesurement Level = Reading level + Correct Factor

Temperature:	25.1℃	Relative Humidity :	50%
Pressure:	101kPa	Phase :	N
Test Voltage:	AC 120V/60Hz		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1 *	0.1500	44.56	9.89	54.45	66.00	-11.55	QP	P
2	0.1500	24.29	9.89	34.18	56.00	-21.82	AVG	P
3	0.1635	41.67	9.90	51.57	65.28	-13.71	QP	P
4	0.1635	27.23	9.90	37.13	55.28	-18.15	AVG	P
5	0.1770	40.12	9.90	50.02	64.63	-14.61	QP	P
6	0.1770	23.87	9.90	33.77	54.63	-20.86	AVG	P
7	0.2130	34.92	9.92	44.84	63.09	-18.25	QP	P
8	0.2130	17.58	9.92	27.50	53.09	-25.59	AVG	P
9	0.2310	33.36	9.92	43.28	62.41	-19.13	QP	P
10	0.2310	18.43	9.92	28.35	52.41	-24.06	AVG	P
11	15.7784	27.48	10.10	37.58	60.00	-22.42	QP	P
12	15.7784	20.02	10.10	30.12	50.00	-19.88	AVG	P

Notes:
1.An initial pre-scan was performed on the line and neutral lines with peak detector.
2.Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3.Mesurement Level = Reading level + Correct Factor

4.2 RADIATED EMISSION MEASUREMENT

Test Requirement:	FCC Part15 C Section 15.209
Test Method:	ANSI C63.10:2013
Test Frequency Range:	9kHz to 25GHz
Test site:	Measurement Distance: 3m
Receiver setup:	

Frequency	Detector	RBW	VBW	Value
9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

4.2.1 RADIATED EMISSION LIMITS

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

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

(2) The tighter limit applies at the band edges.

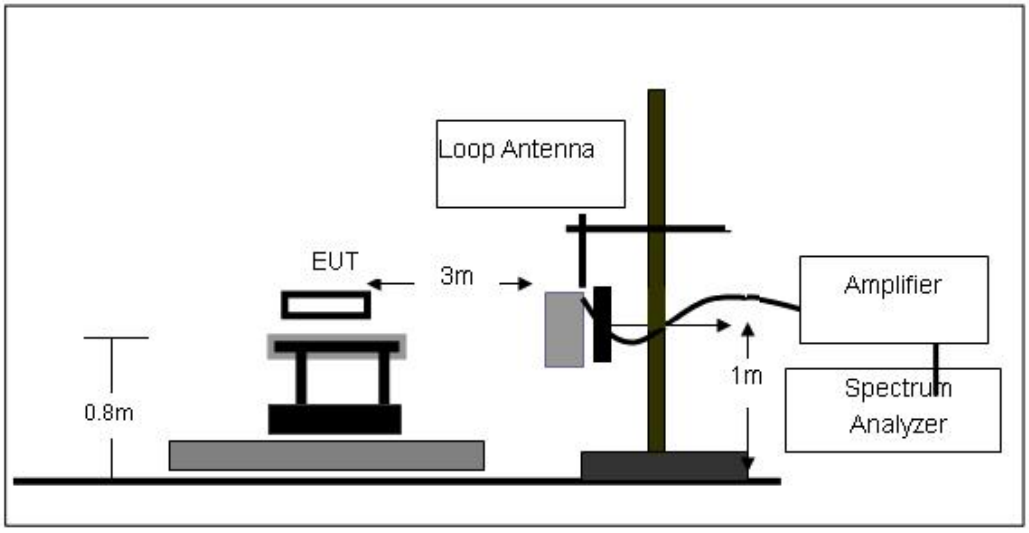
(3) Emission level (dBuV/m)=20log Emission level (uV/m).

4.2.2 TEST PROCEDURE

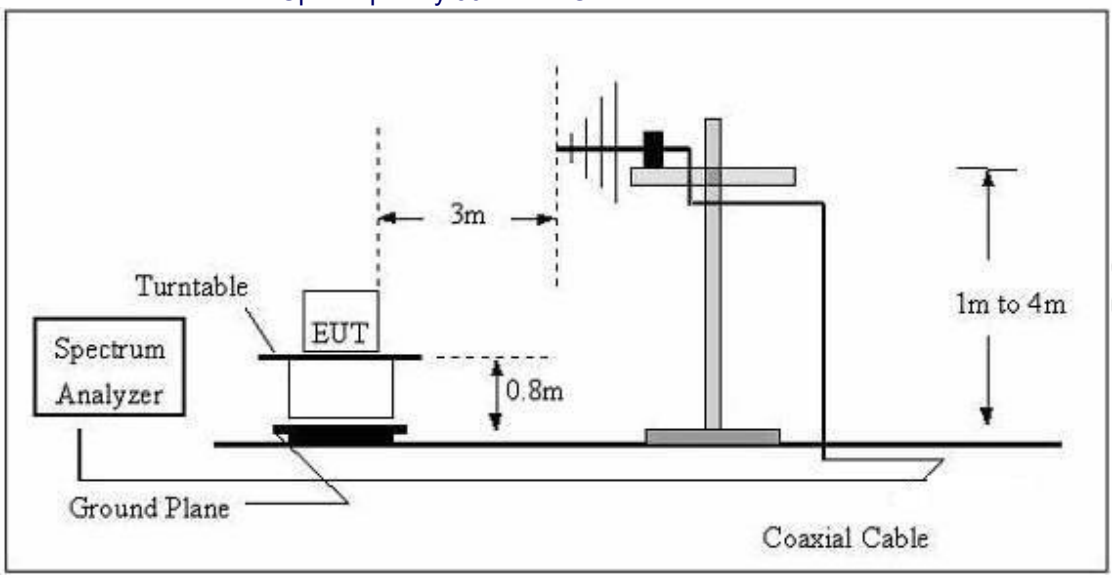
a. The measuring distance of at 3 m shall be used for measurements at frequency up to 25GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-chamber test. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment or of the substitution antenna shall be 0.8m; above 1GHz, the height was 1.5m, the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. 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.
e. 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.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.
g. For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.
The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
Note:
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

4.2.3 DEVIATION FROM TEST STANDARD
No deviation

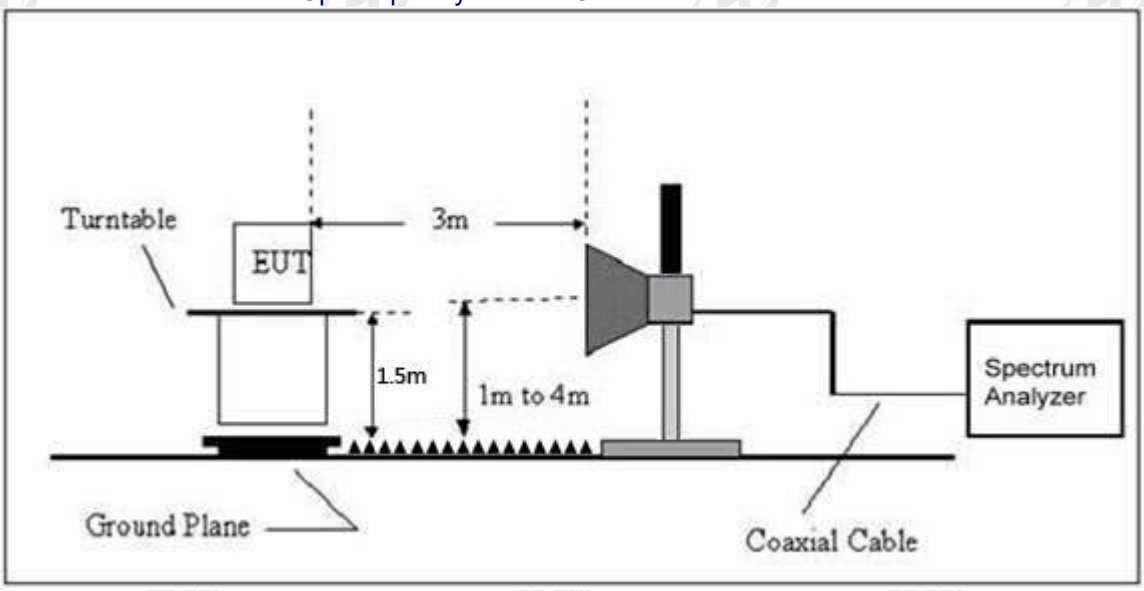
4.2.4 TEST SETUP
（A）Radiated Emission Test-Up Frequency Below 30MHz



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



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



4.2.5 EUT OPERATING CONDITIONS

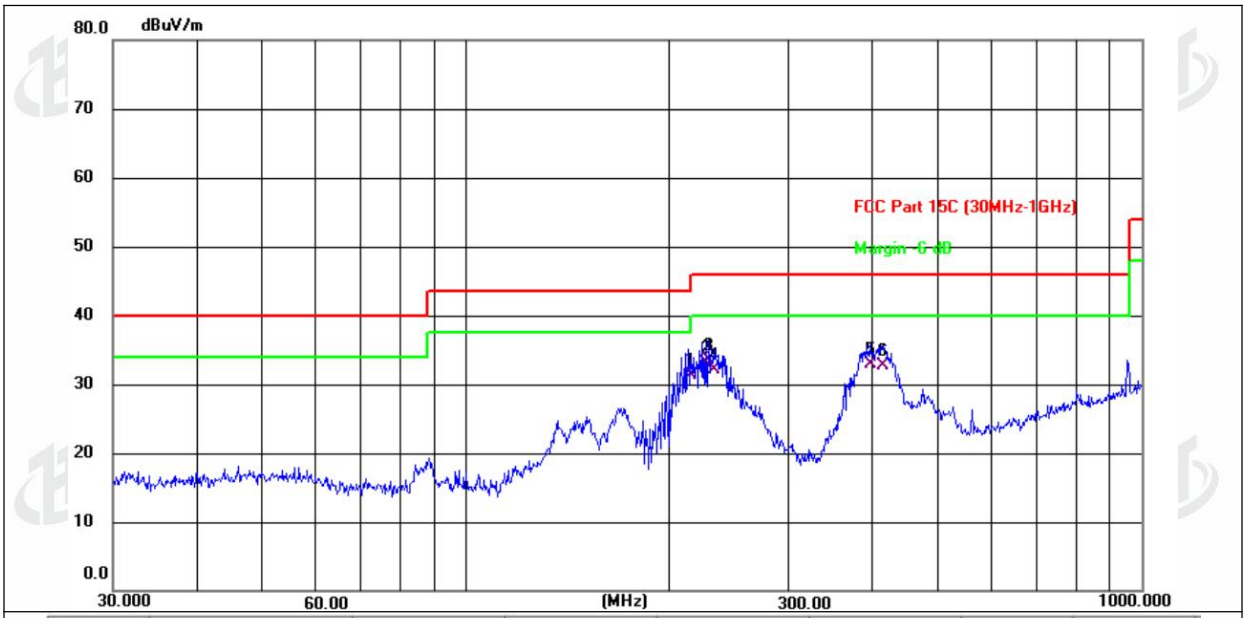
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

4.2.6 TEST RESULTS (Between 9KHz – 30 MHz)

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and according to 15.31(o) & RSS-Gen 6.13, the test result no need to reported.

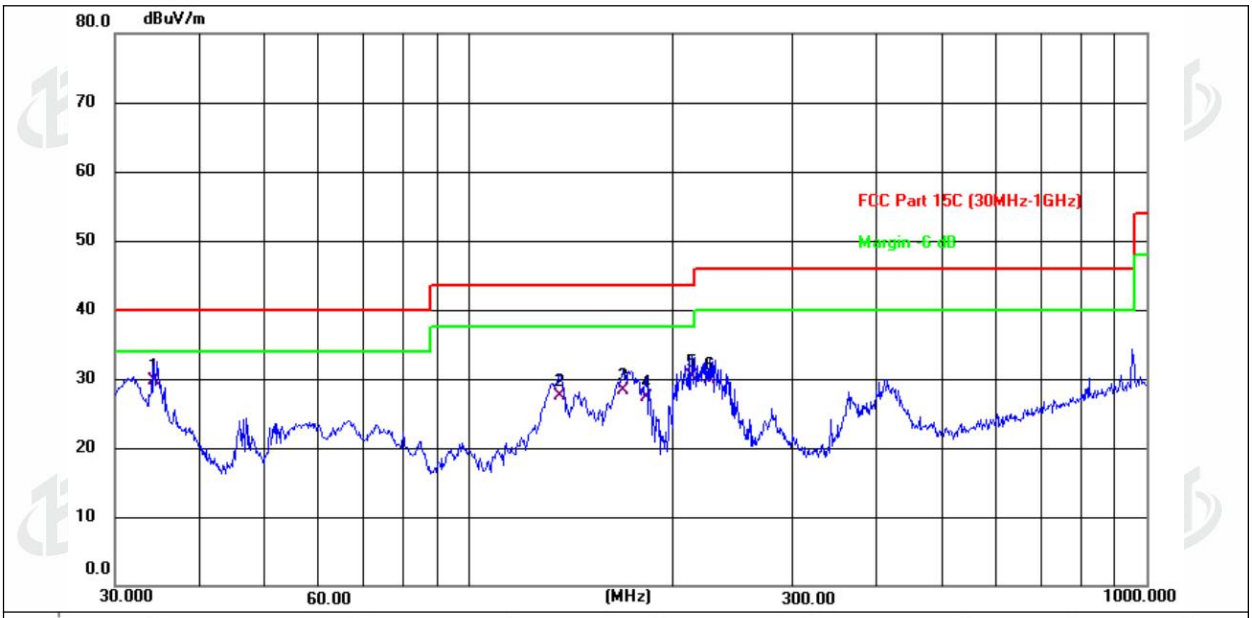
Between 30MHz – 1GHz

Temperature:	25.6℃	Relative Humidity:	47%
Pressure:	101 kPa	Polarization:	Horizontal
Test Voltage:	AC 120 V/60 Hz		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	215.2678	41.27	-9.92	31.35	43.50	-12.15	QP
2	226.0994	42.77	-9.59	33.18	46.00	-12.82	QP
3	228.4904	42.97	-9.52	33.45	46.00	-12.55	QP
4	233.3486	41.38	-9.37	32.01	46.00	-13.99	QP
5	396.2415	38.88	-5.93	32.95	46.00	-13.05	QP
6	414.7223	38.20	-5.58	32.62	46.00	-13.38	QP

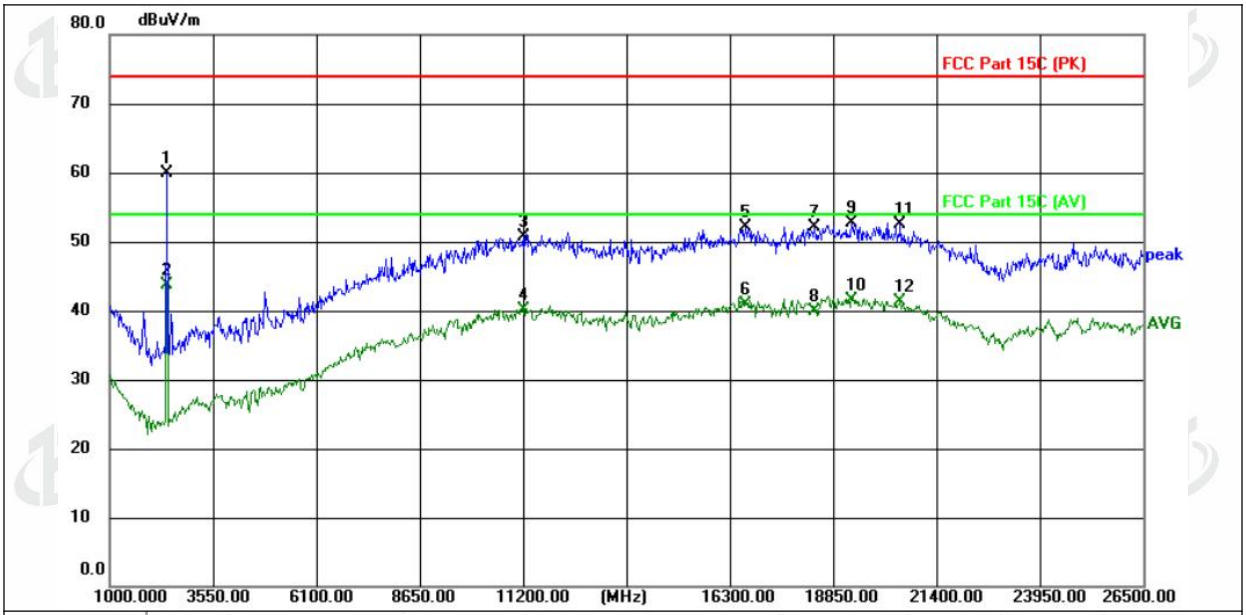
Temperature:	25.6℃	Relative Humidity:	47%
Pressure:	101kPa	Polarization:	Vertical
Test Voltage:	AC 120 V/60 Hz		



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	34.2760	39.65	-9.98	29.67	40.00	-10.33	QP
2	135.9821	40.79	-13.33	27.46	43.50	-16.04	QP
3	169.0053	40.93	-12.72	28.21	43.50	-15.29	QP
4	182.5592	39.22	-11.83	27.39	43.50	-16.11	QP
5	213.0151	40.39	-9.99	30.40	43.50	-13.10	QP
6	226.0994	39.50	-9.59	29.91	46.00	-16.09	QP

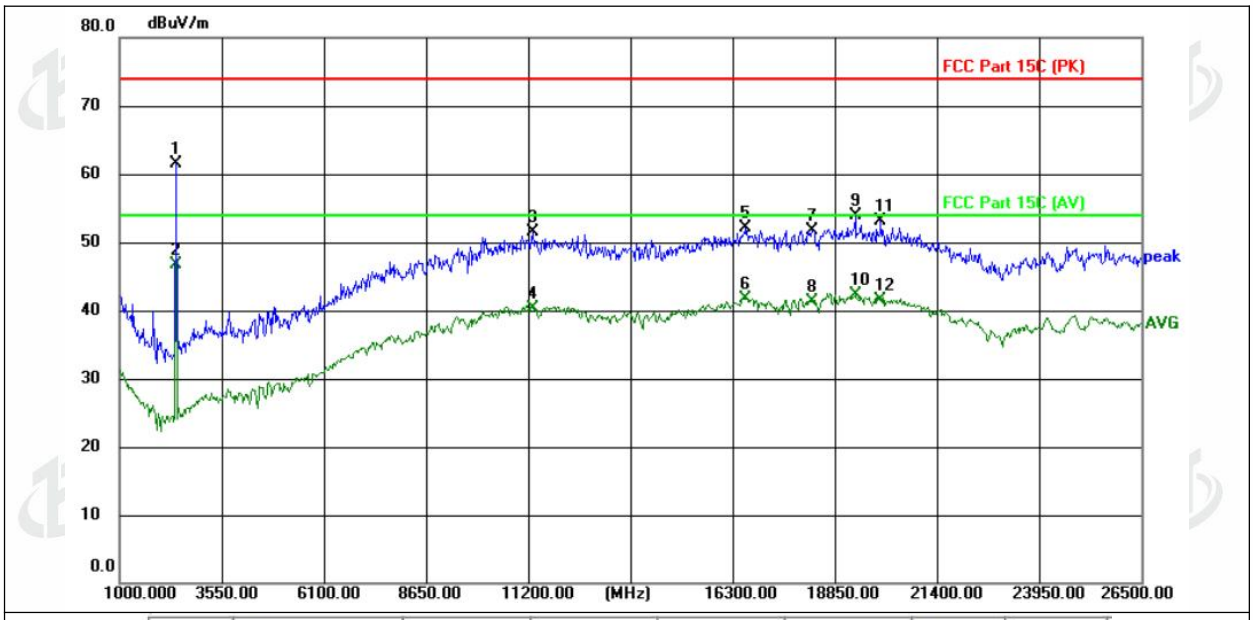
Remarks:
1.Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2.The emission levels of other frequencies are very lower than the limit and not show in test report.

Temperature :	25.1℃	Relative Humidity :	50%
Pressure :	101kPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz	Test Mode:	TX GFSK Mode 2402MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2402.500	64.30	-4.43	59.87	74.00	-14.13	peak
2 *	2402.500	48.14	-4.43	43.71	54.00	-10.29	AVG
3	11200.000	35.75	15.04	50.79	74.00	-23.21	peak
4	11200.000	25.02	15.04	40.06	54.00	-13.94	AVG
5	16682.500	35.41	16.78	52.19	74.00	-21.81	peak
6	16682.500	24.21	16.78	40.99	54.00	-13.01	AVG
7	18391.000	42.11	10.04	52.15	74.00	-21.85	peak
8	18391.000	29.91	10.04	39.95	54.00	-14.05	AVG
9	19309.000	42.26	10.46	52.72	74.00	-21.28	peak
10	19309.000	31.08	10.46	41.54	54.00	-12.46	AVG
11	20507.500	41.60	11.00	52.60	74.00	-21.40	peak
12	20507.500	30.32	11.00	41.32	54.00	-12.68	AVG

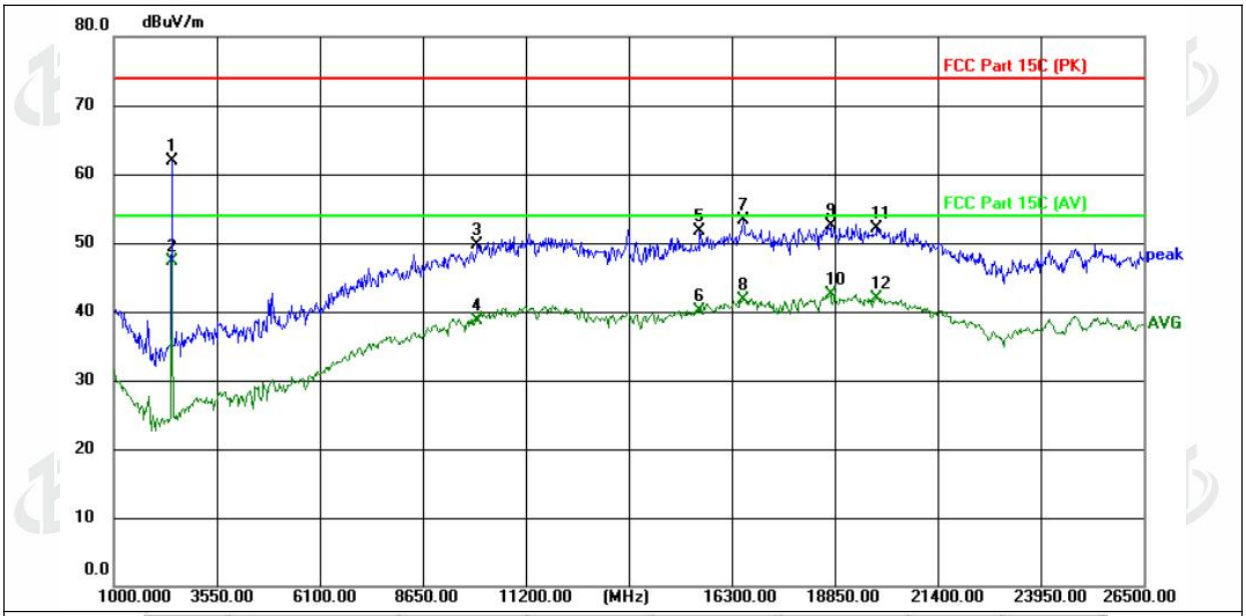
Temperature :	25.1℃	Relative Humidity :	50%
Pressure :	101kPa	Polarization :	Vertical
Test Voltage :	AC 120V/60Hz	Test Mode:	TX GFSK Mode 2402MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2402.500	65.87	-4.43	61.44	74.00	-12.56	peak
2 *	2402.500	51.11	-4.43	46.68	54.00	-7.32	AVG
3	11327.500	36.29	15.22	51.51	74.00	-22.49	peak
4	11327.500	25.01	15.22	40.23	54.00	-13.77	AVG
5	16631.500	35.40	16.71	52.11	74.00	-21.89	peak
6	16631.500	24.92	16.71	41.63	54.00	-12.37	AVG
7	18289.000	41.80	9.99	51.79	74.00	-22.21	peak
8	18289.000	31.41	9.99	41.40	54.00	-12.60	AVG
9	19360.000	43.35	10.48	53.83	74.00	-20.17	peak
10	19360.000	31.87	10.48	42.35	54.00	-11.65	AVG
11	19997.500	42.27	10.77	53.04	74.00	-20.96	peak
12	19997.500	30.69	10.77	41.46	54.00	-12.54	AVG

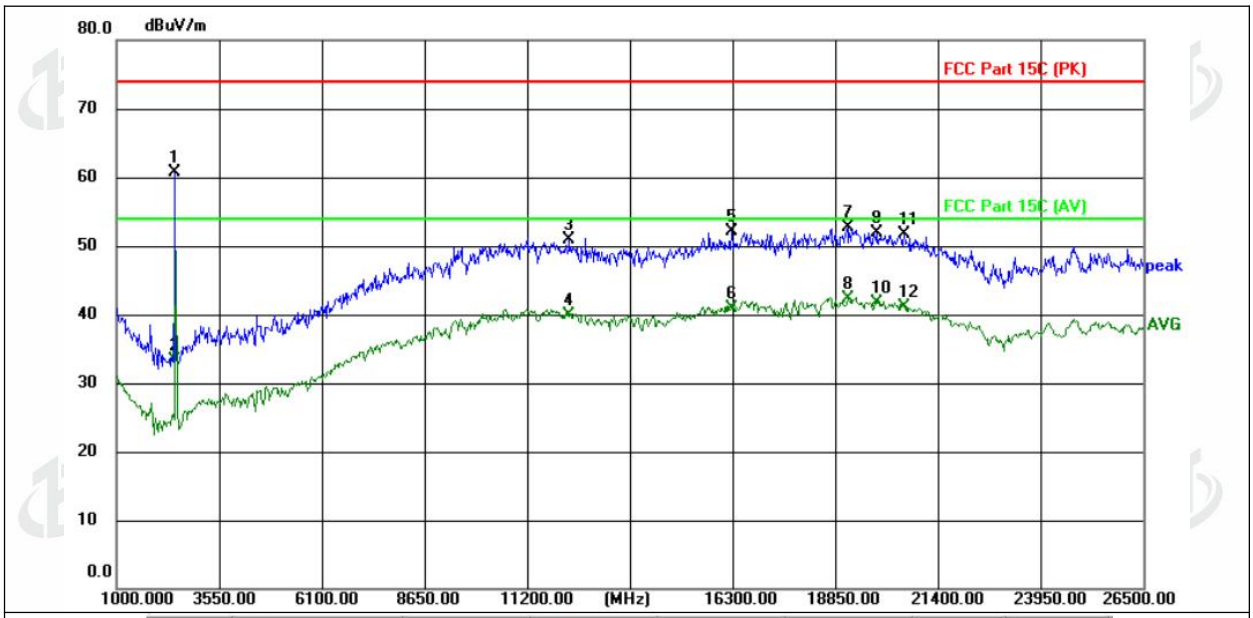
Remarks:
1.Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2.The emission levels of other frequencies are very lower than the limit and not show in test report.

Temperature :	25.1℃	Relative Humidity :	50%
Pressure :	101kPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz	Test Mode:	TX GFSK Mode 2440MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2428.000	66.36	-4.36	62.00	74.00	-12.00	peak
2 *	2428.000	51.73	-4.36	47.37	54.00	-6.63	AVG
3	10001.500	36.36	13.34	49.70	74.00	-24.30	peak
4	10001.500	25.41	13.34	38.75	54.00	-15.25	AVG
5	15509.500	36.67	15.02	51.69	74.00	-22.31	peak
6	15509.500	25.13	15.02	40.15	54.00	-13.85	AVG
7	16580.500	36.61	16.63	53.24	74.00	-20.76	peak
8	16580.500	25.09	16.63	41.72	54.00	-12.28	AVG
9	18748.000	42.32	10.20	52.52	74.00	-21.48	peak
10	18748.000	32.25	10.20	42.45	54.00	-11.55	AVG
11	19895.500	41.38	10.73	52.11	74.00	-21.89	peak
12	19895.500	31.08	10.73	41.81	54.00	-12.19	AVG

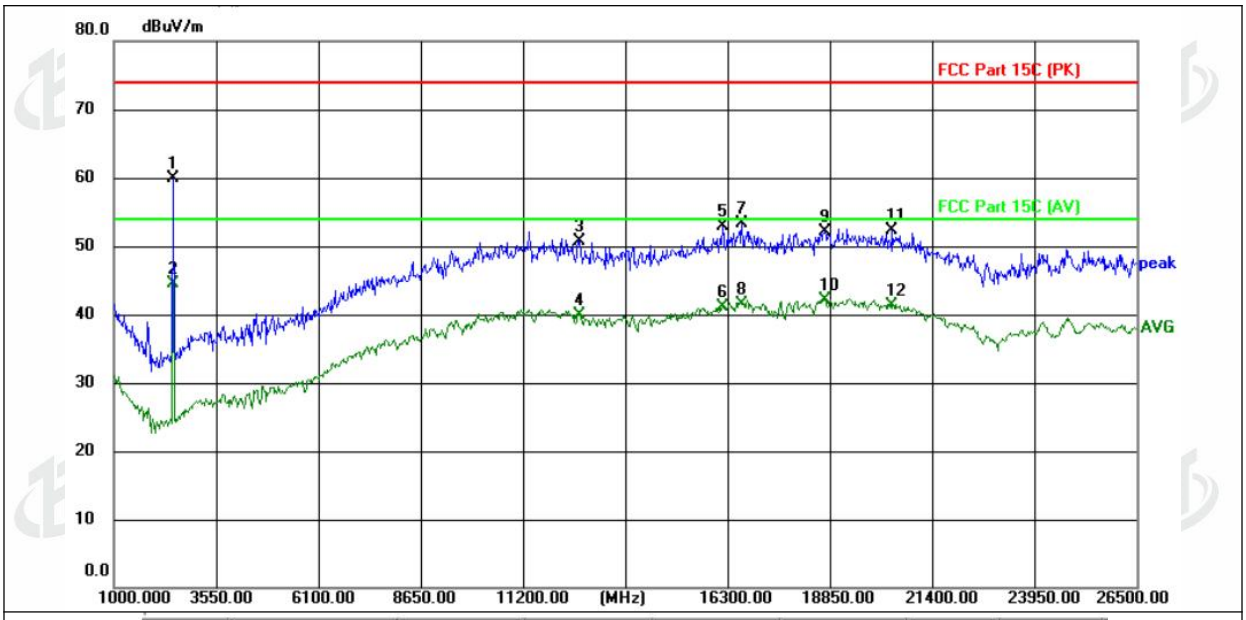
Temperature :	25.1℃	Relative Humidity :	50%
Pressure :	101kPa	Polarization :	Vertical
Test Voltage :	AC 120V/60Hz	Test Mode:	TX GFSK Mode 2440MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2453.500	64.91	-4.30	60.61	74.00	-13.39	peak
2	2453.500	37.65	-4.30	33.35	54.00	-20.65	AVG
3	12245.500	34.55	16.35	50.90	74.00	-23.10	peak
4	12245.500	23.48	16.35	39.83	54.00	-14.17	AVG
5	16274.500	35.92	16.17	52.09	74.00	-21.91	peak
6	16274.500	24.76	16.17	40.93	54.00	-13.07	AVG
7	19156.000	42.24	10.39	52.63	74.00	-21.37	peak
8 *	19156.000	31.85	10.39	42.24	54.00	-11.76	AVG
9	19895.500	41.24	10.73	51.97	74.00	-22.03	peak
10	19895.500	30.98	10.73	41.71	54.00	-12.29	AVG
11	20558.500	40.70	11.03	51.73	74.00	-22.27	peak
12	20558.500	30.03	11.03	41.06	54.00	-12.94	AVG

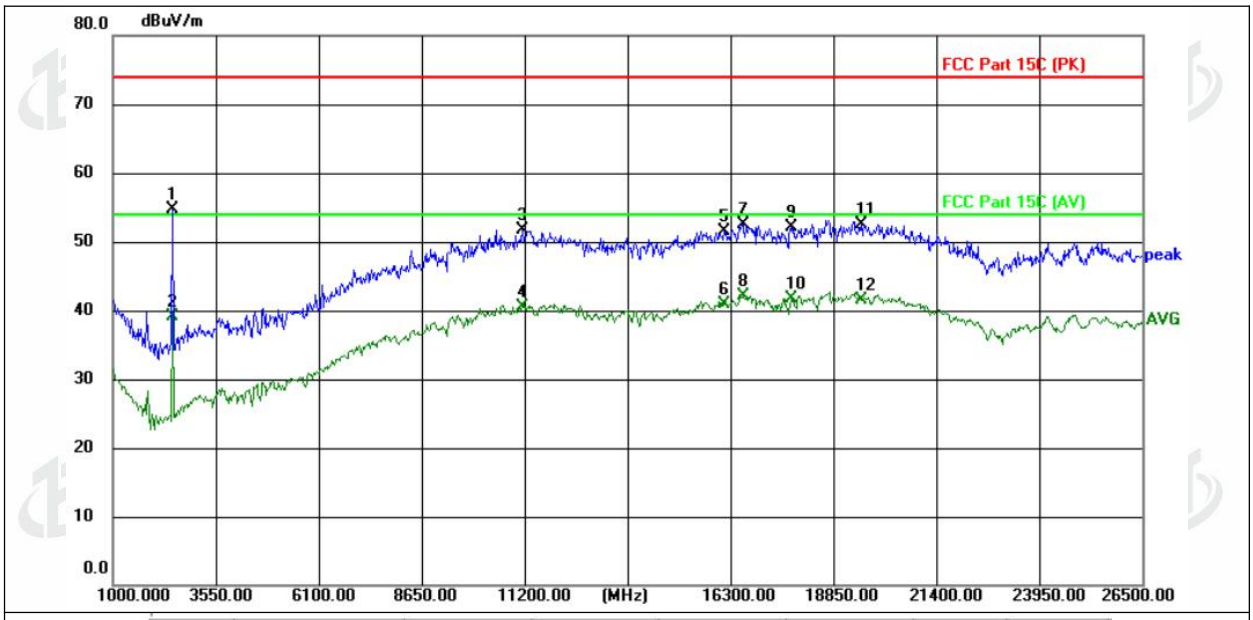
Remarks:
1.Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2.The emission levels of other frequencies are very lower than the limit and not show in test report.

Temperature :	25.1℃	Relative Humidity :	50%
Pressure :	101kPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz	Test Mode:	TX GFSK Mode 2480MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2479.000	64.14	-4.23	59.91	74.00	-14.09	peak
2 *	2479.000	48.70	-4.23	44.47	54.00	-9.53	AVG
3	12602.500	34.20	16.59	50.79	74.00	-23.21	peak
4	12602.500	23.28	16.59	39.87	54.00	-14.13	AVG
5	16172.500	36.99	16.01	53.00	74.00	-21.00	peak
6	16172.500	25.17	16.01	41.18	54.00	-12.82	AVG
7	16657.000	36.51	16.73	53.24	74.00	-20.76	peak
8	16657.000	24.84	16.73	41.57	54.00	-12.43	AVG
9	18722.500	42.00	10.19	52.19	74.00	-21.81	peak
10	18722.500	32.00	10.19	42.19	54.00	-11.81	AVG
11	20405.500	41.36	10.96	52.32	74.00	-21.68	peak
12	20405.500	30.36	10.96	41.32	54.00	-12.68	AVG

Temperature :	25.1℃	Relative Humidity :	50%
Pressure :	101kPa	Polarization :	Vertical
Test Voltage :	AC 120V/60Hz	Test Mode:	TX GFSK Mode 2480MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2479.000	58.94	-4.23	54.71	74.00	-19.29	peak
2	2479.000	43.30	-4.23	39.07	54.00	-14.93	AVG
3	11149.000	36.64	14.97	51.61	74.00	-22.39	peak
4	11149.000	25.46	14.97	40.43	54.00	-13.57	AVG
5	16147.000	35.63	15.97	51.60	74.00	-22.40	peak
6	16147.000	25.03	15.97	41.00	54.00	-13.00	AVG
7	16606.000	35.92	16.66	52.58	74.00	-21.42	peak
8 *	16606.000	25.53	16.66	42.19	54.00	-11.81	AVG
9	17804.500	33.66	18.46	52.12	74.00	-21.88	peak
10	17804.500	23.27	18.46	41.73	54.00	-12.27	AVG
11	19538.500	41.94	10.56	52.50	74.00	-21.50	peak
12	19538.500	30.94	10.56	41.50	54.00	-12.50	AVG

Remarks:
1.Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2.The emission levels of other frequencies are very lower than the limit and not show in test report.

5.RADIATED BAND EMISSION MEASUREMENT

5.1 TEST REQUIREMENT:

Test Requirement:	FCC Part15 C Section 15.209 and 15.205
Test Method:	ANSI C63.10: 2013
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.
Test site:	Measurement Distance: 3m
Receiver setup:	

Frequency	Detector	RBW	VBW	Value
Above 1GHz	Peak	1MHz	3MHz	Peak
	Average	1MHz	3MHz	Average

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

(2) The tighter limit applies at the band edges.

(3) Emission level (dBuV/m)=20log Emission level (uV/m).

5.2 TEST PROCEDURE

Above 1GHz test procedure as below:

a. 1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. Test the EUT in the lowest channel,the Highest channel

Note:

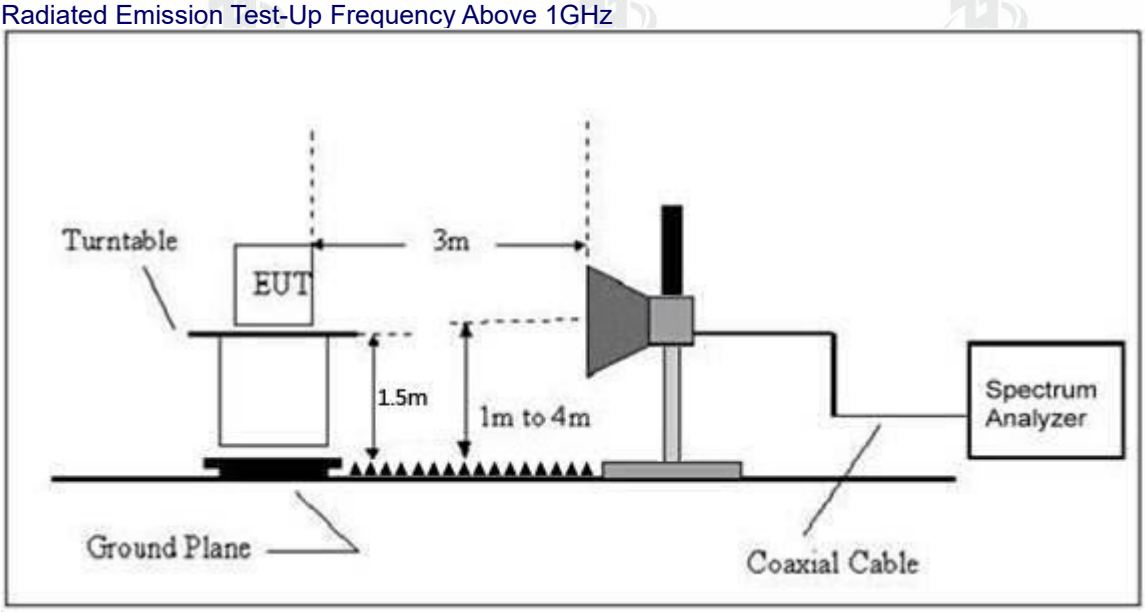
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

5.3 DEVIATION FROM TEST STANDARD

No deviation

5.4 TEST SETUP

Radiated Emission Test-Up Frequency Above 1GHz

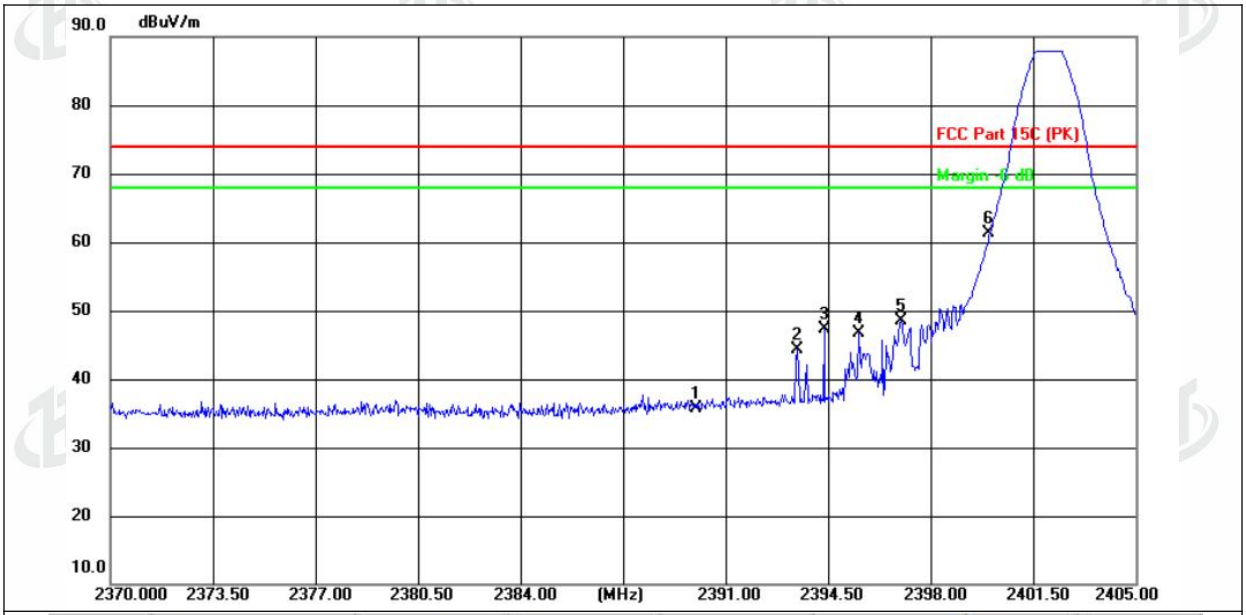


5.5 EUT OPERATING CONDITIONS

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

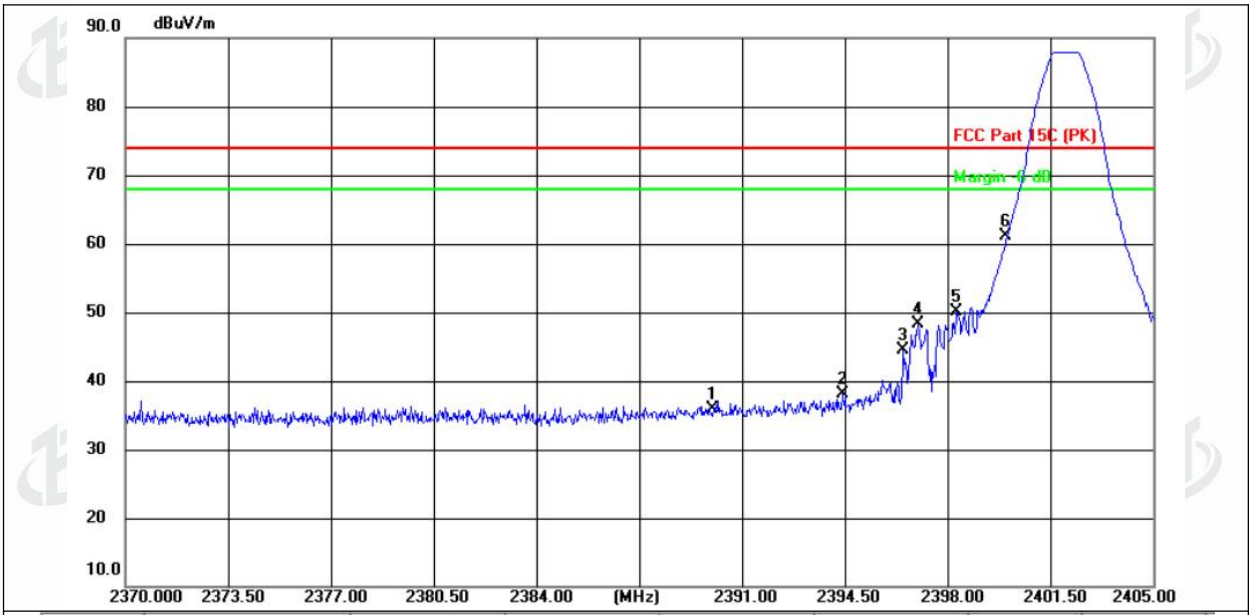
5.6 TEST RESULT

Temperature :	25.1℃	Relative Humidity :	50%
Pressure :	101kPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz	Test Mode:	TX GFSK Mode 2402MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	41.74	-5.97	35.77	74.00	-38.23	peak
2	2393.450	50.30	-5.96	44.34	74.00	-29.66	peak
3	2394.360	53.30	-5.95	47.35	74.00	-26.65	peak
4	2395.550	52.66	-5.95	46.71	74.00	-27.29	peak
5	2396.985	54.36	-5.95	48.41	74.00	-25.59	peak
6 *	2400.000	67.35	-5.95	61.40	74.00	-12.60	peak

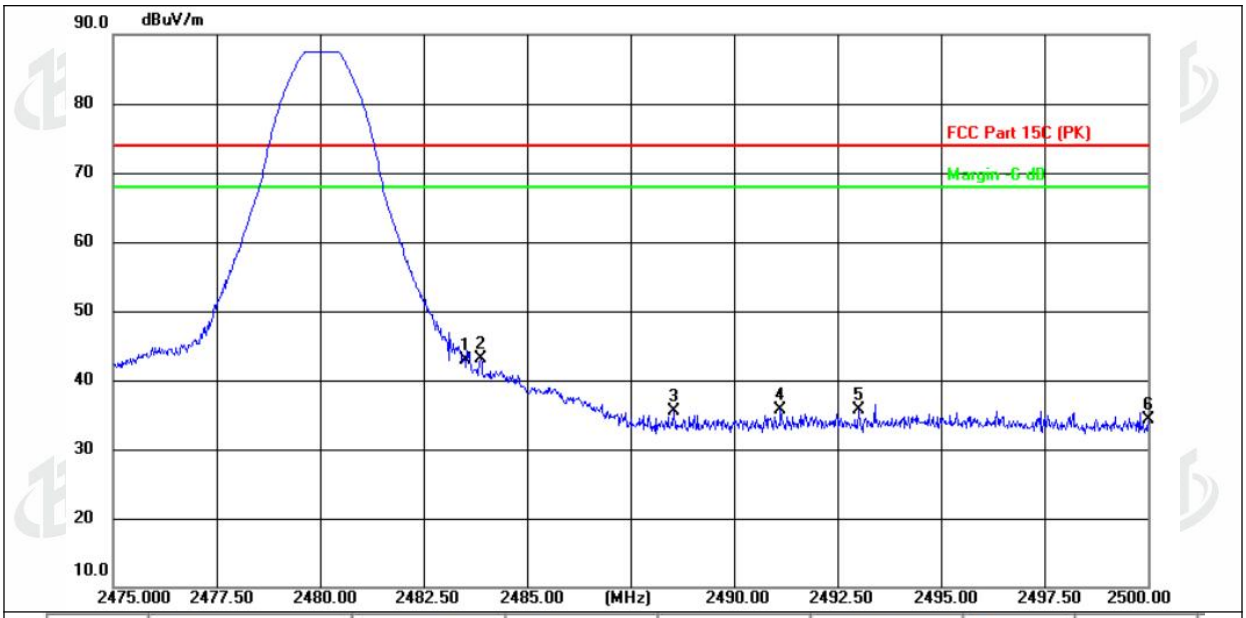
Temperature :	25.1℃	Relative Humidity :	50%
Pressure :	101kPa	Polarization :	Vertical
Test Voltage :	AC 120V/60Hz	Test Mode:	TX GFSK Mode 2402MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	41.83	-5.97	35.86	74.00	-38.14	peak
2	2394.430	44.06	-5.95	38.11	74.00	-35.89	peak
3	2396.495	50.38	-5.95	44.43	74.00	-29.57	peak
4	2396.985	54.19	-5.95	48.24	74.00	-25.76	peak
5	2398.315	56.09	-5.95	50.14	74.00	-23.86	peak
6 *	2400.000	67.08	-5.95	61.13	74.00	-12.87	peak

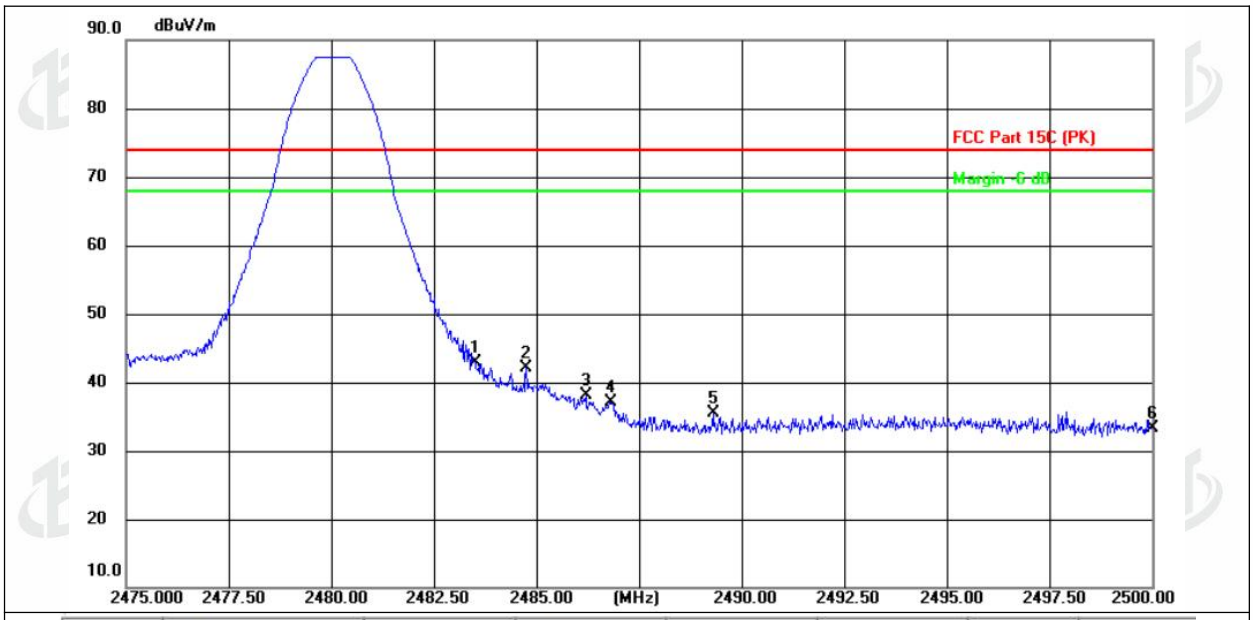
Remarks:
1.Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2.The emission levels of other frequencies are very lower than the limit and not show in test report.

Temperature :	25.1℃	Relative Humidity :	50%
Pressure :	101kPa	Polarization :	Horizontal
Test Voltage :	AC 120V/60Hz	Test Mode:	TX GFSK Mode 2480MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2483.500	48.73	-5.85	42.88	74.00	-31.12	peak
2 *	2483.875	48.86	-5.85	43.01	74.00	-30.99	peak
3	2488.550	41.25	-5.84	35.41	74.00	-38.59	peak
4	2491.125	41.51	-5.84	35.67	74.00	-38.33	peak
5	2493.000	41.46	-5.84	35.62	74.00	-38.38	peak
6	2500.000	40.03	-5.83	34.20	74.00	-39.80	peak

Temperature :	25.1℃	Relative Humidity :	50%
Pressure :	101kPa	Polarization :	Vertical
Test Voltage :	AC 120V/60Hz	Test Mode:	TX GFSK Mode 2480MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	2483.500	48.69	-5.85	42.84	74.00	-31.16	peak
2	2484.750	47.90	-5.85	42.05	74.00	-31.95	peak
3	2486.200	44.01	-5.85	38.16	74.00	-35.84	peak
4	2486.800	42.89	-5.84	37.05	74.00	-36.95	peak
5	2489.300	41.32	-5.84	35.48	74.00	-38.52	peak
6	2500.000	39.03	-5.83	33.20	74.00	-40.80	peak

Remarks:
1.Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2.The emission levels of other frequencies are very lower than the limit and not show in test report.

6.POWER SPECTRAL DENSITY TEST

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB558074 D0115.247 Meas Guidance v05r02

6.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247	Power Spectral Density	8dBm/3kHz	2400-2483.5	PASS

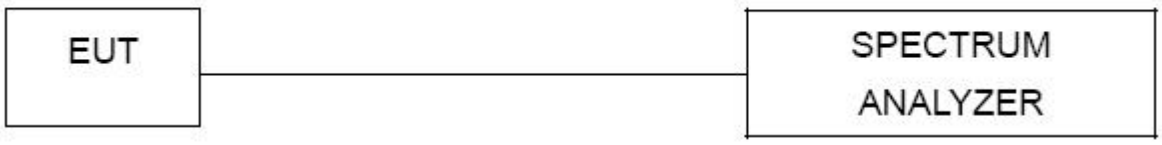
6.2 TEST PROCEDURE

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x 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 within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

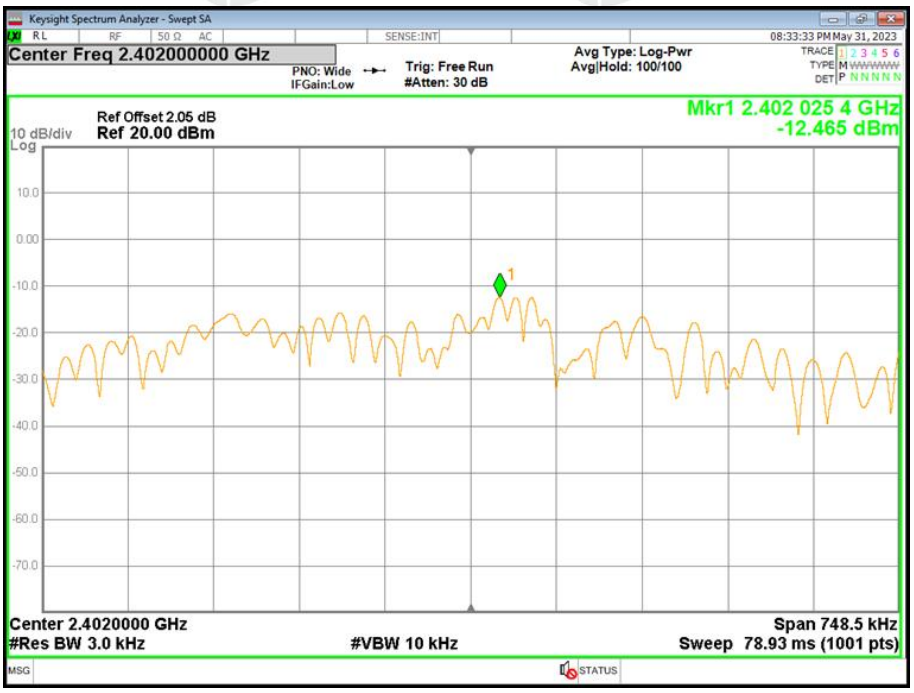
The EUT tested system was configured as the statements of 2.1 Unless otherwise a special operating condition is specified in the follows during the testing.

6.6 TEST RESULTS

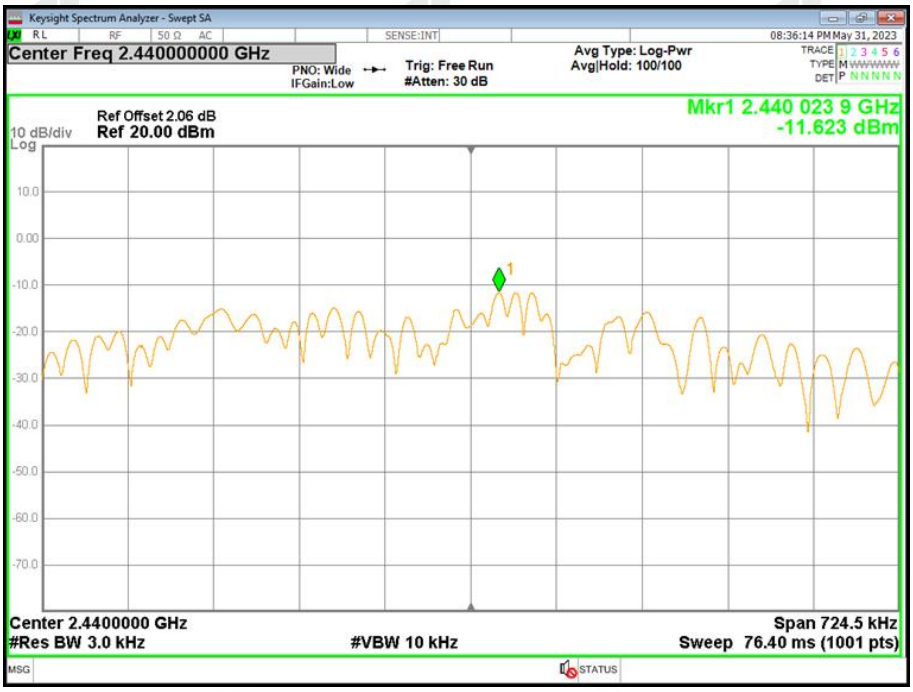
Temperature：	25.6℃	Relative Humidity：	51%
Test Mode ：	GFSK	Test Voltage ：	AC 120 V/60 HZ

Frequency	Power Spectral Density (dBm/3kHz)	Limit (8dBm/3kHz)	Result
2402 MHz	-12.47	8	PASS
2440 MHz	-11.62	8	PASS
2480 MHz	-9.72	8	PASS

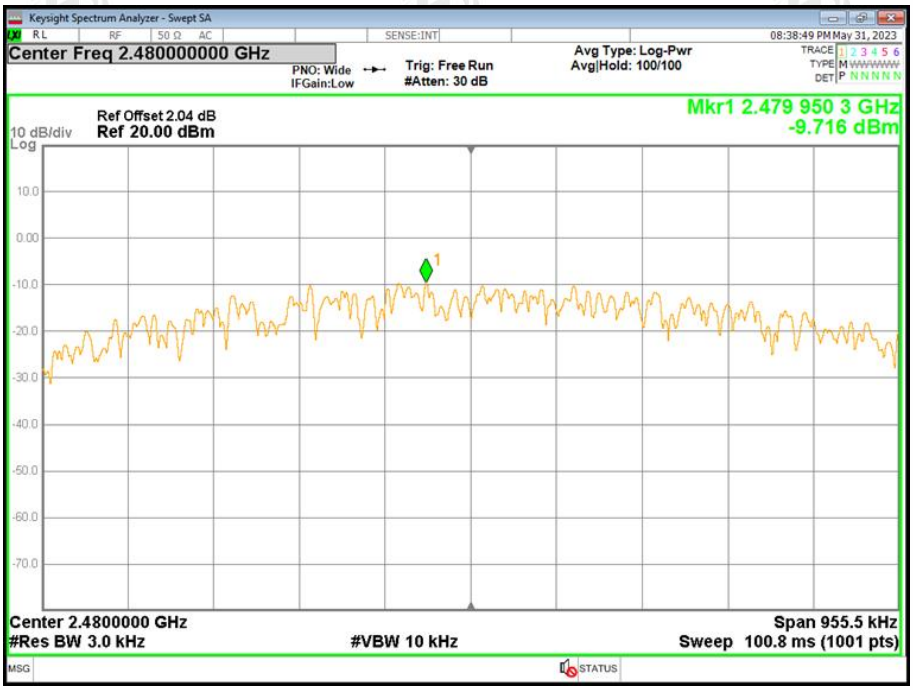
CH01



CH20


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.440000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 100/100
08:36:14 PM May 31, 2023
Ref Offset 2.06 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.440 023 9 GHz
-11.623 dBm
Center 2.4400000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 724.5 kHz
Sweep 76.40 ms (1001 pts)

CH40


Keysight Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 100/100
08:38:49 PM May 31, 2023
Ref Offset 2.04 dB
10 dB/div
Ref 20.00 dBm
Mkr1 2.479 950 3 GHz
-9.716 dBm
Center 2.4800000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 955.5 kHz
Sweep 100.8 ms (1001 pts)

7. CHANNEL BANDWIDTH

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	KDB558074 D0115.247 Meas Guidance v05r02

7.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

7.2 TEST PROCEDURE

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP

7.5 EUT OPERATION CONDITIONS

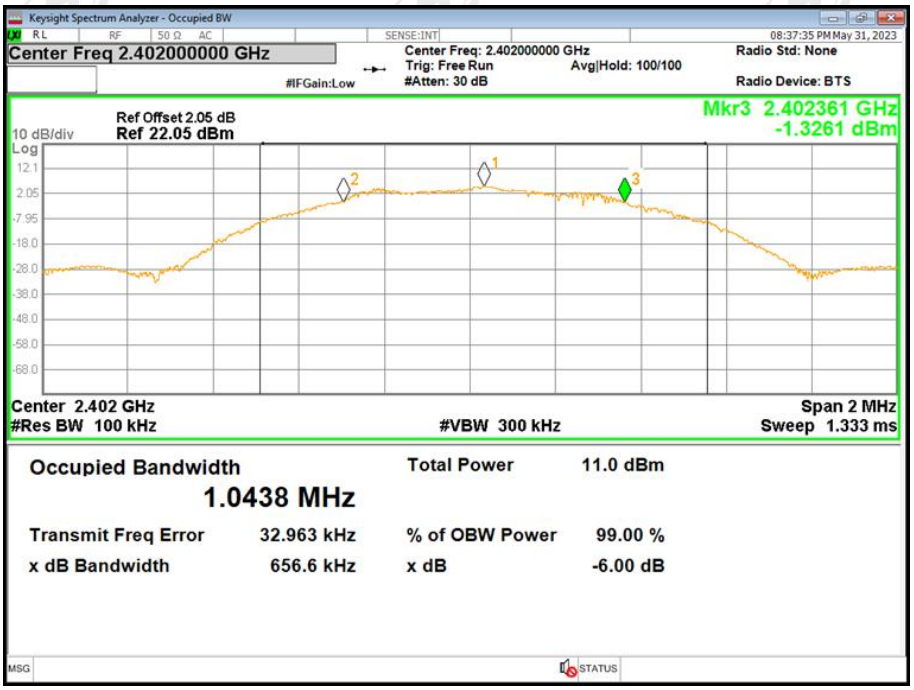
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

7.6 TEST RESULTS

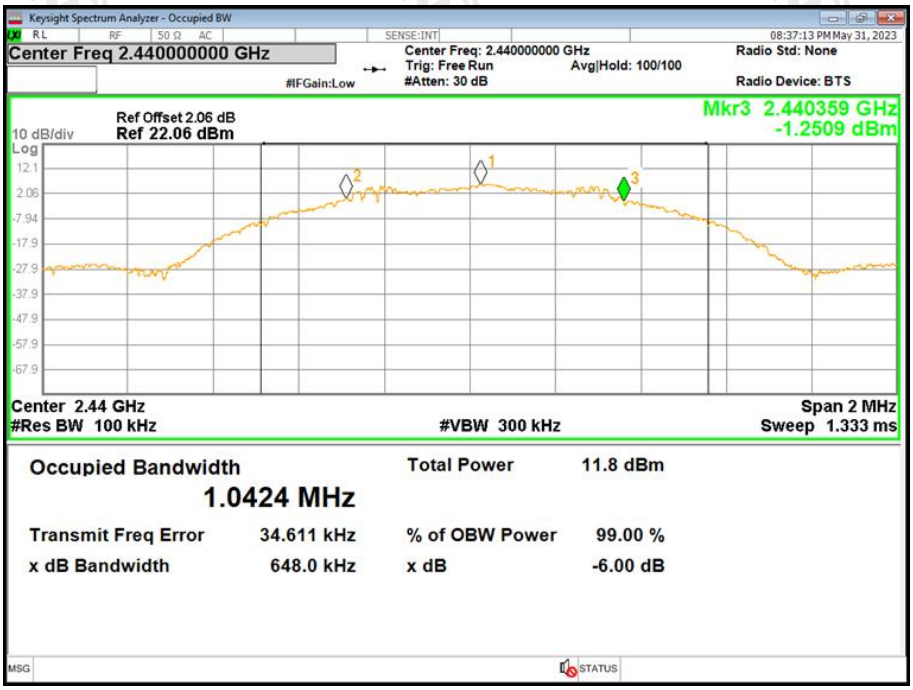
Temperature：	25.6℃	Relative Humidity：	51%
Test Mode ：	GFSK	Test Voltage ：	AC 120 V/60 HZ

Test channel	Channel Bandwidth (MHz)	Limit(KHz)	Result
Lowest	0.657	>=500	Pass
Middle	0.648		
Highest	0.637		

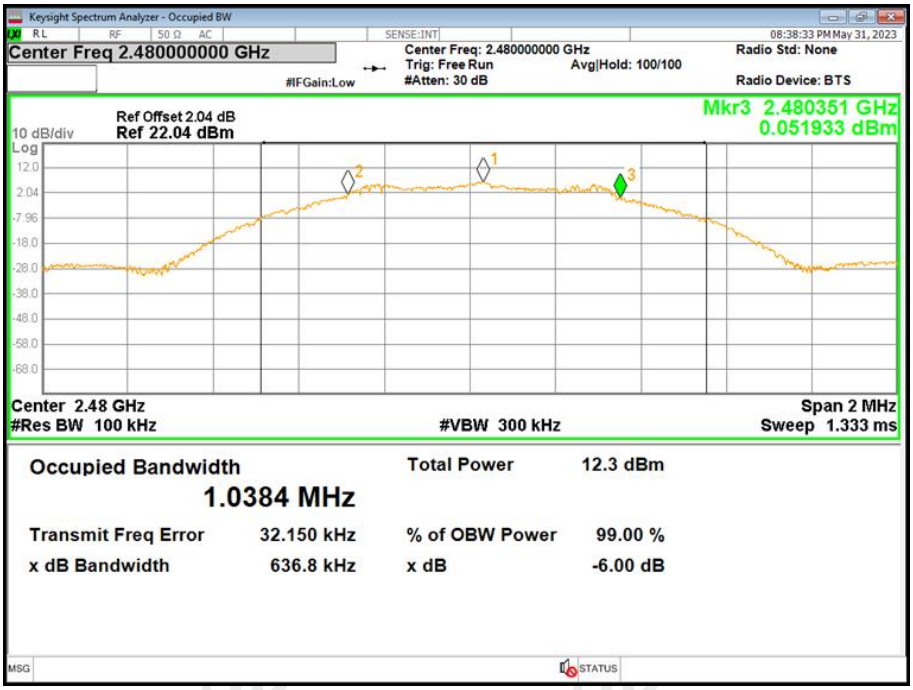
CH 01



CH20


Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.440000000 GHz
Center Freq: 2.440000000 GHz
Trig: Free Run
#Atten: 30 dB
Avg|Hold: 100/100
Radio Std: None
Radio Device: BTS
08:37:13 PM May 31, 2023
#IFGain:Low
Ref Offset 2.06 dB
10 dB/div
Ref 22.06 dBm
Mkr3 2.440359 GHz
-1.2509 dBm
Center 2.44 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 2 MHz
Sweep 1.333 ms
Occupied Bandwidth
1.0424 MHz
Total Power 11.8 dBm
Transmit Freq Error 34.611 kHz
% of OBW Power 99.00 %
x dB Bandwidth 648.0 kHz
x dB -6.00 dB
MSG
STATUS

CH40


Keysight Spectrum Analyzer - Occupied BW
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
#Atten: 30 dB
Avg|Hold: 100/100
Radio Std: None
Radio Device: BTS
08:38:33 PM May 31, 2023
#IFGain:Low
Ref Offset 2.04 dB
10 dB/div
Ref 22.04 dBm
Mkr3 2.480351 GHz
0.051933 dBm
Center 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 2 MHz
Sweep 1.333 ms
Occupied Bandwidth
1.0384 MHz
Total Power 12.3 dBm
Transmit Freq Error 32.150 kHz
% of OBW Power 99.00 %
x dB Bandwidth 636.8 kHz
x dB -6.00 dB
MSG
STATUS

8.PEAK OUTPUT POWER TEST

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	KDB558074 D0115.247 Meas Guidance v05r02

8.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5	PASS

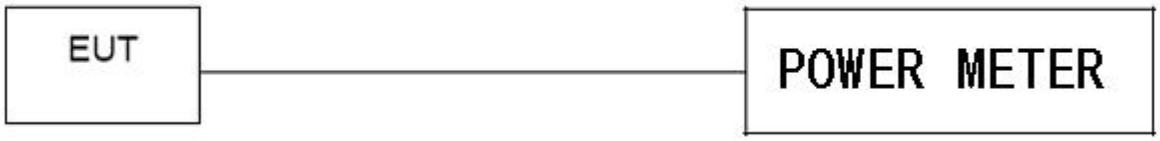
8.2 TEST PROCEDURE

a. The EUT was directly connected to the Power meter

8.3 DEVIATION FROM STANDARD

No deviation.

8.4 TEST SETUP



8.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

8.6 TEST RESULTS

Temperature：	25.6℃	Relative Humidity：	51%
Test Mode ：	GFSK	Test Voltage ：	AC 120 V/60 HZ

Test channel	Peak Output Power (dBm)	Limit(dBm)	Result
Lowest	5.41	30.00	Pass
Middle	6.19		
Highest	6.51		

9. CONDUCTED BAND EDGE AND SPURIOUS EMISSION

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074 D0115.247 Meas Guidance v05r02

9.1 APPLICABLE STANDARD

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

9.2 TEST PROCEDURE

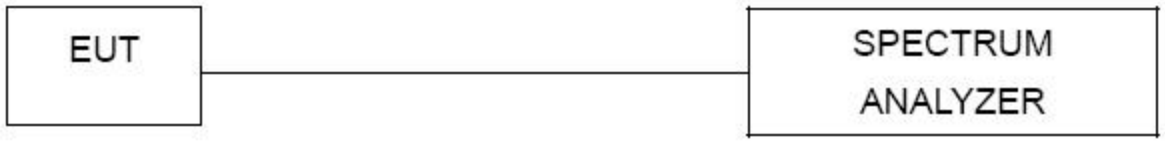
Using the following spectrum analyzer setting:

A) Set the RBW = 100KHz.
B) Set the VBW = 300KHz.
C) Sweep time = auto couple.
D) Detector function = peak.
E) Trace mode = max hold.
F) Allow trace to fully stabilize.

9.3 DEVIATION FROM STANDARD

No deviation.

9.4 TEST SETUP

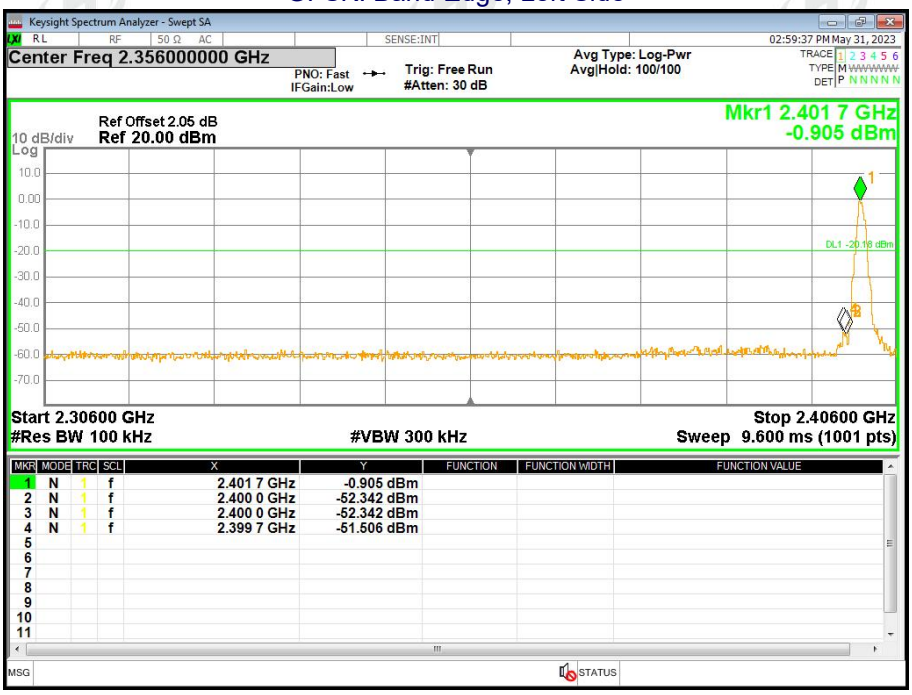


9.5 EUT OPERATION CONDITIONS

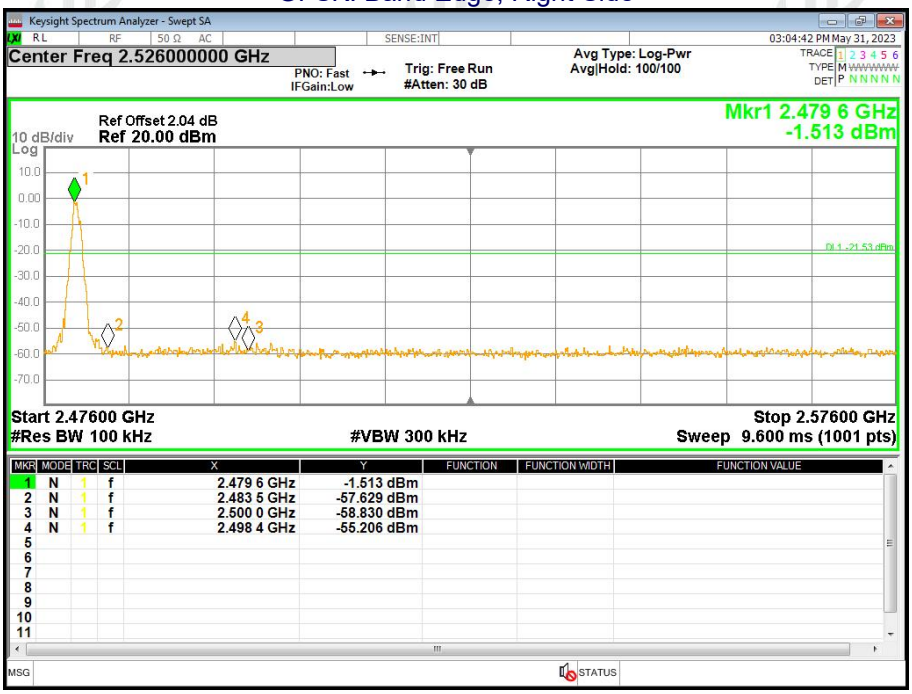
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

9.6 TEST RESULTS

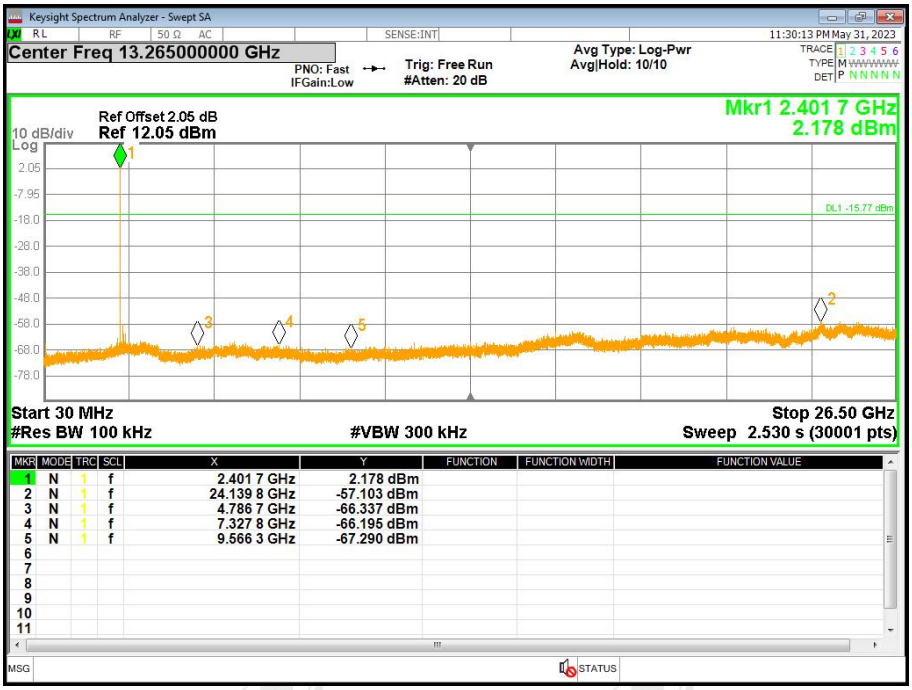
GFSK: Band Edge, Left Side



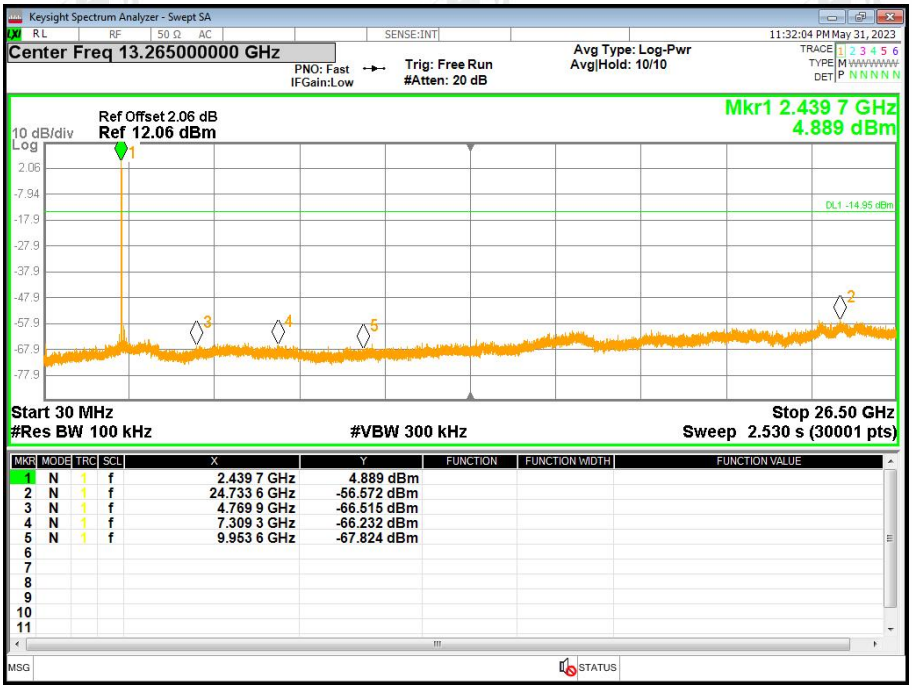
GFSK: Band Edge, Right Side



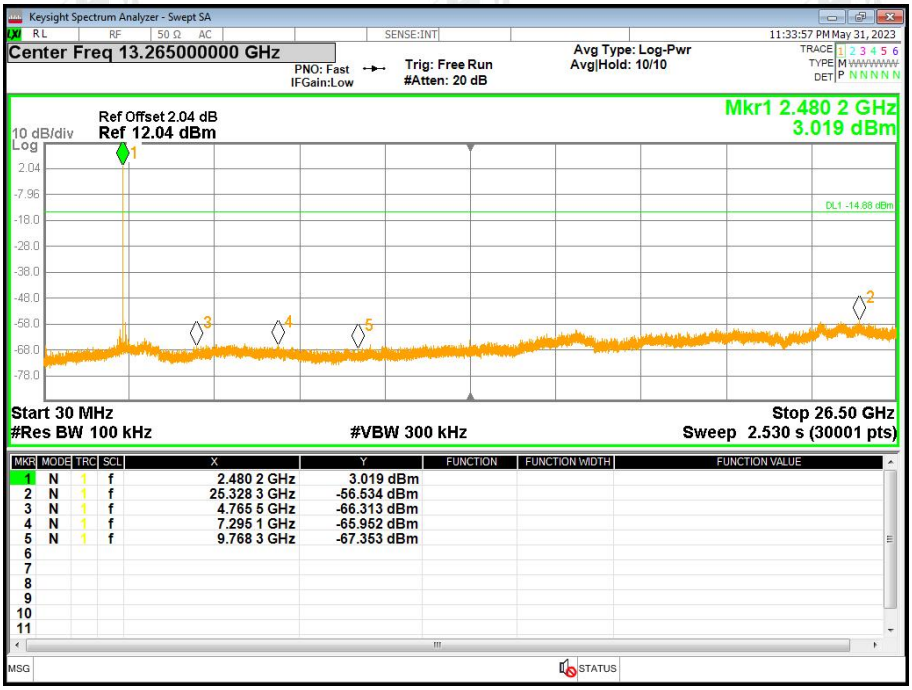
Lowest channel



Middle channel



Highest channel



10.ANTENNA REQUIREMENT

Standard requirement:	FCC Part15 C Section 15.203 /247(b)(4)
15.203 requirement: 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(b) (4) requirement: (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.	
EUT Antenna:	
The antenna is PCB Antenna, the best case gain of the antennas is 2.5dBi, reference to the appendix II for details	

11. TEST SETUP PHOTOS

Reference to the appendix I for details.

12. EUT CONSTRUCTIONAL DETAILS

Reference to the appendix II for details.

※※※※※ **END OF REPORT** ※※※※※