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TEST REPORT

of

FCC Part 15 Subpart C §15.249

FCC ID: RVBXPM170YN

Equipment Under Test	:	X-POINTER
Model Name	:	XPM170YN
Variant Model Name(s)	:	-
Applicant	:	Chois Technology Co., Ltd.
Manufacturer	:	Chois Technology Co., Ltd.
Date of Receipt	:	2022.10.27
Date of Test(s)	:	2022.11.10 ~ 2022.12.08
Date of Issue	:	2022.12.15

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

1) The results of this test report are effective only to the items tested.
2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.
3) This test report cannot be reproduced, except in full, without prior written permission of the Company.
4) The data marked ※ in this report was provided by the customer and may affect the validity of the test results.
We are responsible for all the information of this test report except for the data(※) provided by the customer.

Tested by: Taek Kim

Technical Manager: Jinhyoung Cho

SGS Korea Co., Ltd. Gunpo Laboratory

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
-10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
-4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
-Designation number: KR0150
All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.
Phone No. : +82 31 688 0901
Fax No. : +82 31 688 0921

1.2. Details of Applicant

Applicant : Chois Technology Co., Ltd.
Address : S-1404, 32, Songdogwahak-ro, Yeonsu-gu, Incheon, South Korea, 21984
Contact Person : Son, Dae-heung
Phone No. : +82 70 5118 5568

1.3. Details of Manufacturer

Applicant : Same as applicant
Address : Same as applicant

1.4. Description of EUT

Kind of Product	X-POINTER
Model Name	XPM170YN
Serial Number	Conducted: 001, Radiated: 002
Power Supply	DC 3 V
Frequency Range	2 430 ㎒ ~ 2 460 ㎒
Modulation Technique	GFSK
Number of Channels	31 channels
Antenna Type	PCB Pattern Antenna
Antenna Gain※	1.22 ㏈i
H/W Version	HW_N_VER.1
S/W Version	SW_N_VER.1

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	R&S	SMR40	100272	Jun. 16, 2022	Annual	Jun. 16, 2023
Signal Generator	R&S	SMBV100A	255834	May 25, 2022	Annual	May 25, 2023
Spectrum Analyzer	R&S	FSV30	103453	Nov. 01, 2022	Annual	Nov. 01, 2023
Spectrum Analyzer	Agilent	N9020A	MY53421758	Aug. 26, 2022	Annual	Aug. 26, 2023
Attenuator	AEROFLEX / INMET	40AH2W-10	40G-1	Jun. 08, 2022	Annual	Jun. 08, 2023
High Pass Filter	Wainwright Instrument GmbH	WHKX3.0/18G-6SS	21	Jun. 09, 2022	Annual	Jun. 09, 2023
High Pass Filter	Wainwright Instrument GmbH	WHNX7.5/26.5G-6SS	15	May 31, 2022	Annual	May 31, 2023
Low Pass Filter	Mini-Circuits	NLP-1200+	V 8979400903-2	Feb. 10, 2022	Annual	Feb. 10, 2023
DC Power Supply	R&S	HMP2020	020089489	May 17, 2022	Annual	May 17, 2023
Preamplifier	H.P.	8447F	2944A03909	Aug. 04, 2022	Annual	Aug. 04, 2023
Signal Conditioning Unit	R&S	SCU-18	10117	Jun. 13, 2022	Annual	Jun. 13, 2023
Preamplifier	TESTEK	TK-PA1840H	130016	Jan. 10, 2022	Annual	Jan. 10, 2023
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 23, 2021	Biennial	Aug. 23, 2023
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB 9163	01126	Feb. 07, 2022	Annual	Feb. 07, 2023
Horn Antenna	R&S	HF906	100326	Feb. 18, 2022	Annual	Feb. 18, 2023
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA 9170	9170-540	Nov. 30, 2022	Annual	Nov. 30, 2023
EMI Test Receiver	R&S	ESU26	100109	Jan. 18, 2022	Annual	Jan. 18, 2023
Turn Table	Innco systems GmbH	DS 1200 S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/38 330516/L	N.C.R.	N/A	N.C.R.
Antenna Mast	Innco systems GmbH	MA4640-XP-ET	MA4640/536/38 330516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	RFONE	MWX221-NMSNMS (4 m)	J1023142	Oct. 04, 2022	Semi-Annual	Apr. 04, 2023
Coaxial Cable	Qualwave Inc.	QA500-18-NN-10 (10 m)	22200114	Oct. 04, 2022	Semi-Annual	Apr. 04, 2023
Coaxial Cable	RFONE	PL360P-292M292M-1.5 M-A	20200324002	Aug. 18, 2022	Semi-Annual	Feb. 18, 2023

Note;

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibraition due date.

1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

Applied Standard: FCC Part15 Subpart C		
Section	**Test Item(s)**	**Result**
15.205 15.209(a) 15.249(a) 15.249(c) 15.249(d) 15.249(e)	Field Strength of Fundamental and Radiated Spurious emission	Complied
15.215(c)	20 ㏈ Bandwidth	Complied
15.207	AC Power Line Conducted Emission	N/A[1)]

Note;

1) The AC power line test was not performed because the EUT use battery power for operation and which do not operate from the AC power lines.

1.7. Test Procedure(s)

The measurement procedures described in the American National Standard of Procedure for Compliance Testing of unlicensed Wireless Devices (ANSI C63.10-2013) was used in the measurement of the DUT.

1.8. Sample Calculation

Where relevant, the following sample calculation is provided

1.8.1. Radiation Test

Field strength level (㏈㎶/m) = Measured level (㏈㎶) + Antenna factor (㏈) + Cable loss (㏈) - Amplifier gain (㏈)

1.9. Information of software for test

- Using the software of nRF DTM (Version 2.3.1) to testing of EUT

1.10. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL003634	2022.12.15	Initial

1.11. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

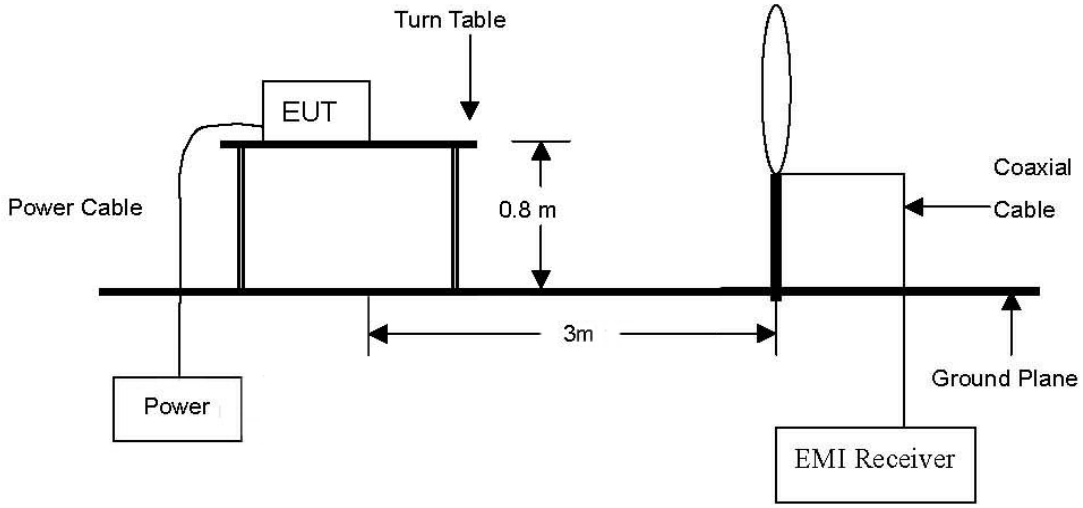
Parameter	Uncertainty	
Occupied Bandwidth	3.90 ㎑	
Radiated Emission, 9 ㎑ to 30 ㎒	H	3.30 dB
	V	3.30 dB
Radiated Emission, below 1 ㎓	H	4.80 dB
	V	5.20 dB
Radiated Emission, above 1 ㎓	H	3.90 dB
	V	4.00 dB

All measurement uncertainty values are shown with a coverage factor of *k*=2 to indicate a 95 % level of confidence.

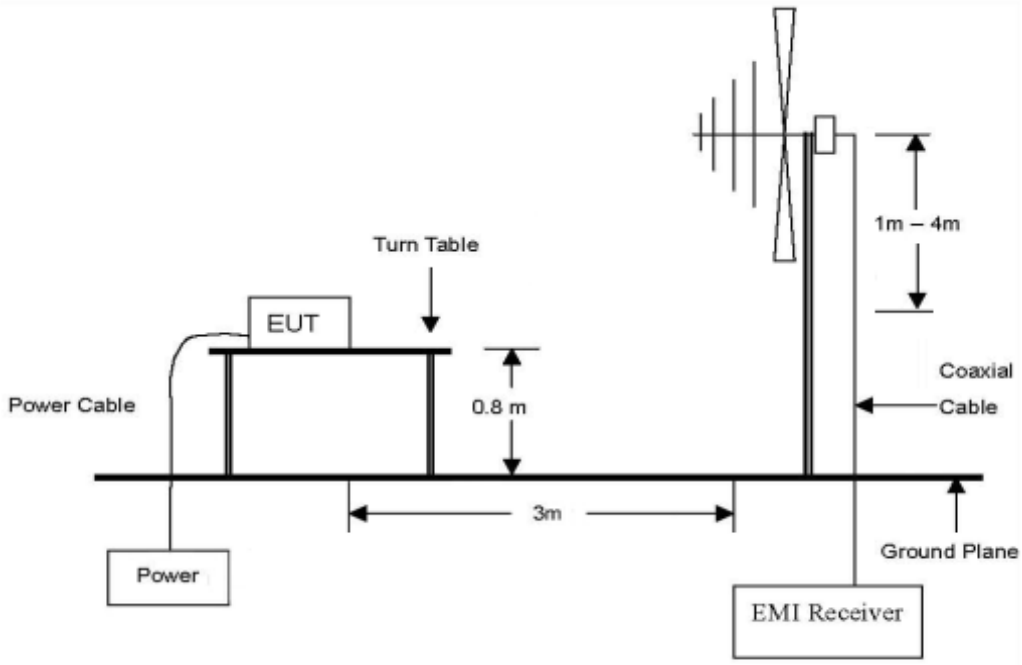
2. Field Strength of Fundamental and Radiated Spurious Emission

2.1. Test Setup

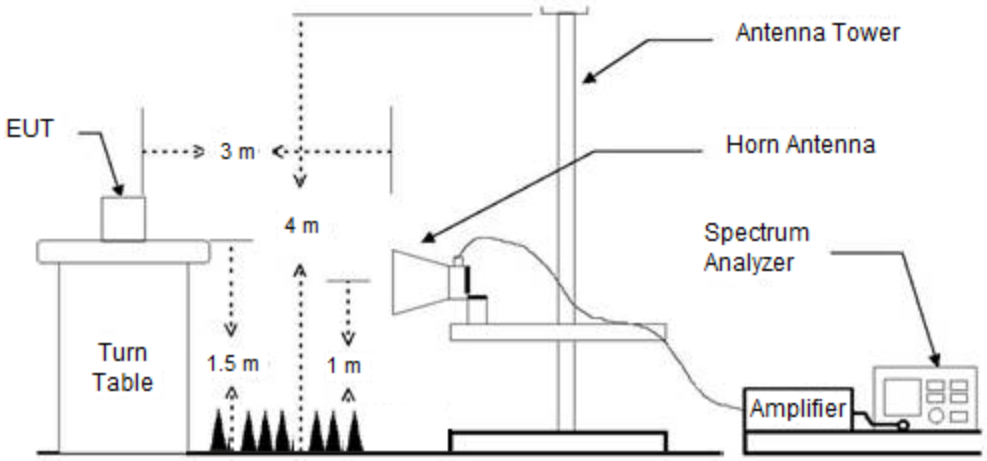
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission. The spurious emissions were investigated form 1 ㎓ to the 10th harmonic of the highest fundamental frequency or 40 ㎓, whichever is lower.



2.2. Limit

According to §15.249(a), Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (㎷/m)	Field strength of harmonics (㎶/m)
902-928 ㎒	50	500
2 400-2 483.5 ㎒	50	500
5 725-5 875 ㎒	50	500
24.0-24.25 ㎓	250	2 500

According to §15.249(c), Field strength limits are specified at a distance of 3 meters.

According to §15.249(d), Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 ㏈ below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

According to §15.249(e), As shown in §15.35(b), for frequencies above 1000 ㎒, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

According to §15.209(a), Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (㎒)	Field strength (㎶/m)	Measurement distance (Meters)
0.009-0.490	2 400/F(㎑)	300
0.490-1.705	24 000/F(㎑)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 ㎒, 76-88 ㎒, 174-216 ㎒ or 470-806 ㎒. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

2.3. Test Procedures

Radiated emissions from the EUT were measured according to ANSI C63.10-2013 and only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

2.3.1. Test Procedures for emission below 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum Hold Mode.

2.3.2. Test Procedures for emission from above 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site below 1 ㎓ and 1.5 meters above the ground at a 3 meter anechoic chamber test site above 1 ㎓. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a bi-log antenna, a horn antenna and its 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.
4. 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 table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. For measurements below 1 ㎓ resolution bandwidth is set to 100 ㎑ for peak detection measurements or 120 ㎑ for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.
6. For measurements Above 1 ㎓ resolution bandwidth is set to 1 ㎒, the video bandwidth is set to 3 ㎒ for peak measurements and as applicable for average measurements.

Note;

The test orthogonal plan of EUT was investigated with three axis described in the test setup photo.
The X-axis was worst-case, all radiated testing of EUT was performed with **X–axis**.

2.4. Test Result

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

2.4.1. Field Strength of Fundamental

All emissions tested both horizontal and vertical. The following table shows the highest levels of radiated emissions on the worst polarization.

- Fundamental

Fundamental Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
<Low channel 2 430 ㎒>								
2 430.40	63.45	Peak	H	28.16	6.78	98.39	113.98	15.59
2 430.11	54.01	Average	H	28.16	6.78	88.95	93.98	5.03
<Middle channel 2 444 ㎒>								
2 444.42	63.20	Peak	H	28.19	6.76	98.15	113.98	15.83
2 443.94	54.77	Average	H	28.19	6.76	89.72	93.98	4.26
<High channel 2 460 ㎒>								
2 459.87	64.14	Peak	H	28.18	6.60	98.92	113.98	15.06
2 460.29	54.31	Average	H	28.18	6.59	89.08	93.98	4.90

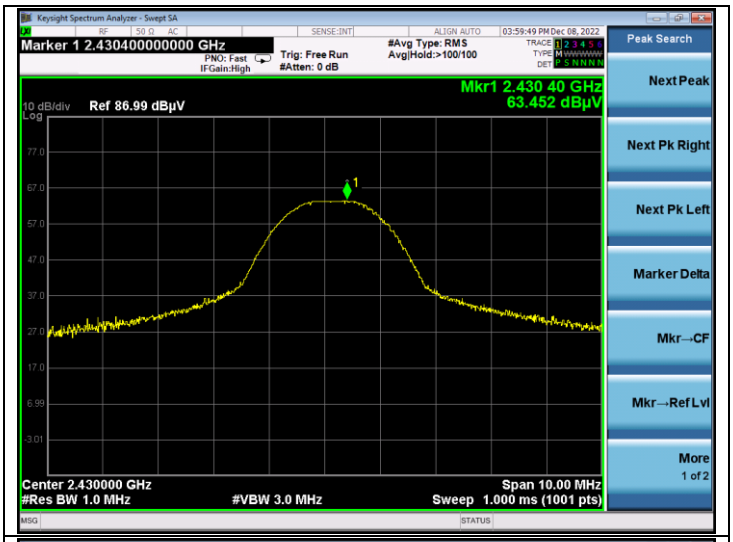
Remark;

1. Actual (dB㎶/m)= Reading + AF + CL.
2. AF = Antenna Factor, CL = Cable Loss.

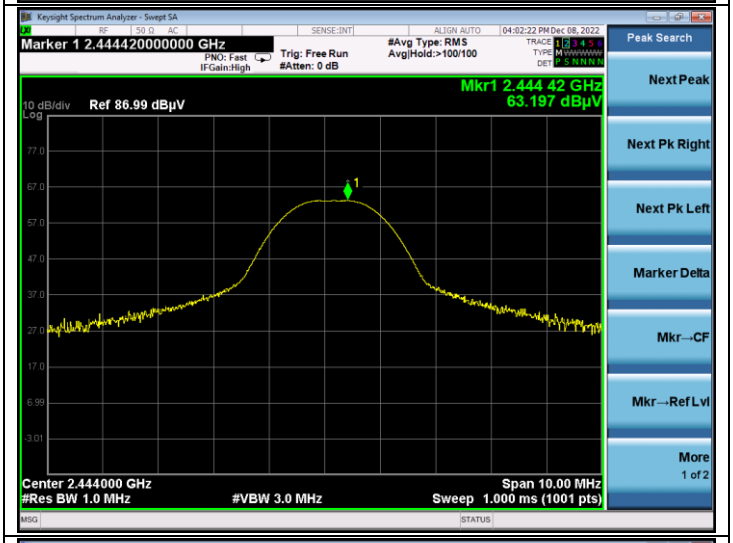
- Test plots

Fundamental (Peak)

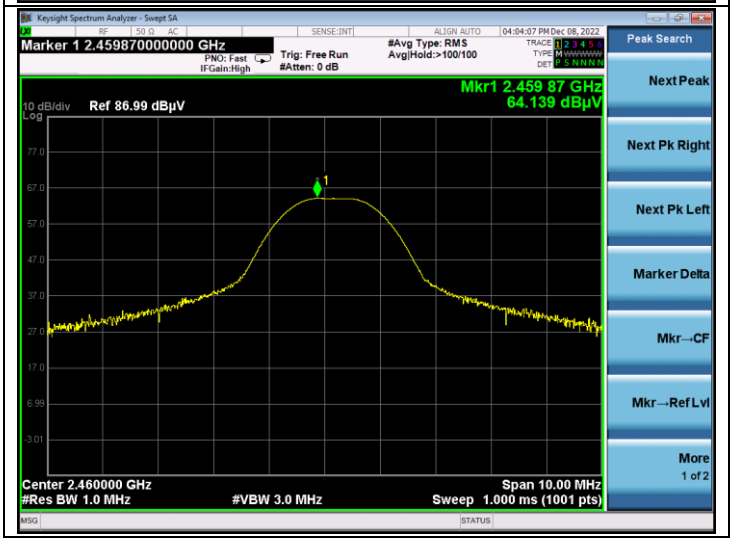
Low Channel



Middle Channel

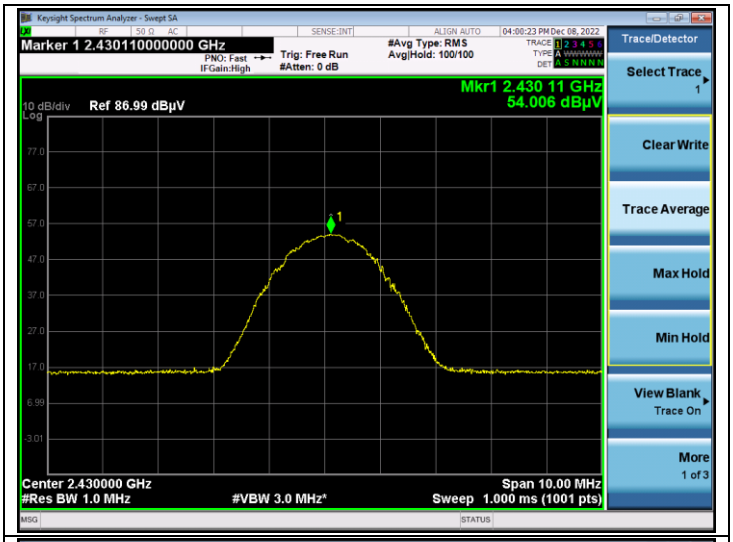


High Channel

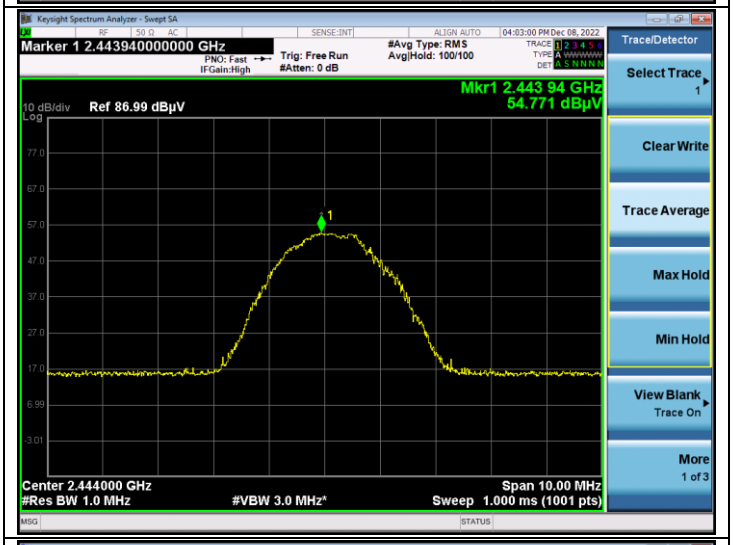


Fundamental (Average)

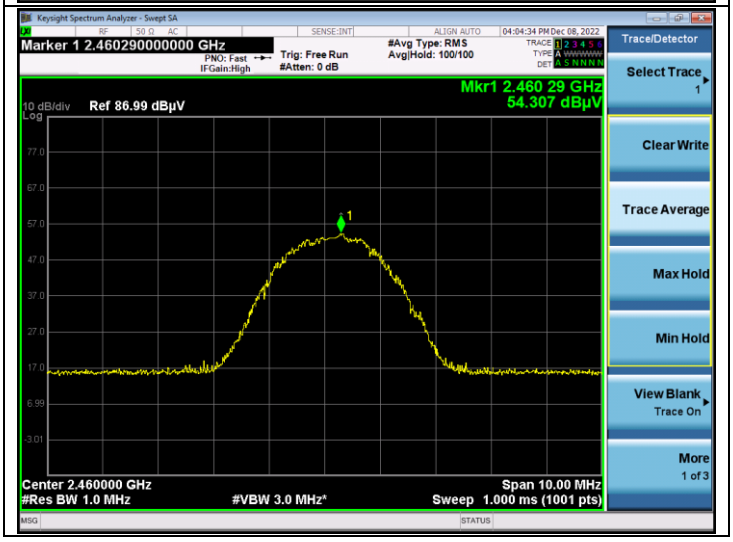
Low Channel



Middle Channel



High Channel



2.4.2. Radiated Spurious Emission below 1 000 ㎒

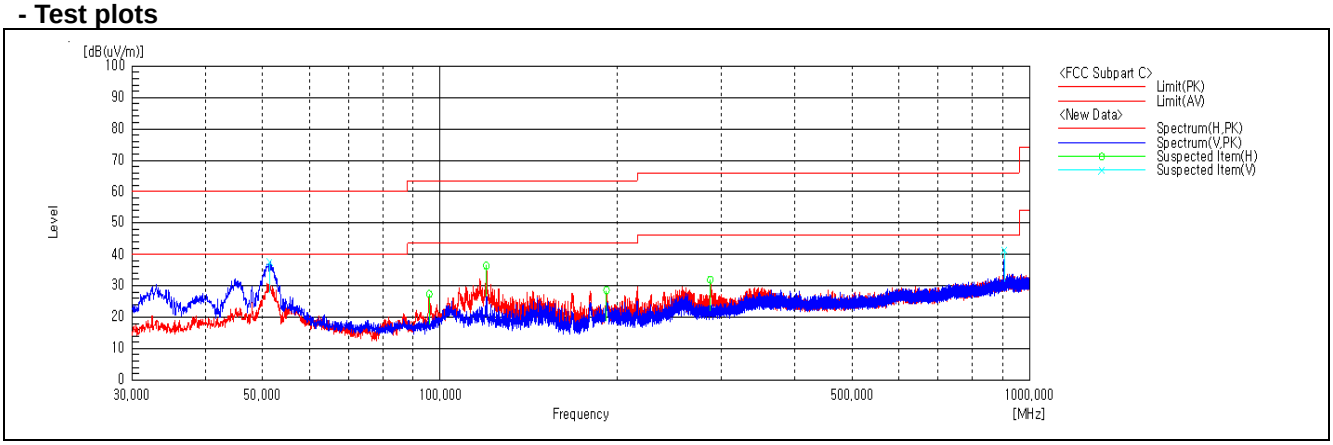
The frequency spectrum from 9 ㎑ to 1 000 ㎒ was investigated. All reading values are peak values.

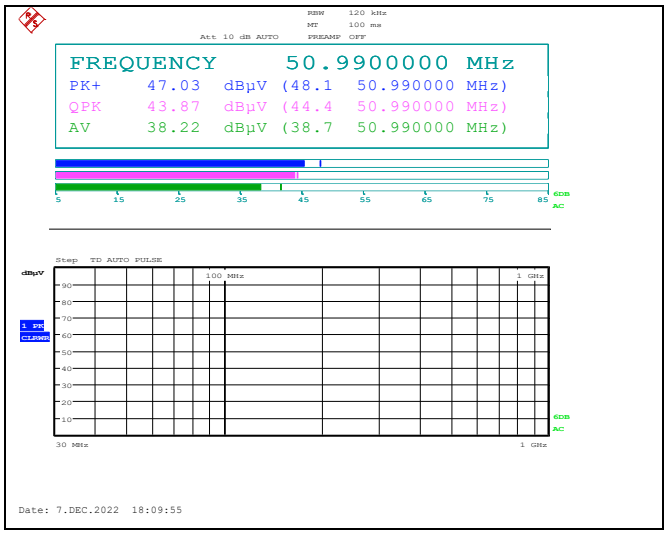
Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP + CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
50.99	44.40	Quasi Peak	V	19.70	-27.49	36.61	40.00	3.39
95.88	37.40	Peak	H	17.18	-27.17	27.41	43.50	16.09
119.81	47.20	Peak	H	16.04	-26.81	36.43	43.50	7.07
191.59	38.50	Peak	H	16.56	-26.45	28.61	43.50	14.89
287.25	38.90	Peak	H	18.95	-25.86	31.99	46.00	14.01
905.83	38.80	Peak	V	28.12	-25.49	41.43	46.00	4.57

Remark;

1. Spurious emissions for all channels were investigated and almost the same below 1 ㎓.
2. Reported spurious emissions are in **High channel** as worst case among other channels.
3. Radiated spurious emission measurement as below.
   (Actual = Reading + AF + AMP + CL)
4. According to §15.31(o), emission levels are not report much lower than the limits by over 20 ㏈.

- Test plots


[dB(uV/m)]
Level
Frequency
[MHz]
30,000
50,000
100,000
500,000
1000,000
<FCC Subpart C>
Limit(PK)
Limit(AV)
<New Data>
Spectrum(H,PK)
Spectrum(V,PK)
Suspected Item(H)
Suspected Item(V)


FREQUENCY 50.9900000 MHz
PK+ 47.03 dBµV (48.1 50.990000 MHz)
QPK 43.87 dBµV (44.4 50.990000 MHz)
AV 38.22 dBµV (38.7 50.990000 MHz)
Date: 7.DEC.2022 18:09:55

2.4.3. Radiated Spurious Emission above 1 000 ㎒

The frequency spectrum above 1 000 ㎒ was investigated. All reading values are peak and average values.

Low Channel (2 430 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2 310.00	18.69	Peak	H	27.80	6.37	52.86	74.00	21.14
2 310.00	7.75	Average	H	27.80	6.37	41.92	54.00	12.08
2 378.54	20.77	Peak	H	27.97	6.53	55.27	74.00	18.73
2 381.06	8.81	Average	H	27.99	6.55	43.35	54.00	10.65
2 400.00	18.24	Peak	H	28.10	6.71	53.05	74.00	20.95
2 400.00	7.93	Average	H	28.10	6.71	42.74	54.00	11.26

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
4 860.87	59.94	Peak	H	32.82	-35.67	57.09	74.00	16.91
4 860.40	50.67	Average	H	32.82	-35.67	47.82	54.00	6.18
Above 4 900.00	Not detected	-	-	-	-	-	-	-

Middle Channel (2 444 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
4 888.77	61.15	Peak	H	32.88	-35.65	58.38	74.00	15.62
4 887.92	51.02	Average	H	32.88	-35.65	48.25	54.00	5.75
Above 4 900.00	Not detected	-	-	-	-	-	-	-

High Channel (2 460 ㎒)

Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
2 483.50	20.63	Peak	H	28.13	6.35	55.11	74.00	18.89
2 483.50	8.19	Average	H	28.13	6.35	42.67	54.00	11.33
2 492.09	24.13	Peak	H	28.12	6.34	58.59	74.00	15.41
2 492.26	12.31	Average	H	28.12	6.34	46.77	54.00	7.23
2 500.00	18.97	Peak	H	28.10	6.32	53.39	74.00	20.61
2 500.00	8.10	Average	H	28.10	6.32	42.52	54.00	11.48

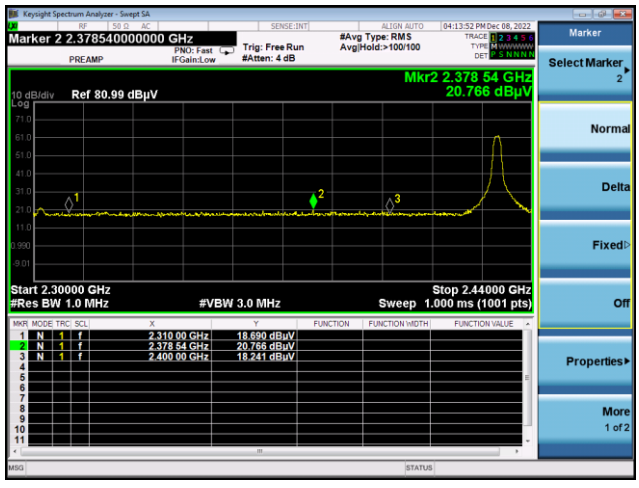
Radiated Emissions			Ant.	Correction Factors		Total	Limit	
Frequency (㎒)	Reading (dB㎶)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
4 920.89	63.71	Peak	H	32.94	-35.71	60.94	74.00	13.06
4 920.47	53.49	Average	H	32.94	-35.71	**50.72**	54.00	3.28
Above 5 000.00	Not detected	-	-	-	-	-	-	-

Remarks;

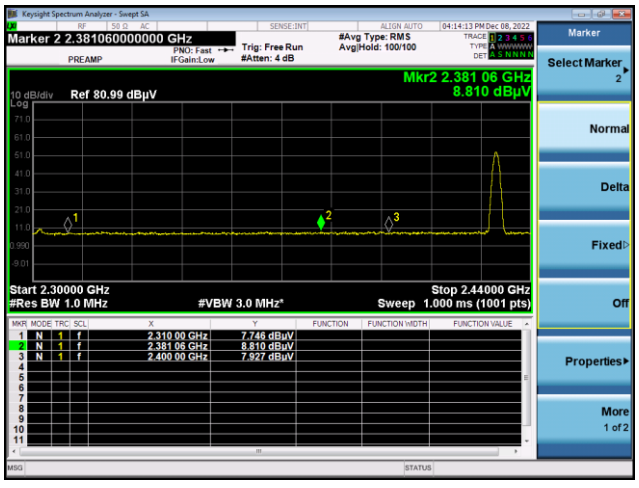
1. Measuring frequencies from 1 ㎓ to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1 000 ㎒ were made with an instrument using peak/average detector mode.
3. Actual = Reading + AF + CL or Reading + AF + AMP + CL.
4. According to § 15.31(o), emission levels are not reported much lower than the limits by over 20 ㏈.
5. The maximized peak measured value complies with the average limit, to perform an average measurement is unnecessary.
6. AF = Antenna Factor, CL = Cable Loss.

- Test plots

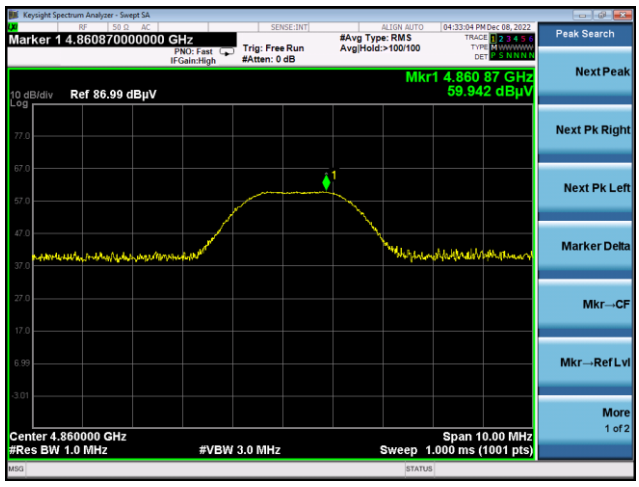
Low channel band edge (Peak)



Low channel band edge (Average)

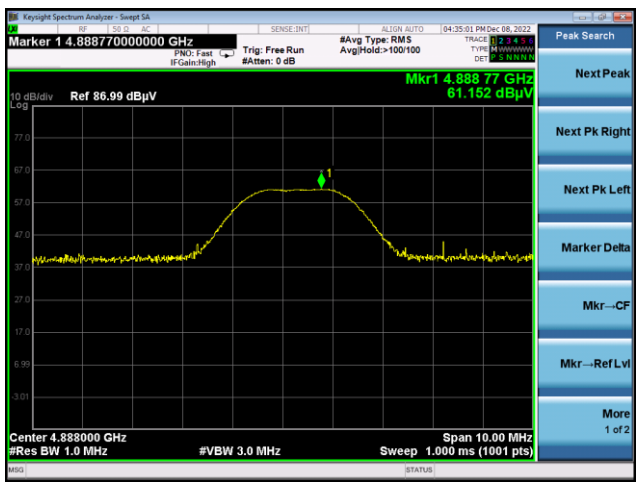


Low channel 2nd Harmonic (Peak)

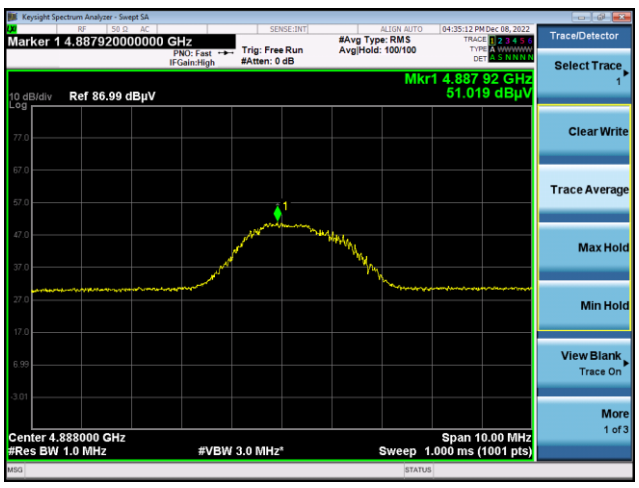


Low channel 2nd Harmonic (Average)

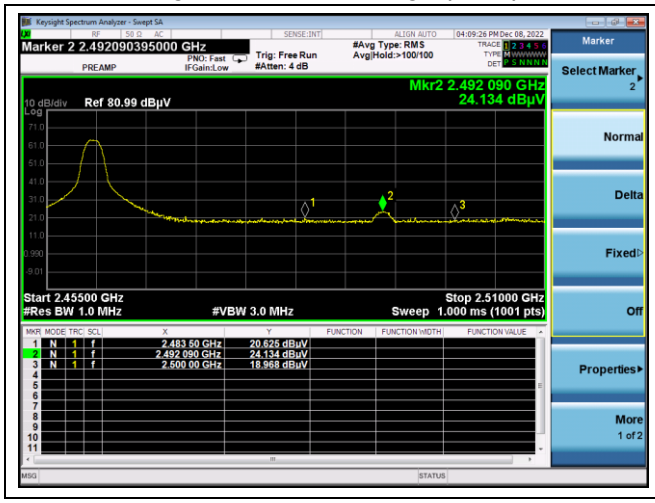
Middle channel 2nd Harmonic (Peak)



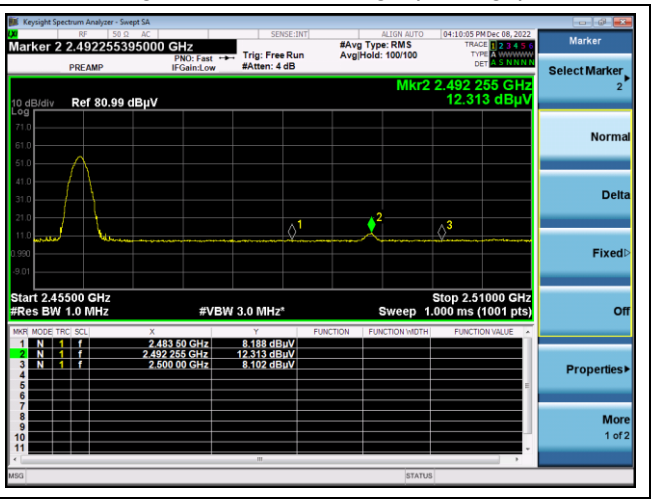
Middle channel 2nd Harmonic (Average)



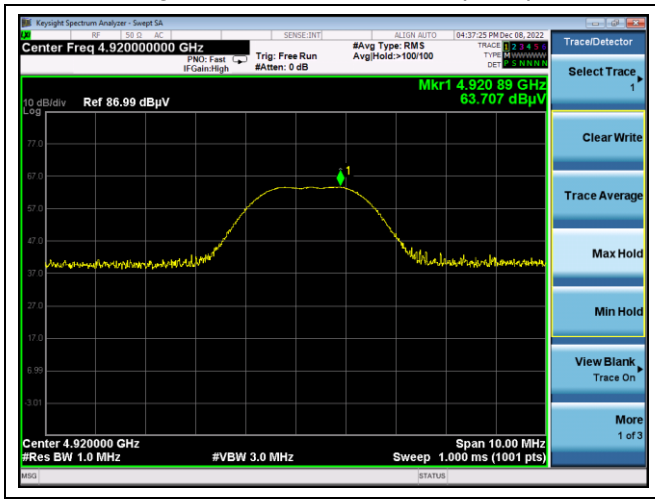
High channel band edge (Peak)



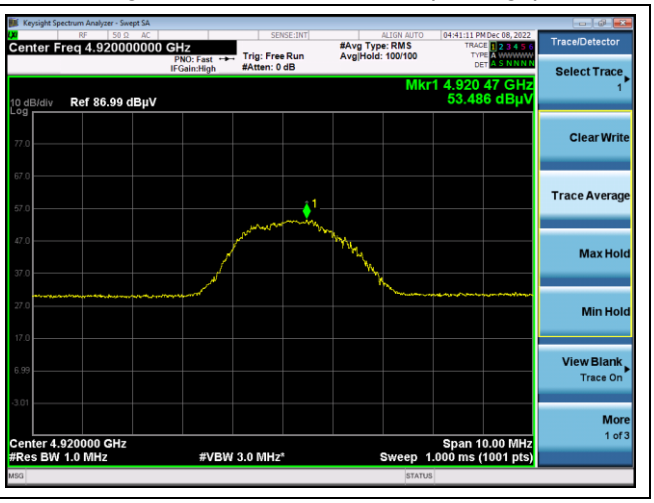
High channel band edge (Average)



High channel 2nd Harmonic (Peak)



High channel 2nd Harmonic (Average)



3. 20 ㏈ Bandwidth

3.1. Test Setup

3.2. Limit

Limit: Not Applicable

3.3. Test Procedure

The test follows ANSI C63.10-2013.

The 20 ㏈ bandwidth was measured with a spectrum analyzer connected to RF antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency.

Use the following spectrum analyzer setting:

Span = approximately 2 to 5 times the 20 ㏈ bandwidth.
RBW ≥ 1 % to 5 % of the 20 ㏈ bandwidth.
VBW ≥ 3 x RBW
Sweep = auto
Detector = peak
Trace = max hold

The marker-to-peak function to set the mark to the peak of the emission. Use the marker-delta function to measure 20 ㏈ down one side of the emission. Reset the function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is 20 ㏈ bandwidth of the emission.

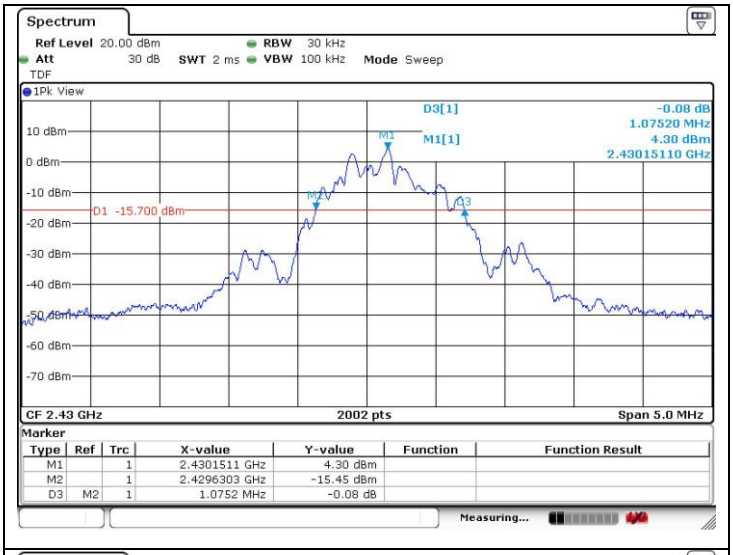
3.4. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

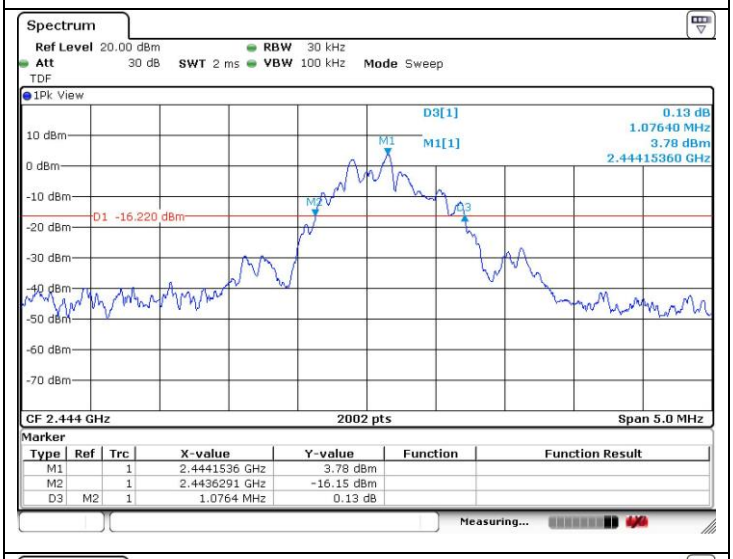
Channel	Frequency (㎒)	20 ㏈ Bandwidth (㎒)
Low	2 430	1.075
Middle	2 444	1.076
High	2 460	1.079

- Test plots

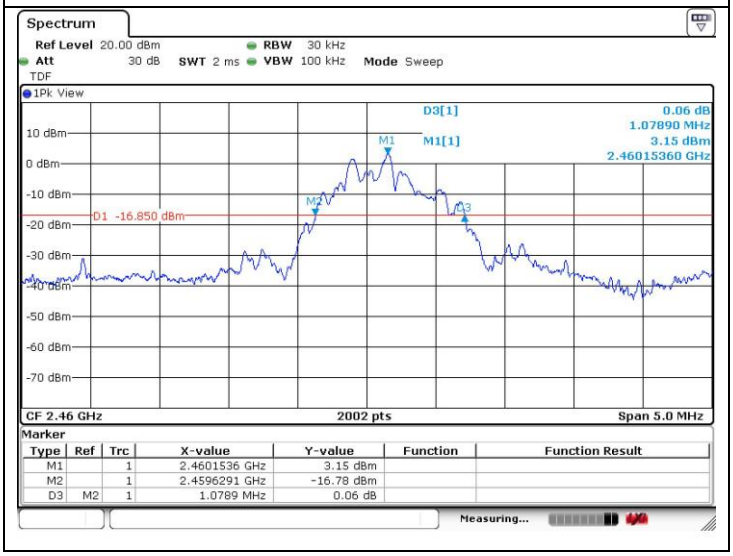
Low Channel



Middle Channel



High Channel



4. Antenna Requirement

4.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. 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.

4.2. Antenna Connected Construction

Antenna used in this product is PCB Pattern Antenna with gain of 1.22 dBi.

- End of the Test Report -