

FCC PART 15C TEST REPORT FOR CERTIFICATION On Behalf of

Korg Inc

BASE

Model Number: WH-L1B

FCC ID: KIJ-WHL1B

Applicant :	Korg Inc
Address:	4015-2 Yanokuchi, Inagi-City, Tokyo, 206-0812 Japan
Prepared By:	EST Technology Co., Ltd.
	Chilingxiang, Qishantou, Santun, Houjie, Dongguan, Guangdong, China
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Report Number:	ESTE-R2406299
Date of Test:	Jun. 12~ Jun. 28, 2024
Date of Report:	Jun. 29, 2024

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Applicant: Korg Inc
Address: 4015-2 Yanokuchi, Inagi-City, Tokyo, 206-0812 Japan

Manufacturer: Korg Inc
Address: 4015-2 Yanokuchi, Inagi-City, Tokyo, 206-0812 Japan

Factory: DONGGUAN TRISTAR ELECTRONIC CO.,LTD.
Address: Building 1 & Building 2, No.196, Tangxia Dongxing Road,
Tangxia Town, Dongguan City, Guangdong Province, China

E.U.T: BASE

Model Number: WH-L1B

Power Supply: DC 12V

Trade Name: KORG **Serial No.:** -----

Date of Receipt: May. 06, 2024 **Date of Test:** Jun. 12~ Jun. 28, 2024

Test Specification: FCC Part 15 Subpart C (15.247)
ANSI C63.10:2013
FCC KDB 558074 D01 15.247 Meas Guidance v05r02

Test Result: The device described above is tested by EST Technology Co., Ltd. The measurement results were contained in this test report and EST Technology Co., Ltd. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with the FCC Rules and Regulations Part 15 Subpart C requirements.

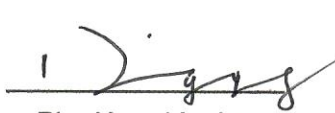
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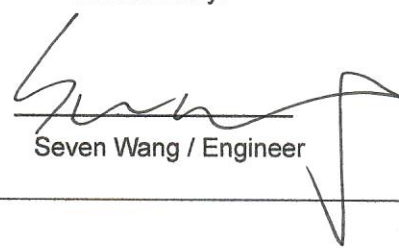
Prepared by:

Reviewed by:

Date: Jun. 29, 2024

Approved by:


Ring Yang / Assistant


Seven Wang / Engineer


Iceman Hu / Manager

Other Aspects:
None.

Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested

This test report is based on a single evaluation of one sample of above mentioned products ,It is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd.

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

Product Name	:	BASE
Model Number	:	WH-L1B
Software Version	:	N/A
Hardware Version	:	N/A
Operation frequency	:	2405.889MHz~ 2473.985 MHz
Number of channel	:	20
Max Output Power (PEAK)	:	14.78dBm
Modulation Type	:	GFSK
Sample Type	:	Prototype production

Note: For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

1.2. Antenna Information

Ant No.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	-	-	PCB	-	1.59

Note:

- 1.The antenna gain is declared by the customer and the laboratory is not responsible for the accuracy of the antenna gain.
- 2.The test results of this report only apply to the sample as received.

1.3. Information of RF Cable

Cable Loss(dB)	Provided by
1.0	Korg Inc

Note:

- 1.The customer declared the loss value of the RF Cable. and the test results of this report only apply to the sample as received.
- 2.The laboratory is not responsible for the accuracy of the cable loss.

2.SUMMARY OF TEST

2.1.Summary of test result

No.	Description of Test Item	FCC Standard Section	Results
1	Maximum Peak Output Power	15.247(a)(1)	PASS
2	20dB Bandwidth	15.247(a)(1)	PASS
3	Carrier Frequency Separation	15.247(a)(1)	PASS
4	Number Of Hopping Channel	15.247(a)(1)(iii)	PASS
5	Dwell Time	15.247(a)(1)(iii)	PASS
6	Conducted Band Edge	15.247(d)	PASS
7	Conducted Spurious Emissions	15.247(d)	PASS
8	Radiated Spurious Emissions and Band Edge	15.205 15.209 15.247(d)	PASS
9	AC Power Line Conducted Emissions	15.207	N/A
10	Antenna Requirement	15.203	PASS

Note:"N/A" denotes test is not applicable in this test report.

2.2. Test Facilities

EMC Lab : Accredited by CNAS, CHINA
Registration No.: L5288
This Accreditation is valid until: November 12, 2029

Recognized by FCC, USA
Designation Number: CN1215
This Recognition is valid until: January 31, 2026

Accredited by A2LA, USA
Registration No.: 4366.01
This Accreditation is valid until: January 31, 2026

Recognized by Industry Canada
CAB identifier No.: CN0035
This Recognition is valid until: January 31, 2026

Recognized by VCCI, Japan
Registration No.: C-14103; T-20073; R-13663;
R-20103; G-20097
Date of registration: Apr. 20, 2020
This Recognition is valid until: Apr. 19, 2026

Recognized by TUV Rheinland, Germany
Registration No.: UA 50413872 0001
Date of registration: July 31, 2018

Recognized by Intertek
Registration No.: 2011-RTL-L2-64
Date of registration: November 08, 2018

Name of Firm : EST Technology Co., Ltd.

Site Location : Chilingxiang, Qishantou, Santun, Houjie, Dongguan,
Guangdong, China

2.3.Measurement uncertainty

Test Item	Uncertainty
Uncertainty for Conduction emission test	±3.48dB
Uncertainty for spurious emissions test (Below 30MHz)	±1.62 dB
Uncertainty for spurious emissions test (30MHz-1GHz)	±4.60 dB(Polarize: H)
	±4.68 dB(Polarize: V)
Uncertainty for spurious emissions test (1GHz to 25GHz)	±4.96dB
Uncertainty for radio frequency	7×10^{-8}
Uncertainty for conducted RF Power	1.08dB
Uncertainty for Power density test	0.26dB

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

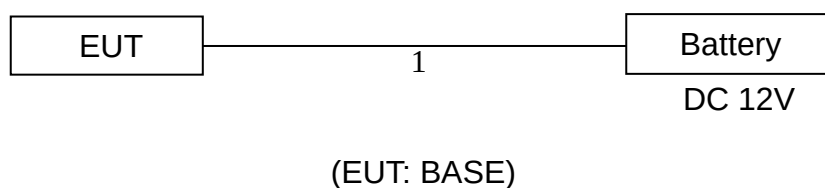
2.4.Assistant equipment used for test

Item	Equipment	Brand	Model Name/Type No.	FCC ID	Series No.
-	-	-	-	-	-

Item	Shielded Type	Ferrite Core	Length	Note
1	NO	NO	1.0m	DC Cable

2.5.Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 (or 1.5) meter high above ground. EUT was beset into Bluetooth test mode by software before test.



2.6. Test mode

Combining all the rates, modulations, and packet types, the Pre-scans had been carried out. The worst case test mode was selected for the final test as listed below.

Test Item	Modulation Type	Operating Mode	Test Channel
Maximum Peak Output Power	GFSK	Non Hopping	Low/Middle/High
20dB Bandwidth	GFSK	Non Hopping	Low/Middle/High
Carrier Frequency Separation	GFSK	Hopping	Low/Middle/High
Number Of Hopping Channel	GFSK	Hopping	All Channel Hopping
Dwell Time	GFSK	Hopping	Middle(All Channel Hopping)
Conducted Band Edge	GFSK	Non Hopping&Hopping	Low/ High& All Channel Hopping
Conducted Spurious Emissions	GFSK	Non Hopping	Low/Middle/High
Radiated Spurious Emissions (Below 1GHz)	GFSK	Non Hopping	Low/Middle/High
Radiated Spurious Emissions (Above 1GHz)	GFSK	Non Hopping	Low/Middle/High
Radiated Band Edge	GFSK	Non Hopping	Low/High

Note: In radiated measurement, the EUT had been pre-scan on the positioned of each 3 axis(X,Y,Z), the worst case was found when positioned on **X-plane**.

2.7.Channel List

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2405.889	11	2441.729
2	2409.473	12	2445.313
3	2413.057	13	2448.897
4	2416.641	14	2452.481
5	2420.225	15	2456.065
6	2423.809	16	2459.649
7	2427.393	17	2463.233
8	2430.977	18	2466.817
9	2434.561	19	2470.401
10	2438.145	20	2473.985

2.8.Power Setting of Test Software

Software Name	A8102_FCC_CE.exe		
Frequency(MHz)	2405.889	2441.729	2473.985
GFSK Setting	14	14	14

Note: This information is provided by the applicant.

2.9. Test Equipment

For radiated emission test(9 kHz-30MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESR7	EST-E047	LISAI	Jun. 11, 2024	Jun. 10, 2025
Active Loop Antenna	SCHWABE BECK	FMZB 1519B	EST-E054	LISAI	Jun. 11, 2024	Jun. 10, 2025
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
9kHz-30MHz Cable	N/A	EST-001	N/A	N/A	N/A	N/A

For radiated emissions test (30-1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESR7	EST-E047	LISAI	Jun. 11, 2024	Jun. 10, 2025
Bilog Antenna	Teseq	CBL 6111D	EST-E034	LISAI	Jun. 11, 2024	Jun. 10, 2025
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
30-1000MHz Cable	N/A	EST-002	N/A	N/A	N/A	N/A

For radiated emission test(Above 1000MHz)						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
Horn Antenna	SCHWARZBECK	BBHA9120D	EST-E144	LISAI	Jun. 11, 2024	Jun. 10, 2025
Horn Antenna	Com-Power	AHA-840	EST-E133	LISAI	Jun. 11, 2024	Jun. 10, 2025
Low Noise Amplifier	RF	TRLA-010180G 45N	EST-E142	LISAI	Jun. 11, 2024	Jun. 10, 2025
Spectrum Analyzer	Rohde & Schwarz	FSV40	EST-E069	LISAI	Jun. 11, 2024	Jun. 10, 2025
Test Software	Audix	e3-6.111221a	N/A	N/A	N/A	N/A
Above 1GHz Cable	N/A	EST-003	N/A	N/A	N/A	N/A

For connect EUT antenna terminal test						
Equipment	Manufacturer	Model No.	Serial No.	Calibration Body	Last Cal.	Next Cal.
TS 1120	Tonscend	/	/	/	/	/
Test Software	Tonscend	TS1120-3	3.3.38	/	/	/
RF Control Unit	Tonscend	JS0806-2	EST-E134	LISAI	Jun. 11, 2024	Jun. 10, 2025
Signal and Spectrum Analyzer	Keysight	N9010B	EST-E141	LISAI	Jun. 11, 2024	Jun. 10, 2025

3. MAXIMUM PEAK OUTPUT POWER

3.1. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

3.2. Test Setup



3.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	5MHz
VBW	5MHz
Span	25MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

3.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 3.3.
- Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
- Allow trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission.
- Repeat above procedures until all channels and test modes were measured.
- Record the results in the test report.

3.5. Test Result

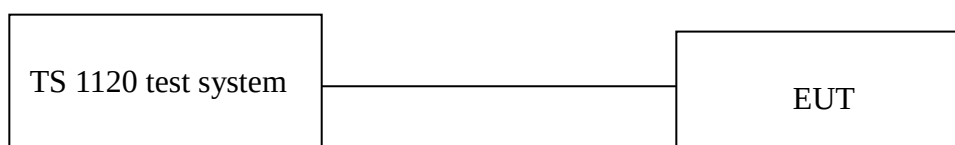
Refer to section 12: Appendix B

4.20 DB BANDWIDTH

4.1.Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

4.2.Test Setup



4.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Span	10MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

4.4.Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 4.3.
- Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
- Allow trace to stabilize, use the ndB down function to measure 20dB Bandwidth.
- Repeat above procedures until all channels and test modes were measured.
- Record the results in the test report.

4.5.Test Result

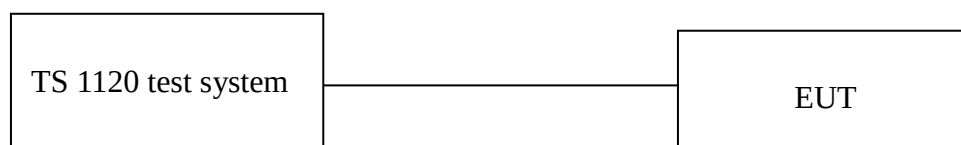
Refer to section 12: Appendix A

5. CARRIER FREQUENCY SEPARATION

5.1. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

5.2. Test Setup



5.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Span	10MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

5.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 5.3.
- Set the EUT transmit continuously with maximum output power in all channel hopping mode.
- Allow trace to stabilize, use the marker-delta function to measure channel separation between two adjacent channels.
- Repeat above procedures until all channels and test modes were measured.
- Record the results in the test report.

5.5. Test Result

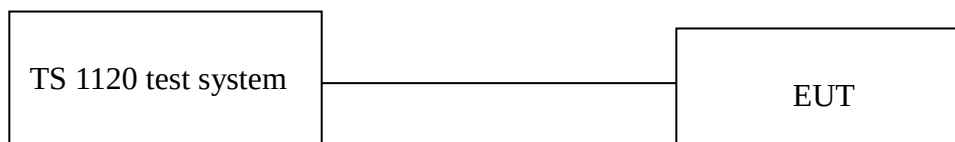
Refer to section 12: Appendix C

6. NUMBER OF HOPPING CHANNEL

6.1. Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels

6.2. Test Setup



6.3. Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	1MHz
VBW	1MHz
Start frequency	2400MHz
Stop frequency	2483.5MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

6.4. Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 6.3.
- Set the EUT transmit continuously with maximum output power in all channel hopping mode.
- Allow trace to stabilize, use the marker-peak function to mark the first and last frequency hopping channel.
- Repeat above procedures until all test modes were measured.
- Record the results in the test report.

6.5. Test Result

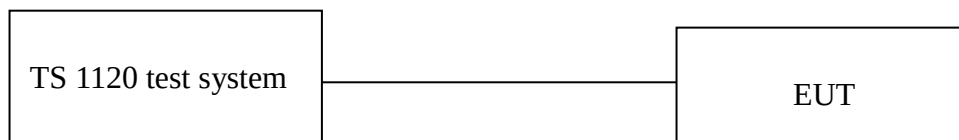
Refer to section 12: Appendix E

7.DWELL TIME

7.1.Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

7.2.Test Setup



7.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	1MHz
VBW	1MHz
Span	Zero
Detector	Peak
Sweep Time	2.5ms(DH1)/10ms(DH3)/20ms(DH5)
Sweep Mode	Single Sweep

7.4.Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 7.3.
- Set the EUT transmit continuously with maximum output power in all channel hopping mode.
- Allow trace to stabilize, use the marker-delta function to measure single pulse duration.
- Repeat above procedures until all test modes were measured.
- Record the results in the test report.

7.5.Test Result

Refer to section 12: Appendix D

8.CONDUCTED BAND EDGE

8.1.Limit

In any 100 kHz 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 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

8.2.Test Setup



8.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Span	100MHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

8.4.Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 8.3.
- Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
- Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
- Repeat above procedures until all channels and test modes were measured(including frequency hopping off and frequency hopping on).
- Record the results in the test report.

8.5.Test Result

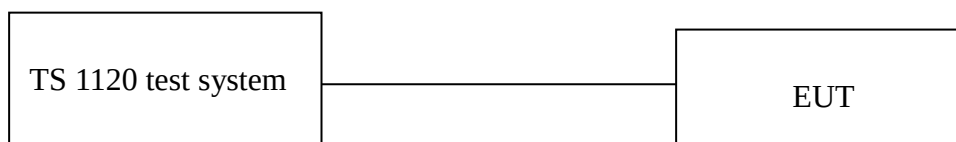
Refer to section 12: Appendix F & H

9.CONDUCTED SPURIOUS EMISSIONS

9.1.Limit

In any 100 kHz 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 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

9.2.Test Setup



9.3.Spectrum Analyzer Setting

Spectrum Parameters	Setting
RBW	100KHz
VBW	300KHz
Start frequency	30MHz
Stop frequency	26.5GHz
Sweep Time	Auto
Detector	Peak
Trace Mode	Max Hold

9.4.Test Procedure

- Connect EUT antenna terminal to the spectrum analyzer with RF cable.
- Spectrum analyzer setting parameters in accordance with section 9.3.
- Set the EUT transmit continuously with maximum output power over fixed single hopping channel.
- Allow trace to stabilize, use the marker function to mark the highest emission level outside the authorized band.
- Repeat above procedures until all channels and test modes were measured.
- Record the results in the test report.

9.5.Test Result

Refer to section 12: Appendix G & H

10. RADIATED SPURIOUS EMISSIONS AND BAND EDGE

10.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 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	(²)

15.209 Limit

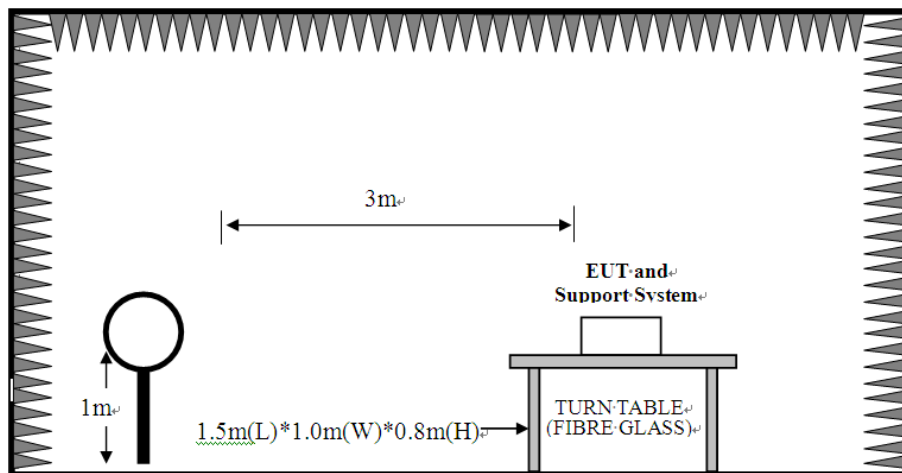
Frequency (MHz)	Field Strength(μ V/m)	Distance(m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

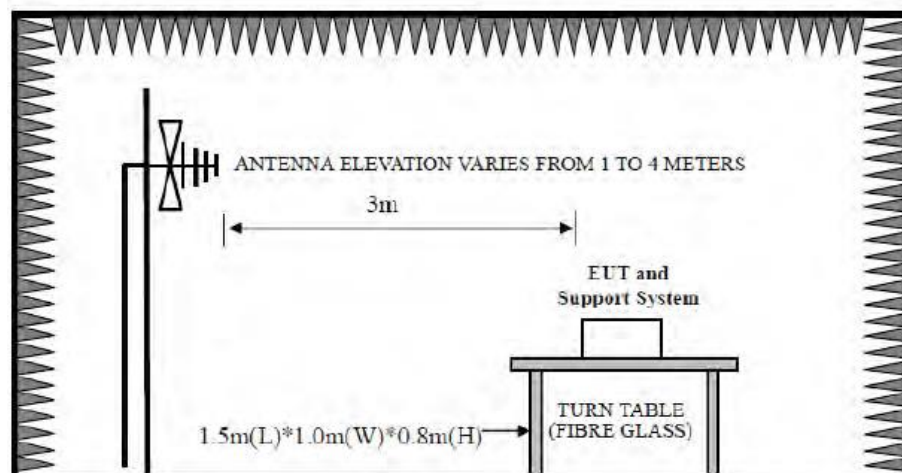
- (1) Emission level $\text{dB}\mu\text{V} = 20 \log \text{Emission level } \mu\text{V/m}$.
- (2) The smaller limit shall apply at the cross point between two frequency bands.
- (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

10.2. Test Setup

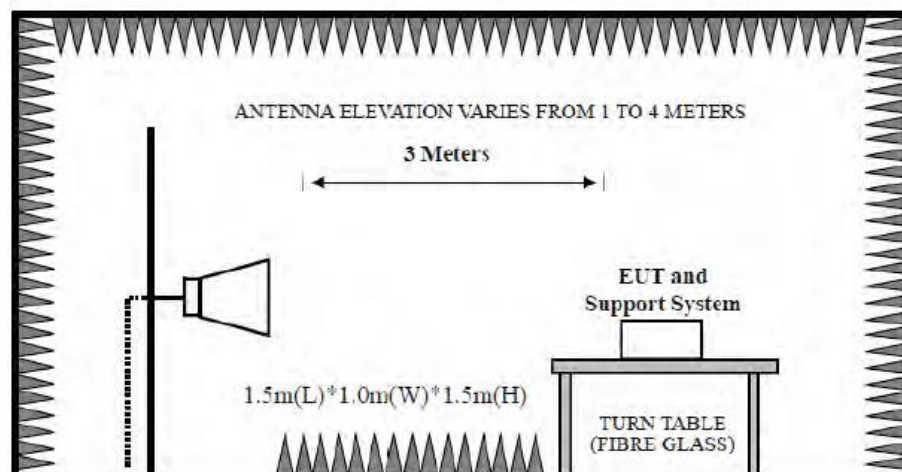
9kHz~30MHz



30~1000MHz



Above 1GHz



10.3. Spectrum Analyzer Setting

For 9KHz-150KHz

Spectrum Parameters	Setting
RBW	300Hz(for Peak&AVG)/CISPR 200Hz(for QP)
VBW	300Hz(for Peak&AVG)/CISPR 200Hz(for QP)
Start frequency	9KHz
Stop frequency	150KHz
Sweep Time	Auto
Detector	PEAK/QP/AVG
Trace Mode	Max Hold

For 150KHz-30MHz

Spectrum Parameters	Setting
RBW	9KHz
VBW	9KHz
Start frequency	150KHz
Stop frequency	30MHz
Sweep Time	Auto
Detector	QP
Trace Mode	Max Hold

For 30MHz-1GHz

Spectrum Parameters	Setting
RBW	120KHz
VBW	300KHz
Start frequency	30MHz
Stop frequency	1GHz
Sweep Time	Auto
Detector	QP
Trace Mode	Max Hold

For Above 1GHz

Spectrum Parameters	Setting	
RBW	1MHz	
VBW	PEAK Measurement	AVG Measurement
	3MHz	Duty cycle $\geq$ 98%,VBW=10Hz Duty cycle<98%,VBW $\geq$ 1/T
Start frequency	1GHz	
Stop frequency	25GHz	
Sweep Time	Auto	
Detector	PEAK	
Trace Mode	Max Hold	

10.4. Test Procedure

- a. EUT was placed on a turn table, which is 0.8 meter high above ground for below 1GHz test, and which is 1.5 meter high above ground for above 1GHz test.
- b. EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower.
- c. Set the EUT transmit continuously with maximum output power.
- d. The turn table can rotate 360 degrees to determine the position of the maximum emission level.
- e. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.
- f. Spectrum analyzer setting parameters in accordance with section 10.3.
- g. Repeat above procedures until all channels and test modes were measured.
- h. Record the results in the test report.

Note:

1. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
2. The frequency 2402MHz ,2441MHz and 2480MHz is fundamental frequency which no limit, the limit on plots is automatically generated by the software, it's not fundamental limit, we can't remove it.

10.5. Test Result

Radiated Emissions Below 1GHz

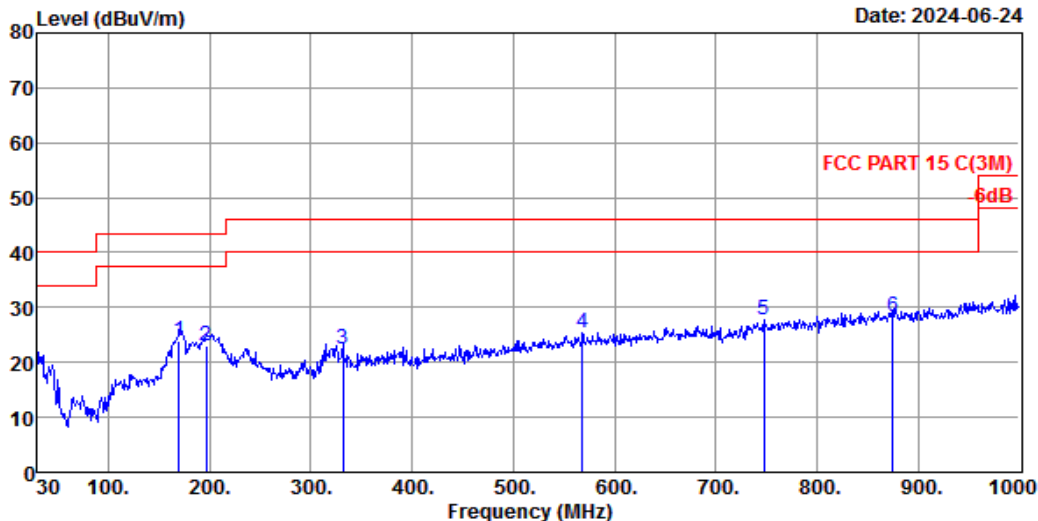
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Data: 47

File: E:\5#966\RF\Ting Feng\WH-L1B.EM6 (52)

Date: 2024-06-24



Site no. : 5# 966 Chamber Data no. : 47
Dis. / Ant. : 3m 54681 Ant. pol. : VERTICAL
Limit : FCC PART 15 C(3M)
Env. / Ins. : Temp:23.8°C :Humi:54%: Press:101.1kPa
Engineer : Aikun
EUT : BASE
Power : DC 12V From Battery
M/N : WH-L1B
Test Mode : TX Mode

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	169.68	10.60	2.02	11.39	24.01	43.50	19.49	QP
2	196.84	9.58	2.23	11.34	23.15	43.50	20.35	QP
3	331.67	14.27	3.18	4.97	22.42	46.00	23.58	QP
4	568.35	19.38	4.21	1.87	25.46	46.00	20.54	QP
5	747.80	21.56	5.00	1.26	27.82	46.00	18.18	QP
6	874.87	22.70	5.55	0.02	28.27	46.00	17.73	QP

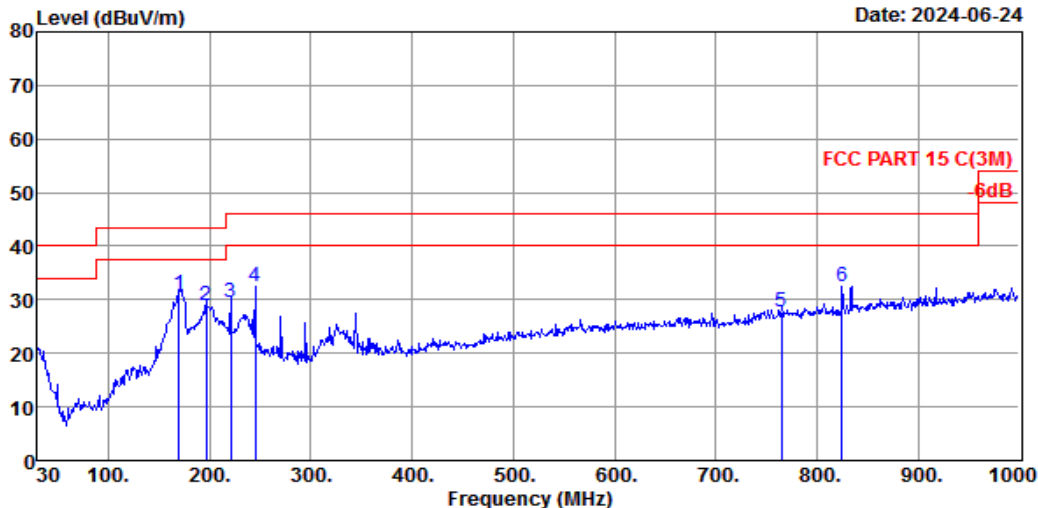
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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Data: 48 File: E:\5#966\RF\Ting Feng\WH-L1B.EM6 (52)

Date: 2024-06-24



Site no. : 5# 966 Chamber Data no. : 48
Dis. / Ant. : 3m 54681 Ant. pol. : HORIZONTAL
Limit : FCC PART 15 C(3M)
Env. / Ins. : Temp:23.8°C :Humi:54%: Press:101.1kPa
Engineer : Aikun
EUT : BASE
Power : DC 12V From Battery
M/N : WH-L1B
Test Mode : TX Mode

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	169.68	10.60	2.02	18.27	30.89	43.50	12.61	QP
2	196.84	9.58	2.23	17.20	29.01	43.50	14.49	QP
3	221.09	10.32	2.42	16.67	29.41	46.00	16.59	QP
4	245.34	12.80	2.61	17.06	32.47	46.00	13.53	QP
5	765.26	21.60	5.07	0.94	27.61	46.00	18.39	QP
6	824.43	21.95	5.33	5.28	32.56	46.00	13.44	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

Note:

1. The amplitude of 9KHz to 30MHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
2. All test mode had been pre-test, only the worst case was reported.

Radiated Emissions Above 1G

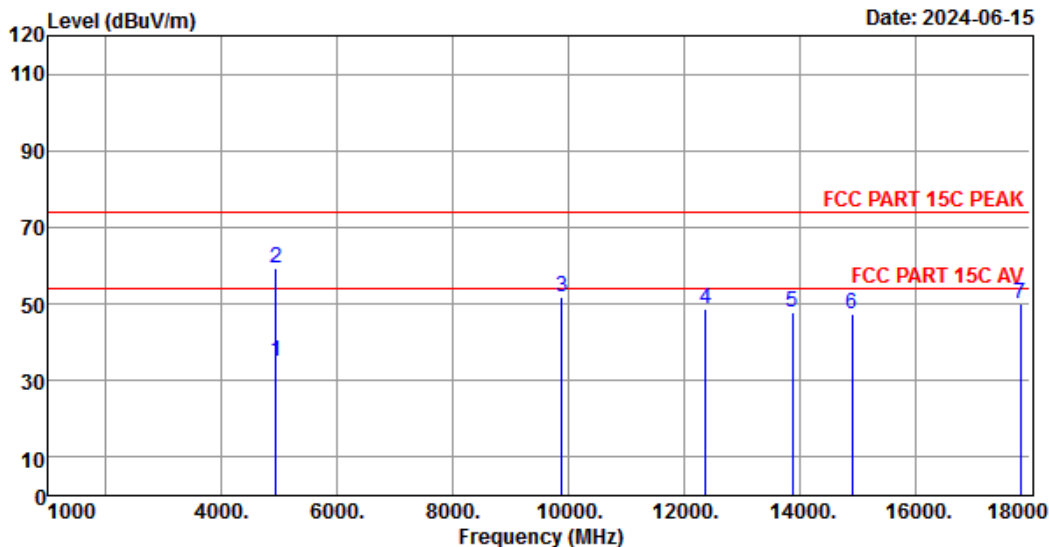
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Data: 31

File: E:\5#966\RF\Ting Feng\WH-L1B.EM6 (42)

Date: 2024-06-15



Site no. : 5# 966 Chamber Data no. : 31
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5°C;Humi:51%;Press:101.52kPa
Engineer : Aron
EUT : BASE
Power : DC 12V From Battery
M/N : WH-L1B
Test Mode : TX 2473.985MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4944.00	32.68	6.10	44.35	40.74	35.17	54.00	18.83	Average
2	4944.00	32.68	6.10	44.35	64.69	59.12	74.00	14.88	Peak
3	9891.00	38.18	8.94	43.76	48.23	51.59	74.00	22.41	Peak
4	12373.00	39.14	10.04	41.68	41.39	48.89	74.00	25.11	Peak
5	13886.00	39.97	10.61	40.80	38.19	47.97	74.00	26.03	Peak
6	14906.00	39.55	10.97	43.05	39.99	47.46	74.00	26.54	Peak
7	17830.00	41.04	12.08	42.95	39.78	49.95	74.00	24.05	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official
limit are not reported.

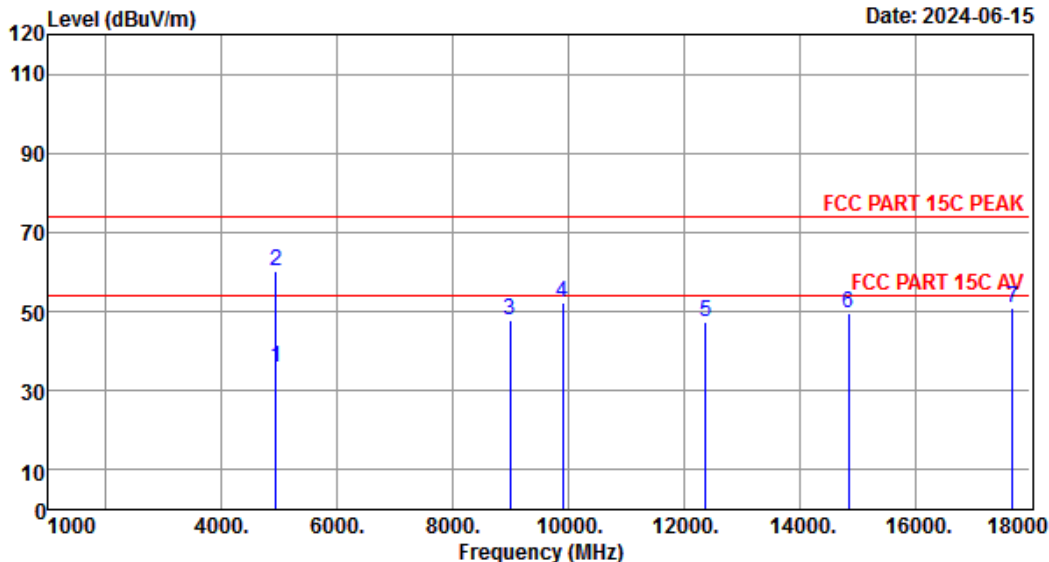
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Data: 32

File: E:\5#966\RF\Ting Feng\WH-L1B.EM6 (42)

Date: 2024-06-15



Site no. : 5# 966 Chamber Data no. : 32
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5°C;Humi:51%;Press:101.52kPa
Engineer : Aron
EUT : BASE
Power : DC 12V From Battery
M/N : WH-L1B
Test Mode : TX 2473.985MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4944.00	32.68	6.10	44.35	41.65	36.08	54.00	17.92	Average
2	4944.00	32.68	6.10	44.35	65.77	60.20	74.00	13.80	Peak
3	8990.00	37.99	8.47	43.41	44.84	47.89	74.00	26.11	Peak
4	9908.00	38.18	8.94	43.77	48.93	52.28	74.00	21.72	Peak
5	12373.00	39.14	10.04	41.68	39.99	47.49	74.00	26.51	Peak
6	14855.00	39.57	10.96	42.92	41.78	49.39	74.00	24.61	Peak
7	17694.00	40.59	12.02	43.16	41.30	50.75	74.00	23.25	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

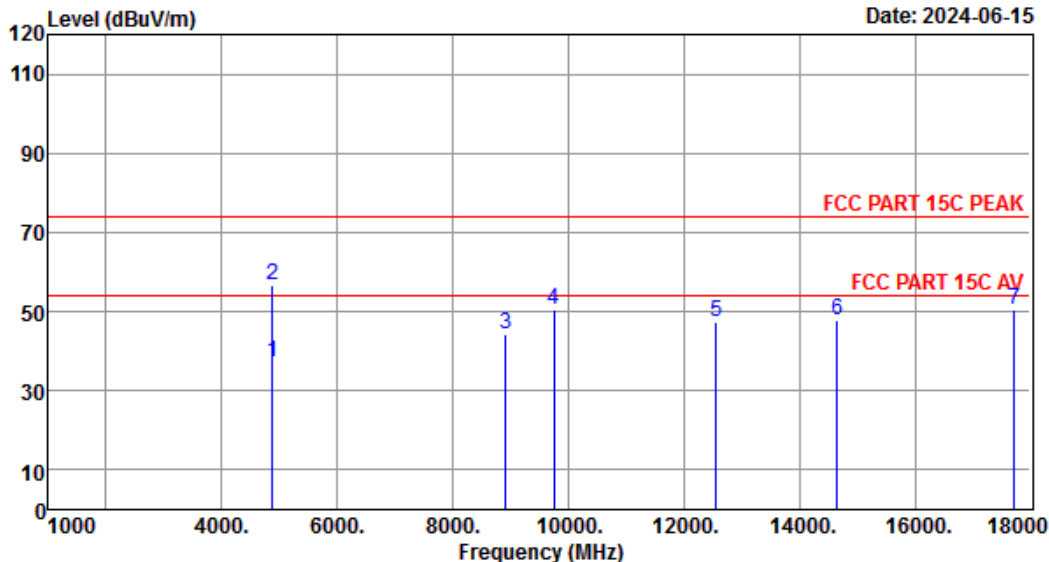
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Data: 33

File: E:\5#966\RF\Ting Feng\WH-L1B.EM6 (42)

Date: 2024-06-15



Site no. : 5# 966 Chamber Data no. : 33
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5°C;Humi:51%;Press:101.52kPa
Engineer : Aron
EUT : BASE
Power : DC 12V From Battery
M/N : WH-L1B
Test Mode : TX 2441.729MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4876.00	32.54	6.05	44.42	42.82	36.99	54.00	17.01	Average
2	4876.00	32.54	6.05	44.42	62.47	56.64	74.00	17.36	Peak
3	8922.00	37.91	8.42	43.45	41.38	44.26	74.00	29.74	Peak
4	9755.00	38.15	8.87	43.70	47.04	50.36	74.00	23.64	Peak
5	12560.00	39.30	10.11	41.42	39.24	47.23	74.00	26.77	Peak
6	14651.00	39.67	10.89	42.41	39.87	48.02	74.00	25.98	Peak
7	17728.00	40.70	12.04	43.11	40.81	50.44	74.00	23.56	Peak

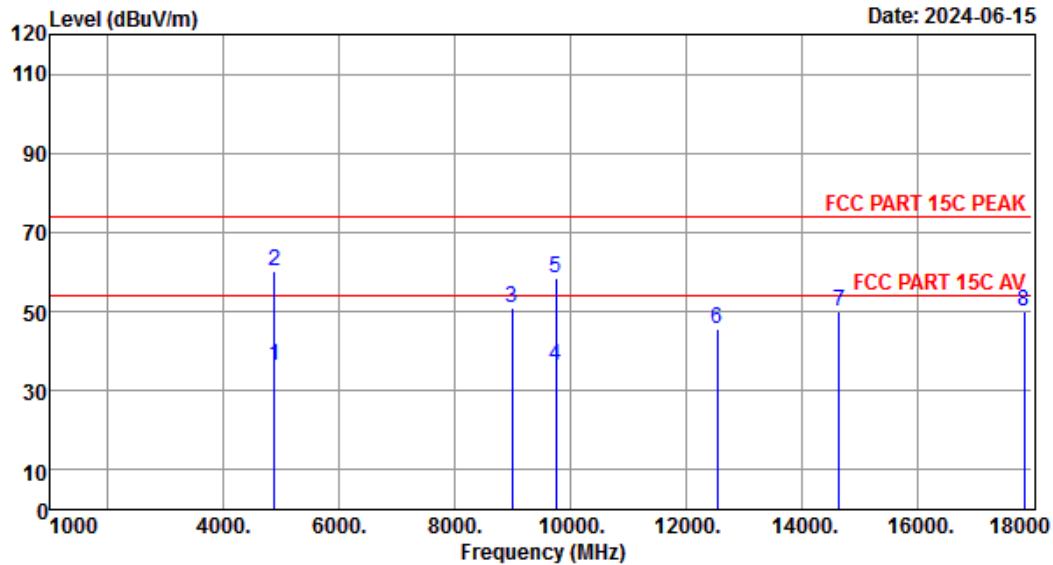
Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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Data: 34 File: E:\5#966\RF\Ting Feng\WH-L1B.EM6 (42)

Date: 2024-06-15



Site no. : 5# 966 Chamber Data no. : 34
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5°C;Humi:51%;Press:101.52kPa
Engineer : Aron
EUT : BASE
Power : DC 12V From Battery
M/N : WH-L1B
Test Mode : TX 2441.729MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4876.00	32.54	6.05	44.42	41.92	36.09	54.00	17.91	Average
2	4876.00	32.54	6.05	44.42	66.25	60.42	74.00	13.58	Peak
3	8990.00	37.99	8.47	43.41	47.94	50.99	74.00	23.01	Peak
4	9755.00	38.15	8.87	43.70	32.77	36.09	54.00	17.91	Average
5	9755.00	38.15	8.87	43.70	55.28	58.60	74.00	15.40	Peak
6	12543.00	39.29	10.11	41.44	37.71	45.67	74.00	28.33	Peak
7	14651.00	39.67	10.89	42.41	41.99	50.14	74.00	23.86	Peak
8	17864.00	41.15	12.08	42.90	39.71	50.04	74.00	23.96	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

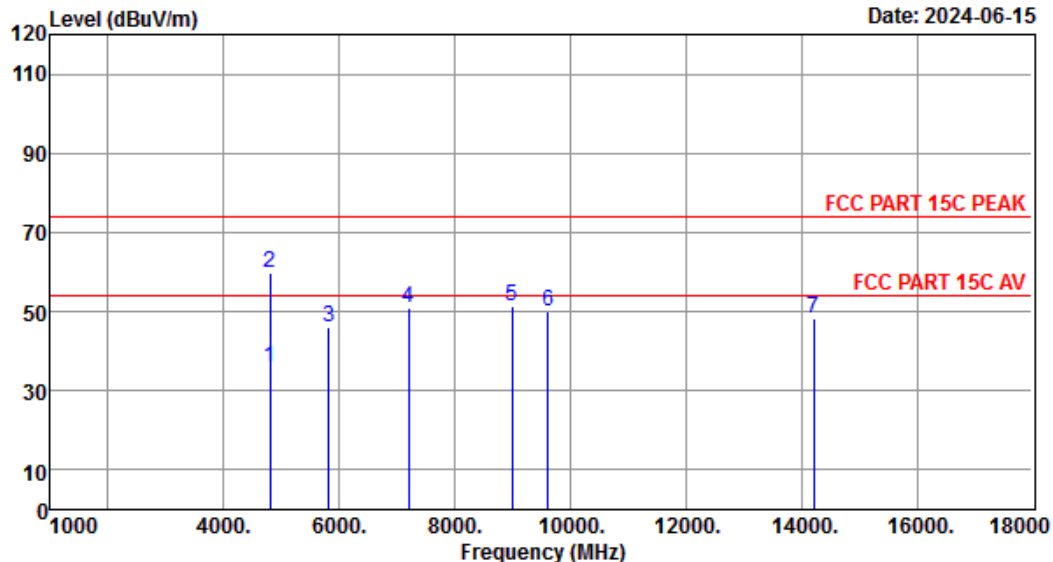
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Data: 35

File: E:\5#966\RF\Ting Feng\WH-L1B.EM6 (42)

Date: 2024-06-15



Site no. : 5# 966 Chamber Data no. : 35
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5°C;Humi:51%;Press:101.52kPa
Engineer : Aron
EUT : BASE
Power : DC 12V From Battery
M/N : WH-L1B
Test Mode : TX 2405.889MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4808.00	32.40	6.01	44.49	41.78	35.70	54.00	18.30	Average
2	4808.00	32.40	6.01	44.49	66.03	59.95	74.00	14.05	Peak
3	5811.00	33.69	6.65	44.14	49.94	46.14	74.00	27.86	Peak
4	7205.00	36.16	7.47	44.08	51.45	51.00	74.00	23.00	Peak
5	8990.00	37.99	8.47	43.41	48.10	51.15	74.00	22.85	Peak
6	9619.00	38.12	8.80	43.65	46.73	50.00	74.00	24.00	Peak
7	14209.00	39.90	10.73	41.31	39.01	48.33	74.00	25.67	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

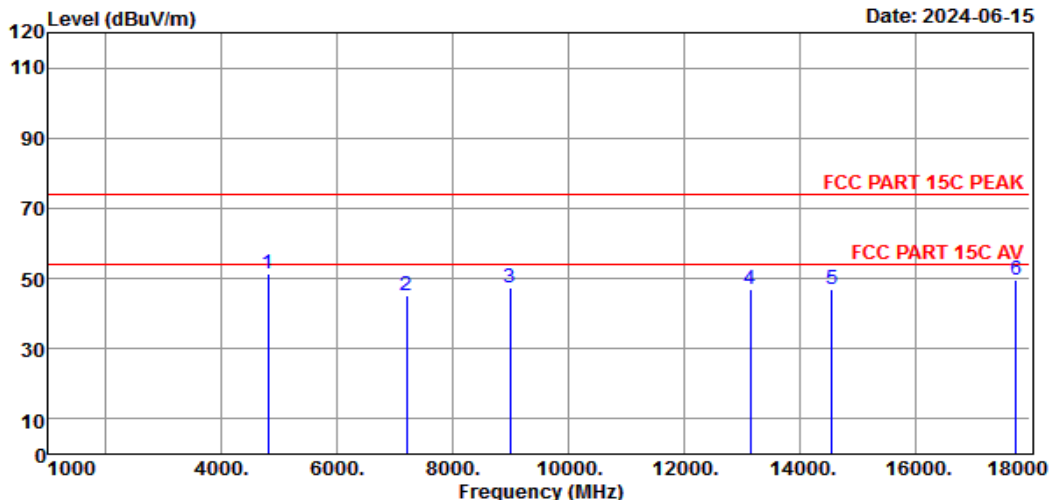
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Data: 36

File: E:\5#966\RF\T\Ting Feng\WH-L1B.EM6 (42)

Date: 2024-06-15



Site no. : 5# 966 Chamber Data no. : 36
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5°C;Humi:51%;Press:101.52kPa
Engineer : Aron
EUT : BASE
Power : DC 12V From Battery
M/N : WH-L1B
Test Mode : TX 2405.889MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	4808.00	32.40	6.01	44.49	57.27	51.19	74.00	22.81	Peak
2	7205.00	36.16	7.47	44.08	45.80	45.35	74.00	28.65	Peak
3	8990.00	37.99	8.47	43.41	44.38	47.43	74.00	26.57	Peak
4	13155.00	39.75	10.36	40.80	37.69	47.00	74.00	27.00	Peak
5	14566.00	39.72	10.86	42.20	38.64	47.02	74.00	26.98	Peak
6	17745.00	40.76	12.04	43.08	39.75	49.47	74.00	24.53	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

Note:

1. The amplitude of 18GHz to 25GHz spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
2. All test mode had been pre-test, only Low/Middle/High Channel of the worst case modulation mode was reported.

Radiated Band Edge

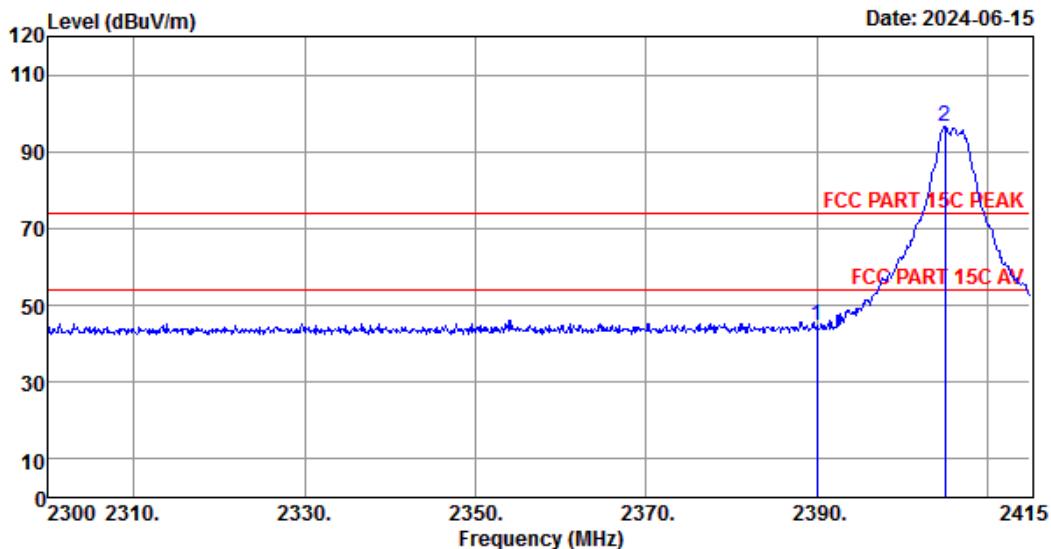
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Data: 1

File: E:\5#966\RF\Ting Feng\WH-L1B.EM6 (42)

Date: 2024-06-15



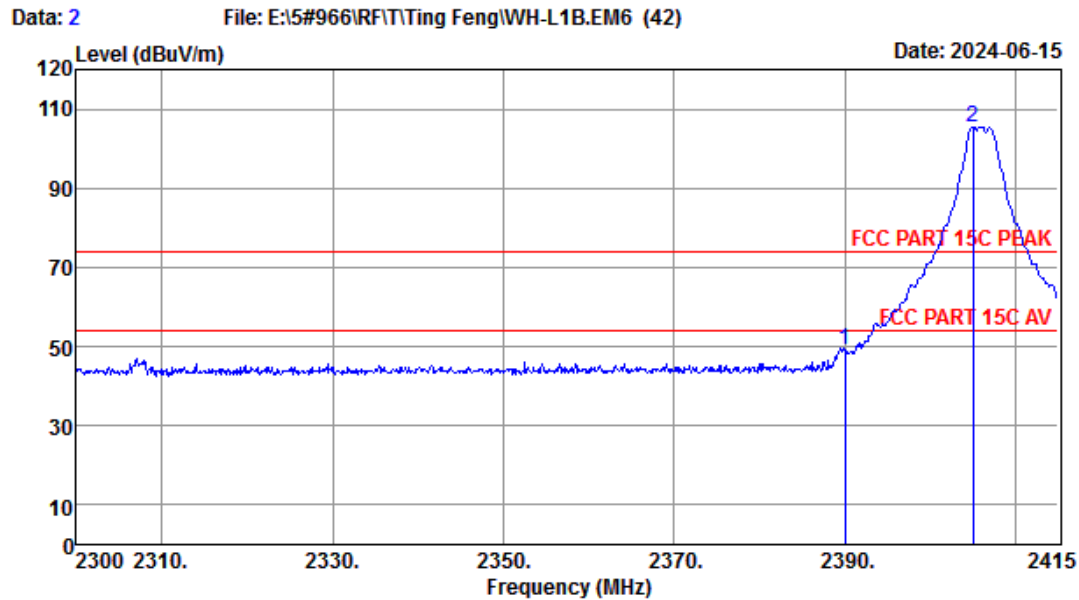
Site no. : 5# 966 Chamber Data no. : 1
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5°C;Humi:51%;Press:101.52kPa
Engineer : Aron
EUT : BASE
Power : DC 12V From Battery
M/N : WH-L1B
Test Mode : TX 2405.889MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.43	4.23	45.01	57.90	44.55	74.00	29.45	Peak
2	2405.00	27.47	4.24	44.99	109.63	96.35	74.00	-22.35	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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Site no. : 5# 966 Chamber Data no. : 2
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5°C;Humi:51%;Press:101.52kPa
Engineer : Aron
EUT : BASE
Power : DC 12V From Battery
M/N : WH-L1B
Test Mode : TX 2405.889MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.43	4.23	45.01	62.35	49.00	74.00	25.00	Peak
2	2405.00	27.47	4.24	44.99	118.78	105.50	74.00	-31.50	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

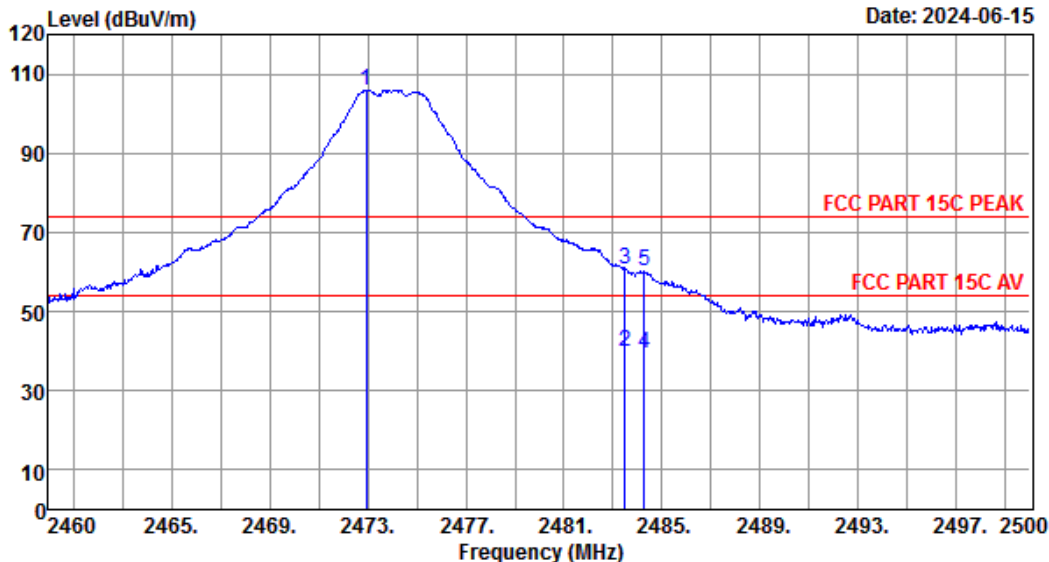
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Data: 3

File: E:\5#966\RF\Ting Feng\WH-L1B.EM6 (42)

Date: 2024-06-15



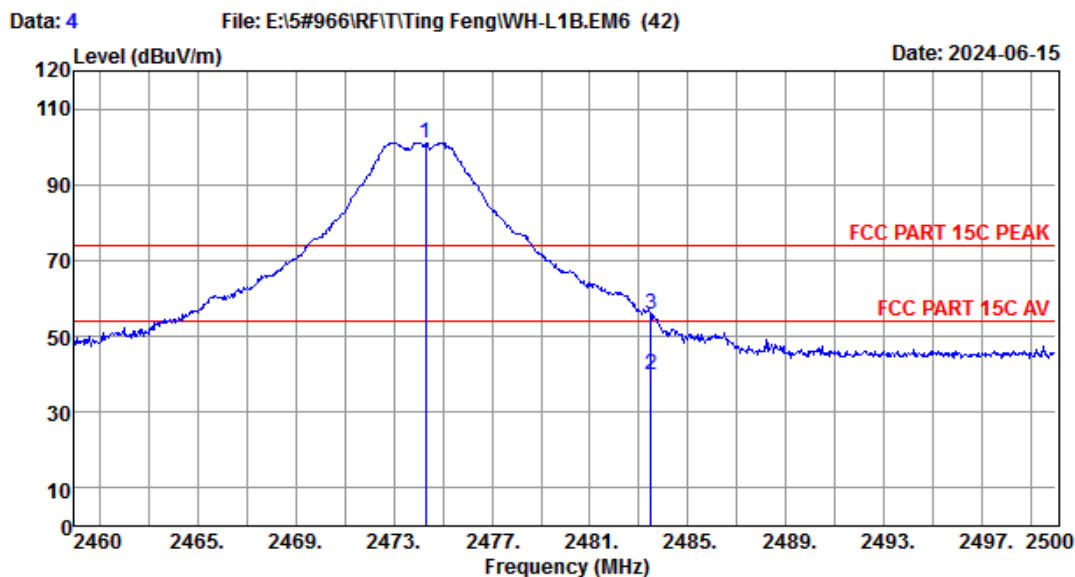
Site no. : 5# 966 Chamber Data no. : 3
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5°C;Humi:51%;Press:101.52kPa
Engineer : Aron
EUT : BASE
Power : DC 12V From Battery
M/N : WH-L1B
Test Mode : TX 2473.985MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2472.96	27.67	4.30	44.93	118.77	105.81	74.00	-31.81	Peak
2	2483.50	27.70	4.31	44.93	52.57	39.65	54.00	14.35	Average
3	2483.50	27.70	4.31	44.93	73.52	60.60	74.00	13.40	Peak
4	2484.28	27.70	4.31	44.93	52.48	39.56	54.00	14.44	Average
5	2484.28	27.70	4.31	44.93	73.07	60.15	74.00	13.85	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

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Site no. : 5# 966 Chamber Data no. : 4
Dis. / Ant. : 3m BBHA9120D-2667 Ant. pol. : HORIZONTAL
Limit : FCC PART 15C PEAK
Env. / Ins. : Temp:19.5°C;Humi:51%;Press:101.52kPa
Engineer : Aron
EUT : BASE
Power : DC 12V From Battery
M/N : WH-L1B
Test Mode : TX 2473.985MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2474.32	27.68	4.30	44.93	114.07	101.12	74.00	-27.12	Peak
2	2483.50	27.70	4.31	44.93	52.90	39.98	54.00	14.02	Average
3	2483.50	27.70	4.31	44.93	68.91	55.99	74.00	18.01	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. Margin= Limit - Emission Level.
3. The emission levels that are 20dB below the official limit are not reported.

Note: All test mode had been pre-test, only Low/High Channel of the worst case modulation mode was reported.

11. ANTENNA REQUIREMENTS

11.1. Limit

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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

11.2. Test Result

The antennas used for this product is PCB antenna ,so compliance with antenna requirements. (Please refer to the EUT photo for details)

12.APPENDIX

Appendix A: 20dB Emission Bandwidth Test Result

Test Mode	Antenna	Frequency[MHz]	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
TX	Ant1	2405.889	4.450	2403.639	2408.089	---	---
TX	Ant1	2441.729	4.590	2439.369	2443.959	---	---
TX	Ant1	2473.985	4.520	2471.655	2476.175	---	---

Test Graphs

TX-Ant1-2405.889



TX-Ant1-2441.729



TX-Ant1-2473.985



Appendix B: Maximum conducted output power

Test Result Peak

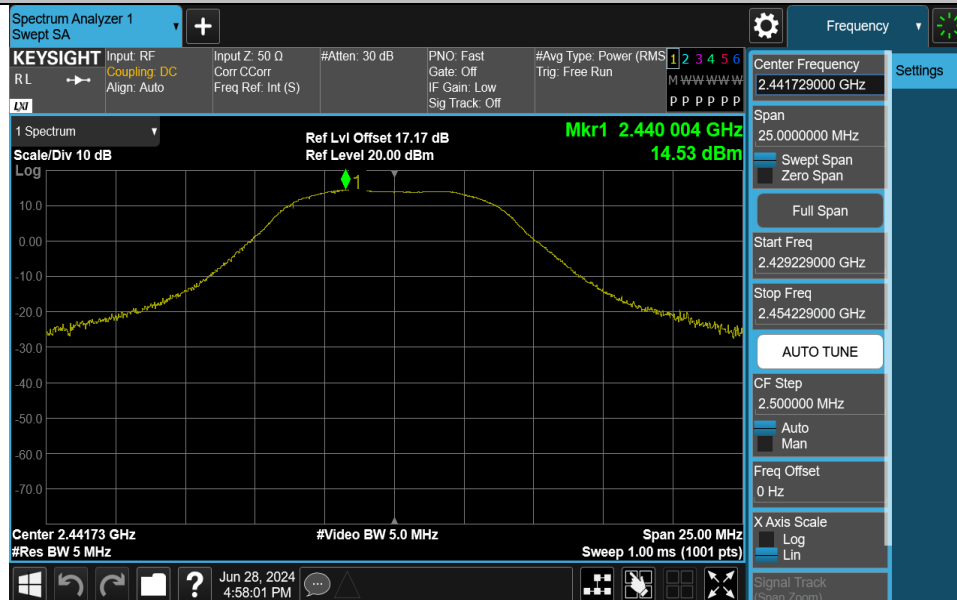
Test Mode	Antenna	Frequency[MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	Verdict
TX	Ant1	2405.889	14.78	≤20.98	PASS
TX	Ant1	2441.729	14.53	≤20.98	PASS
TX	Ant1	2473.985	13.95	≤20.98	PASS

Test Graphs

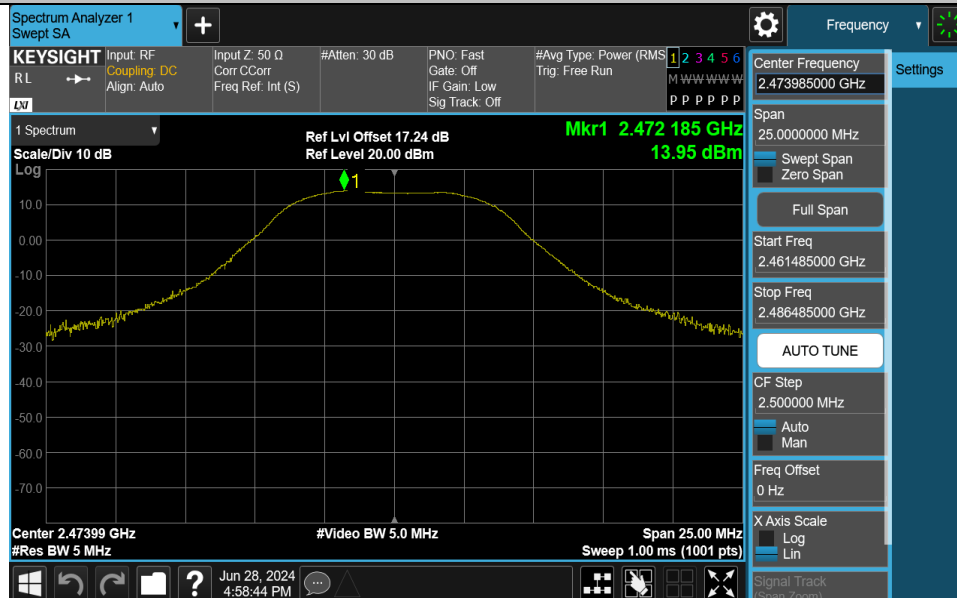
TX-Ant1-2405.889-PASS



TX-Ant1-2441.729-PASS



TX-Ant1-2473.985-PASS



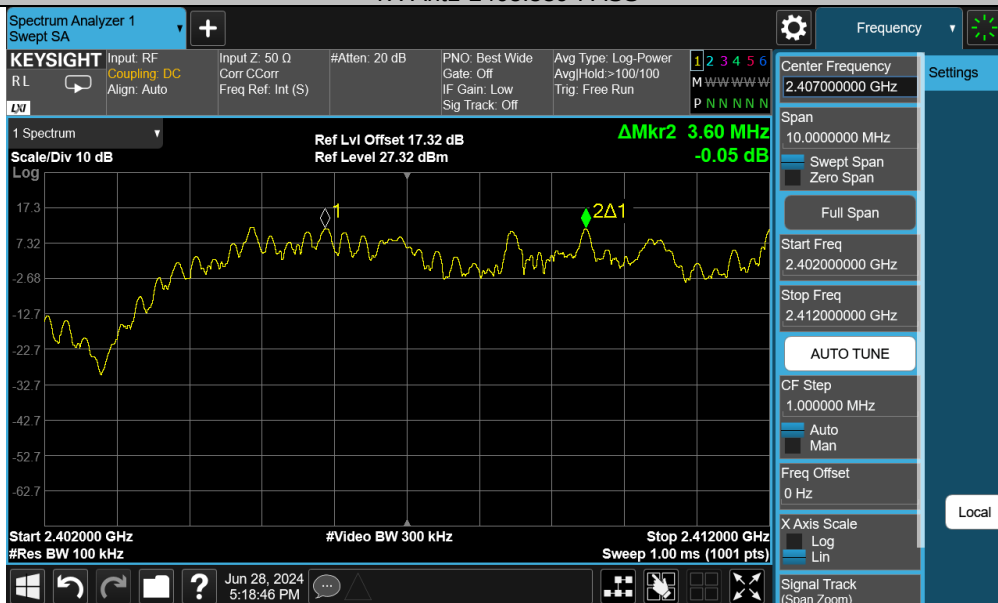
Appendix C: Carrier frequency separation

Test Result

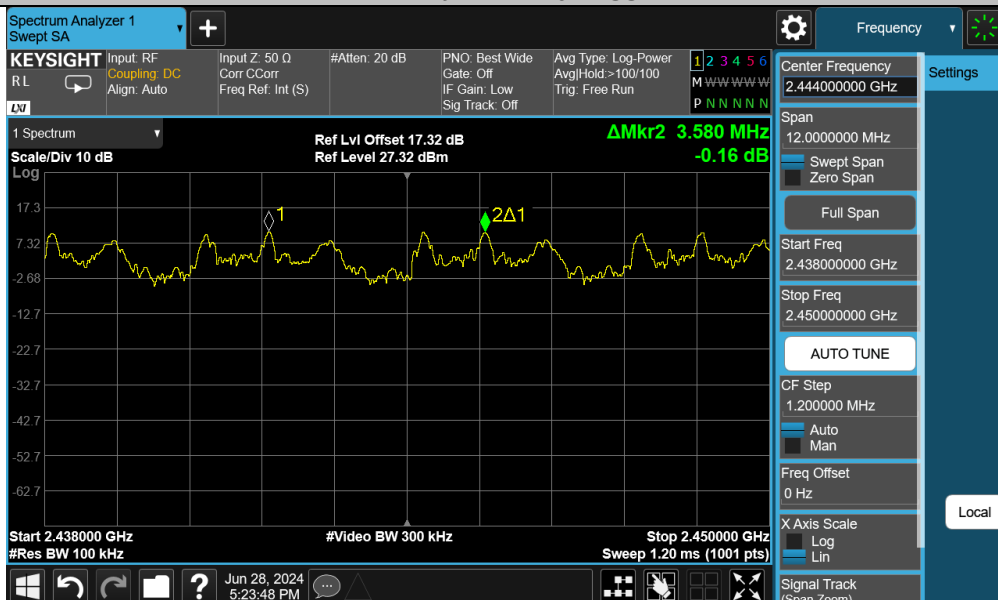
Test Mode	Antenna	Frequency[MHz]	Result[MHz]	Limit[MHz]	Verdict
TX	Ant1	2405.889	3.60	≥ 2.97	PASS
TX	Ant1	2441.729	3.58	≥ 3.06	PASS
TX	Ant1	2473.985	3.59	≥ 3.01	PASS

Test Graphs

TX-Ant1-2405.889-PASS



TX-Ant1-2441.729-PASS



TX-Ant1-2473.985-PASS





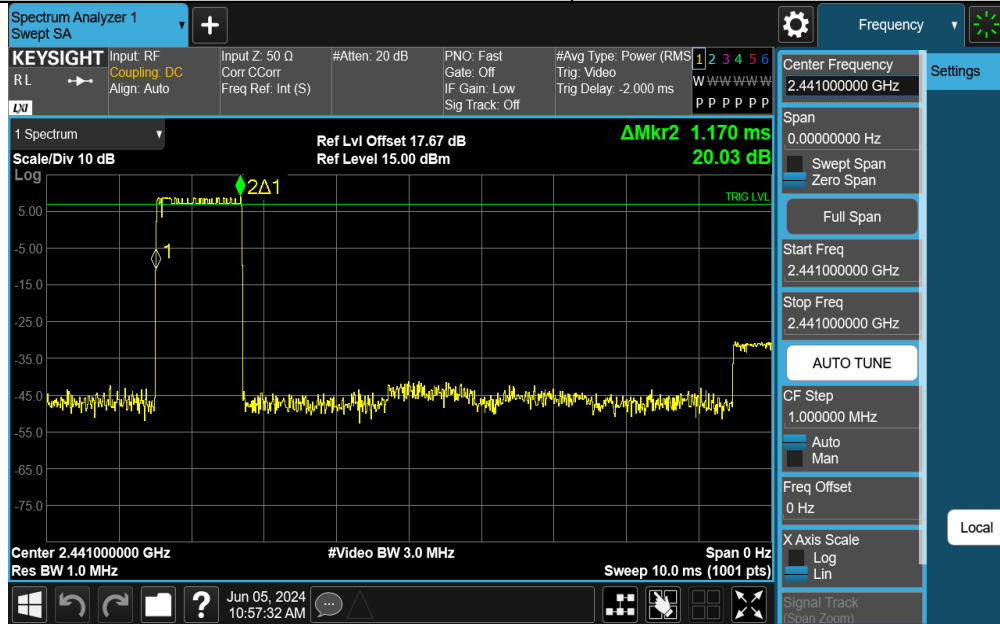
Appendix D: Time of occupancy

Test Result

Test Mode	Antenna	Frequency[MHz]	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
2.4G SRD	Ant1	Hop	1.170	242	0.283	≤0.4	PASS

Test Graphs

2.4G SRD-Ant1-Hop-PASS

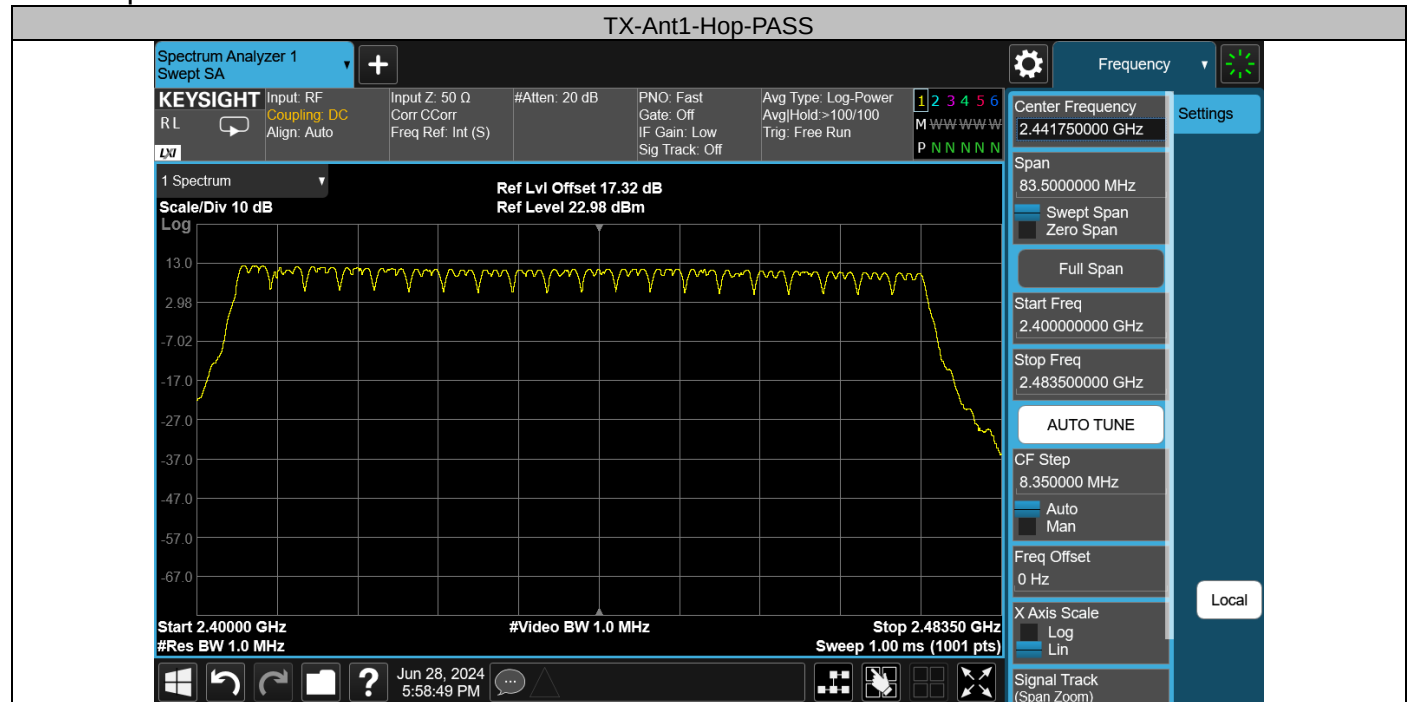


Appendix E: Number of hopping channels

Test Result

Test Mode	Antenna	Frequency[MHz]	Result[Num]	Limit[Num]	Verdict
TX	Ant1	Hop	20	≥15	PASS

Test Graphs



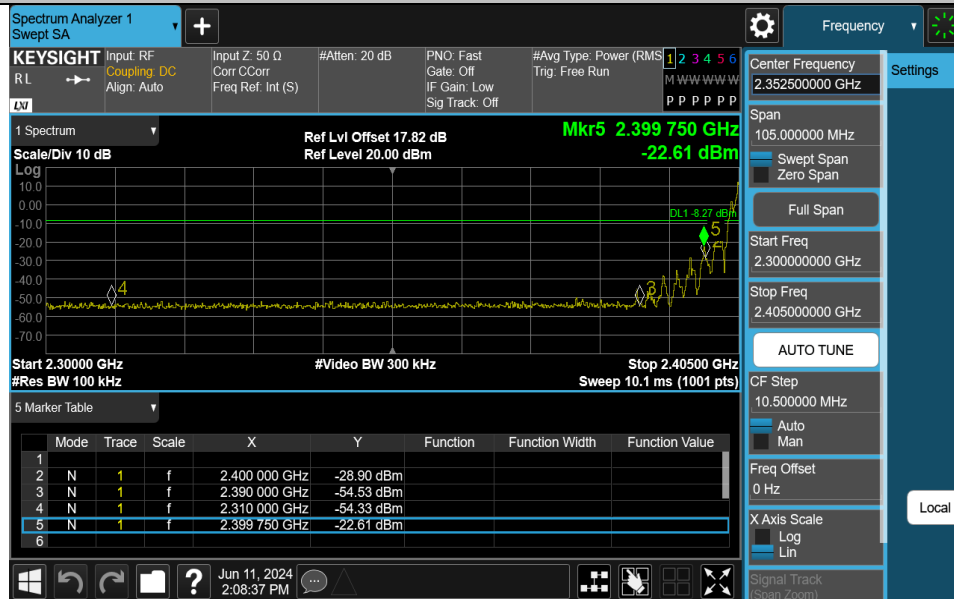
Appendix F: Band edge measurements

Test Result

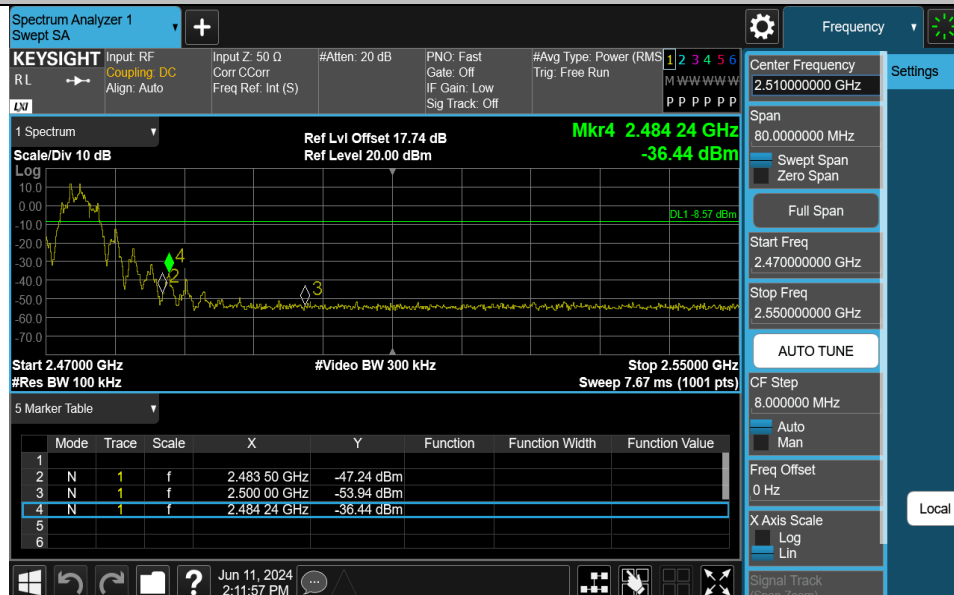
Test Mode	Antenna	ChName	Frequency[MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
2.4G SRD	Ant1	Low	2405.889	11.73	-22.61	≤ -8.27	PASS
2.4G SRD	Ant1	High	2473.985	11.43	-36.44	≤ -8.57	PASS
2.4G SRD	Ant1	Low	Hop_ 2405.889	9.18	-15.84	≤ -10.82	PASS
2.4G SRD	Ant1	High	Hop_ 2473.985	8.30	-38.46	≤ -11.7	PASS

Test Graphs

2.4G SRD-Ant1-2405.889-PASS



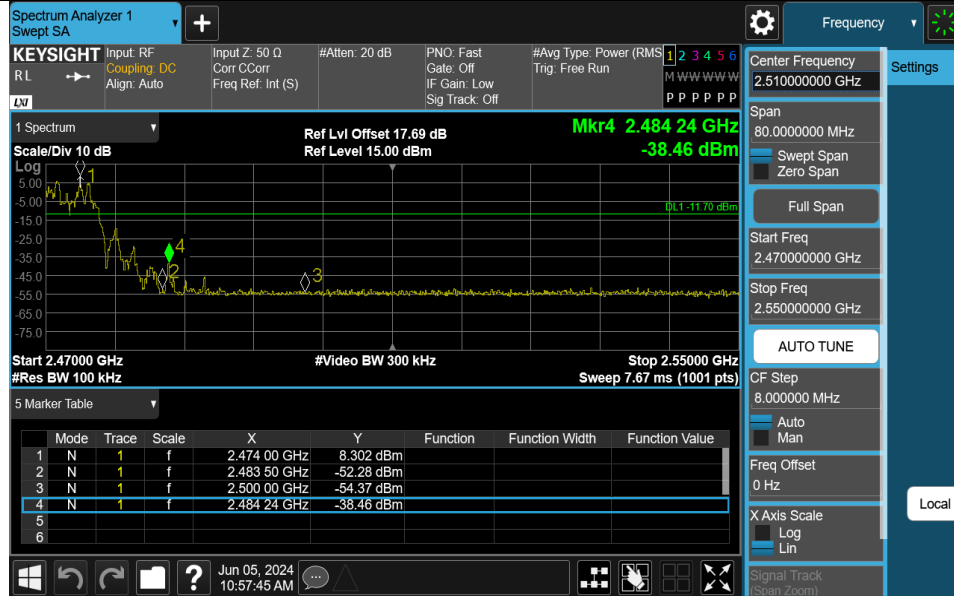
2.4G SRD-Ant1-2473.985-PASS



2.4G SRD-Ant1-Hop 2405.889-PASS



2.4G SRD-Ant1-Hop 2473.985-PASS

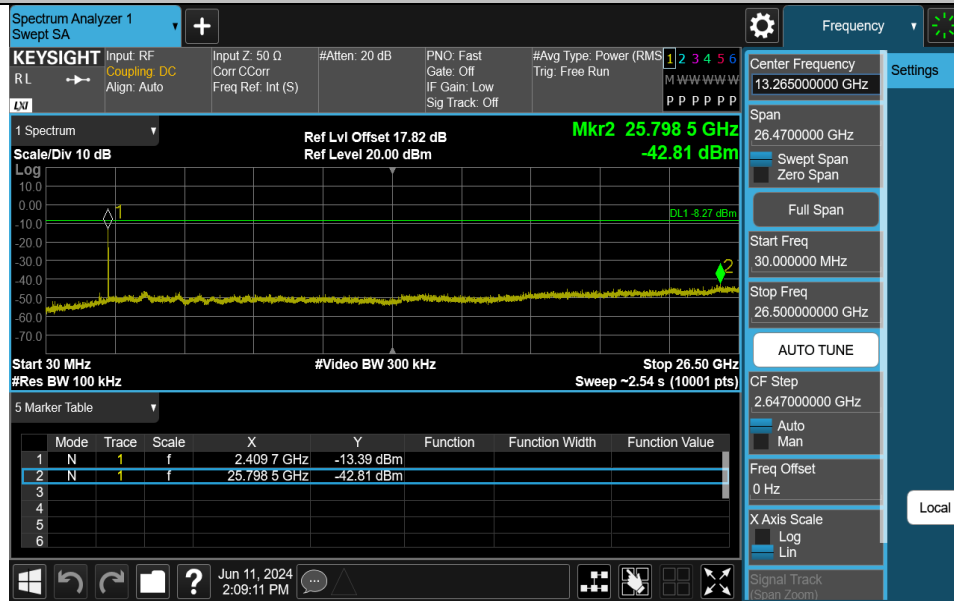


Appendix G: Conducted Spurious Emission Test Result

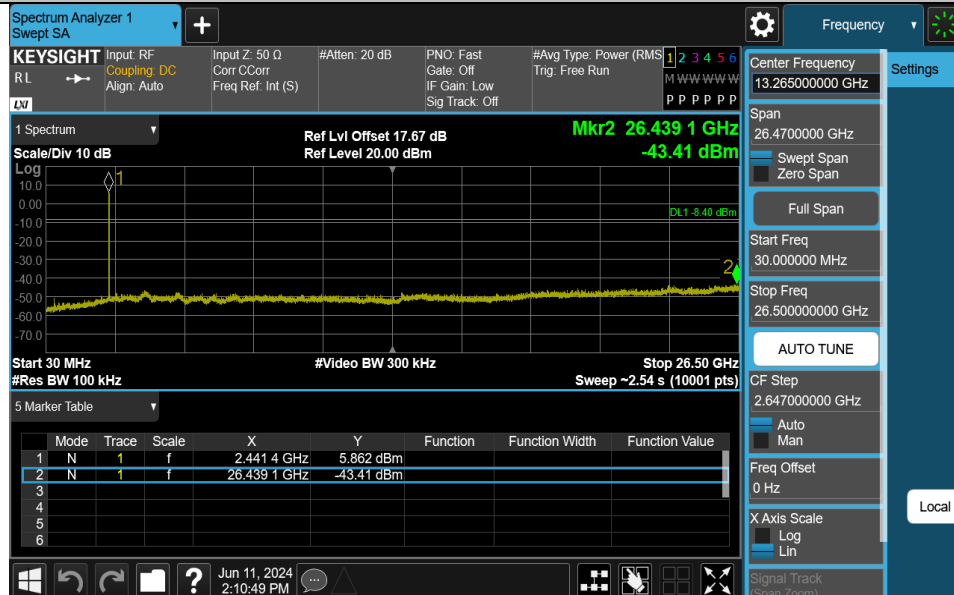
Test Mode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
2.4G SRD	Ant1	2405.889	30~26500	11.73	-42.81	≤ -8.27	PASS
2.4G SRD	Ant1	2441.729	30~26500	11.60	-43.41	≤ -8.4	PASS
2.4G SRD	Ant1	2473.985	30~26500	11.43	-43.32	≤ -8.57	PASS

Test Graphs

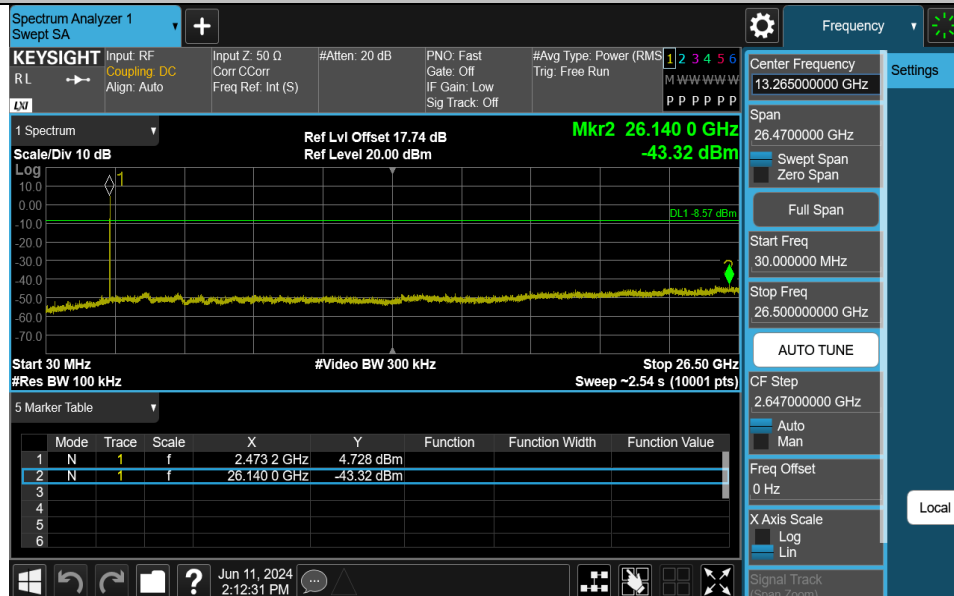
2.4G SRD-Ant1-2405.889-30~26500-PASS



2.4G SRD-Ant1-2441.729-30~26500-PASS



2.4G SRD-Ant1-2473.985-30~26500-PASS





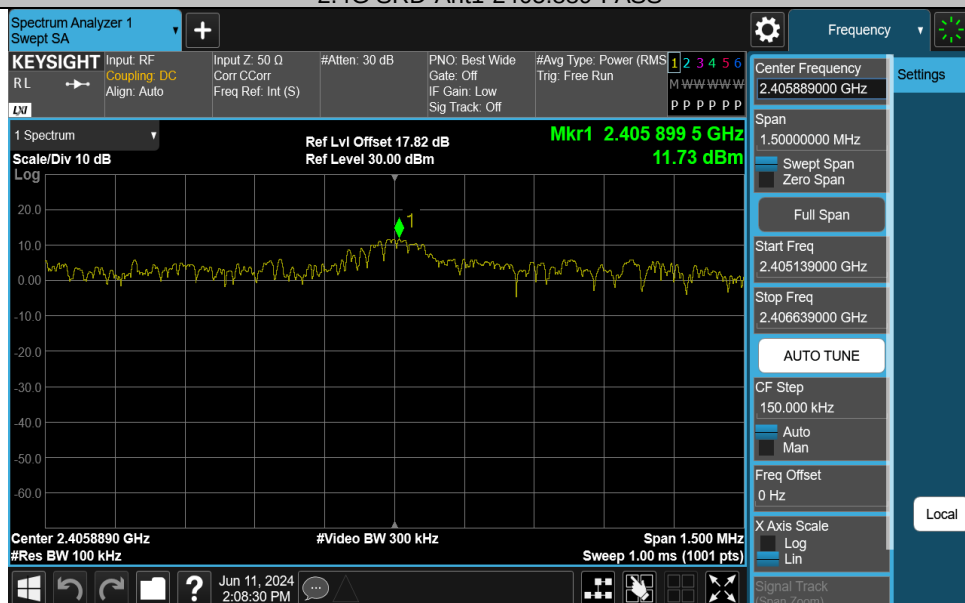
Appendix H: Reference level measurement

Test Result

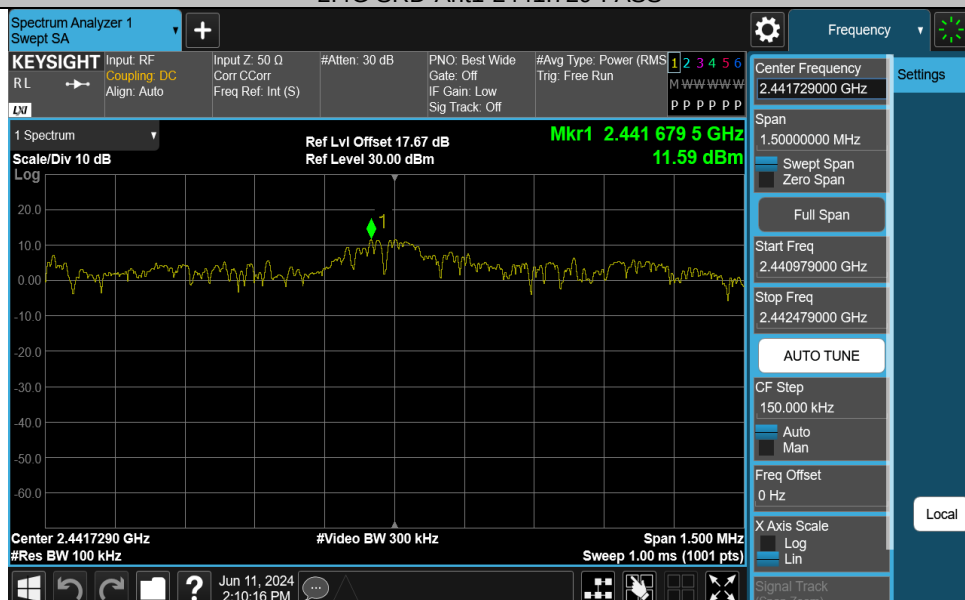
Test Mode	Antenna	Freq(MHz)	Max.Point[MHz]	Result[dBm]
2.4G SRD	Ant1	2405.889	2405.90	11.73
2.4G SRD	Ant1	2441.729	2441.68	11.60
2.4G SRD	Ant1	2473.985	2473.98	11.43

Test Graphs

2.4G SRD-Ant1-2405.889-PASS



2.4G SRD-Ant1-2441.729-PASS



2.4G SRD-Ant1-2473.985-PASS



13.TEST SETUP PHOTO

Refer to report no. ESTE-R2407158 (Appendix A)

14. EUT PHOTO

Refer to report no. ESTE-R2407159 (Appendix B)

End of Test Report