NVLAP TESTING
NVLAP LAB CODE 600338-0

BACL Bay Area Compliance Labs Corp.

FCC PART 15.231

TEST REPORT

For

Neuracle Technology (Changzhou) Co., Ltd.

6-B602 R&D HUB Changzhou Science and Education Town No.18 Changwu RD, Wujin District, Changzhou City, Jiangsu Province, China

FCC ID: 2BGXN-MTB02

Report Type:	**Product Name:**
Original Report	Triggerbox Pro

Report Number:	RSHA240124005-00D
Report Date:	2024-09-30
Reviewed By:	Bard Liu
Approved By:	Kyle Xu
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Kunshan) No.248 Chenghu Road, Kunshan, Jiangsu province, China Tel: +86-512-86175000 Fax: +86-512-88934268 www.baclcorp.com.cn

TABLE OF CONTENTS

REPORT REVISION HISTORY

Number of Revisions	Report No.	Version	Issue Date	Description
0	RSHA240124005-00D	R1V1	2024-09-30	Initial Release

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant:	Neuracle Technology (Changzhou) Co., Ltd.
Product Name:	Triggerbox Pro
Tested Model:	MTB1
Power Supply:	DC 5V
RF Function	SRD
Operating Band/Frequency	433.42 MHz
Field Strength of Fundamental	68.93 dBμV/m@3m
Channel Number	1
Modulation Type	FSK
Antenna Type	Rod Antenna
★Maximum Antenna Gain	Unknown

All measurement and test data in this report was gathered from production sample serial number: RSHA240124005-1 (Assigned by the BACL (Kunshan). The EUT supplied by the applicant was received on 2024-01-24.)

Objective

This test report is prepared on behalf of *Neuracle Technology (Changzhou) Co., Ltd.* All the test measurements were performed according to the measurement procedure described in ANSI C63.10 - 2013.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, section 15.203, 15.205, 15.207, 15.209, 15.35(c) and 15.231 rules.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10 - 2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Item		Uncertainty
AC Power Lines Conducted Emissions		3.19 dB
RF conducted test with spectrum		0.9dB
Radiated emission	9 kHz~150 kHz	3.8dB
	150 kHz~30 MHz	3.4dB
	30MHz~1GHz	6.11dB
	1GHz~6GHz	4.45dB
	6GHz ~18GHz	5.23dB
Occupied Bandwidth		0.5kHz
Temperature		1.0℃
Humidity		6%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Bay Area Compliance Laboratories Corp. (Kunshan) is accredited in accordance with ISO/IEC 17025:2017 by NVLAP (Lab code: 600338-0), and the lab has been recognized as the FCC accredited lab under the KDB 974614 D01, the FCC Designation No. : CN5055.

SYSTEM TEST CONFIGURATION

Justification

Channel List:

Channel	Frequency (MHz)
1	433.42

EUT Exercise Software

Test in engineer mode which provided by applicant*

Equipment Modifications

No modification was made to the EUT.

Support Equipment List and Details

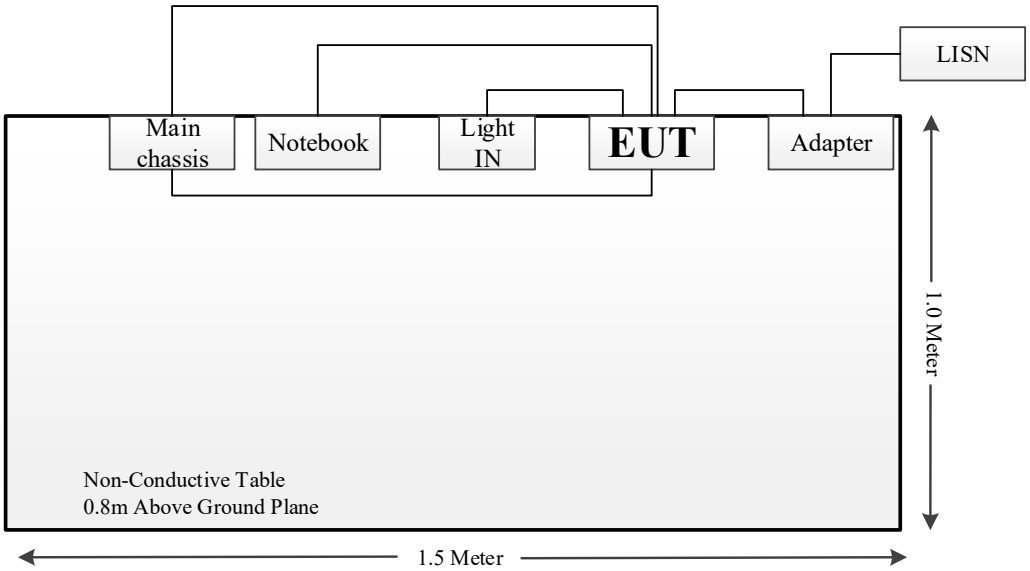
Manufacturer	Description	Model	Serial Number
Lenovo	Notebook	Thinkpad T470S	R9-0FYHD4 15/05
DELL	Main chassis	I7-3770/8G/240G	37742859757

External I/O Cable

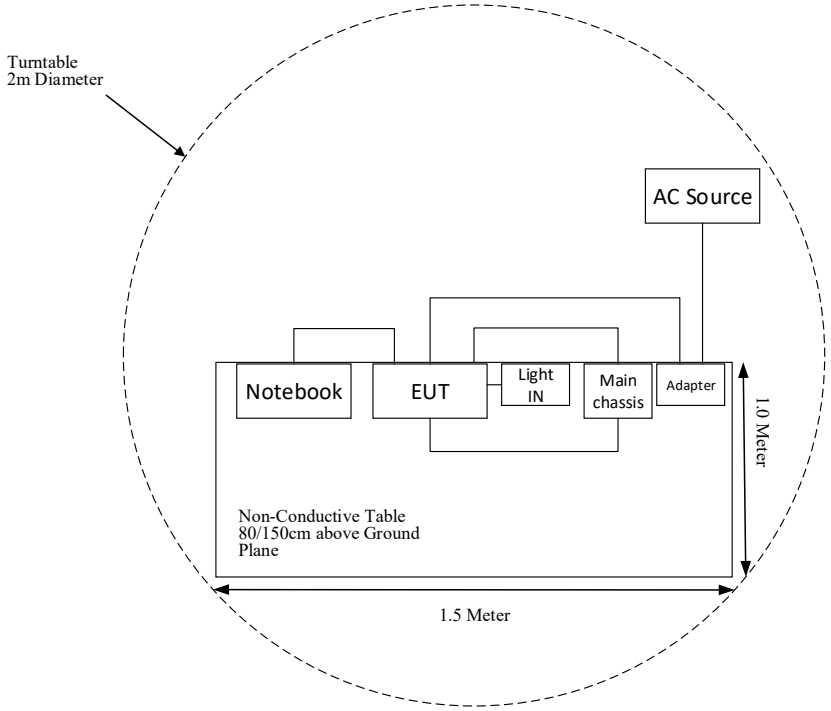
Cable Description	Length (m)	From Port	To
Power Cable	1.0	LISN	Adapter
Power Cable	0.2	Light IN	EUT
USB cable 1	1.0	Notebook	EUT
USB Cable 2	1.5	Adapter	EUT
DB 25 Pin cable	1.0	Main chassis	EUT
Audio cable	1.5	Main chassis	EUT

Block Diagram of Test Setup

For Conducted Emissions:



For Radiated Emissions (Below 1GHz & Above 1 GHz):



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1310 & §2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207(a)	Conducted Emissions	Compliant
§15.205, §15.209, §15.231(e)	Radiated Emissions	Compliant
§15.231 (c)	20dB Emission Bandwidth	Compliant
§15.231 (e)	Deactivation	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test (Chamber #1)					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2024-04-23	2025-04-22
Sunol Sciences	Hybrid Antenna	JB3	A090314-1	2023-11-11	2024-11-10
ETS-LINDGREN	Loop Antenna	6512	108100	2023-11-09	2024-11-08
Sonoma Instrument	Amplifier	310N	171205	2024-04-23	2025-04-22
Rohde & Schwarz	Auto test Software	EMC32	100361	N/A	N/A
MICRO-COAX	Coaxial Cable	Cable-8	008	2024-04-25	2025-04-24
MICRO-COAX	Coaxial Cable	Cable-9	009	2024-04-23	2025-04-22
MICRO-COAX	Coaxial Cable	Cable-10	010	2024-04-23	2025-04-22
Narda	6dB Attenuator	773-6	10690812-2-1	2023-11-11	2024-11-10
Radiated Emission Test (Chamber #2)					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207/040	2024-04-25	2025-04-24
ETS-LINDGREN	Horn Antenna	3115	9311-4159	2023-12-02	2024-12-01
A.H.Systems,inc	Amplifier	PAM-0118P	512	2024-04-25	2025-04-24
Narda	Attenuator	10dB	010	2024-04-23	2025-04-22
Rohde & Schwarz	Auto test Software	EMC32	100361	N/A	N/A
MICRO-COAX	Coaxial Cable	Cable-6	006	2024-04-23	2025-04-22
MICRO-COAX	Coaxial Cable	Cable-11	011	2024-04-25	2025-04-24
MICRO-COAX	Coaxial Cable	Cable-12	012	2024-04-25	2025-04-24
Conducted Emission Test					
Rohde & Schwarz	EMI Test Receiver	ESR	101746	2024-04-23	2025-04-22
Rohde & Schwarz	LISN	ENV216	101115	2024-04-23	2025-04-22
Audix	Test Software	e3	V9	N/A	N/A
Rohde & Schwarz	Pulse Limiter	ESH3-Z2	0357.8810.54	2024-04-23	2025-04-22
MICRO-COAX	Coaxial Cable	Cable-15	015	2024-04-23	2025-04-22

Statement of Traceability: Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC §1.1310 & §2.1091 - MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart §2.1091 and subpart §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f^2)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary

Predication of MPE limit at a given distance
$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Calculated Data:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Output Power★		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
SRD	433.42	/	/	-26.0	0.003	20	＜0.0001	0.3
5G Wi-Fi	5150-5250	2.7	1.86	13.0	19.95	20	0.0074	1.0
	5250-5350	2.7	1.86	13.0	19.95	20	0.0074	1.0
	5470-5725	2.7	1.86	12.0	15.85	20	0.0059	1.0
	5725-5850	2.7	1.86	12.0	15.85	20	0.0059	1.0

Note:
1. For the above tune up power were declared by the manufacturer.
2. The SRD EIRP = 68.93 dBμV/m -95.2 = -26.27dBm.
3. The worst condition of transmit simultaneously (WiFi&SRD) is as below:

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.0003+0.0074=0.0077 < 1.0$$

Conclusion: The device meets MPE at distance 20cm.

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

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.

Antenna Connected Construction

The EUT has a rod antenna, Antenna use a unique type of connector to attach to the EUT， fulfill the requirement of this section. Please refer to EUT photos.

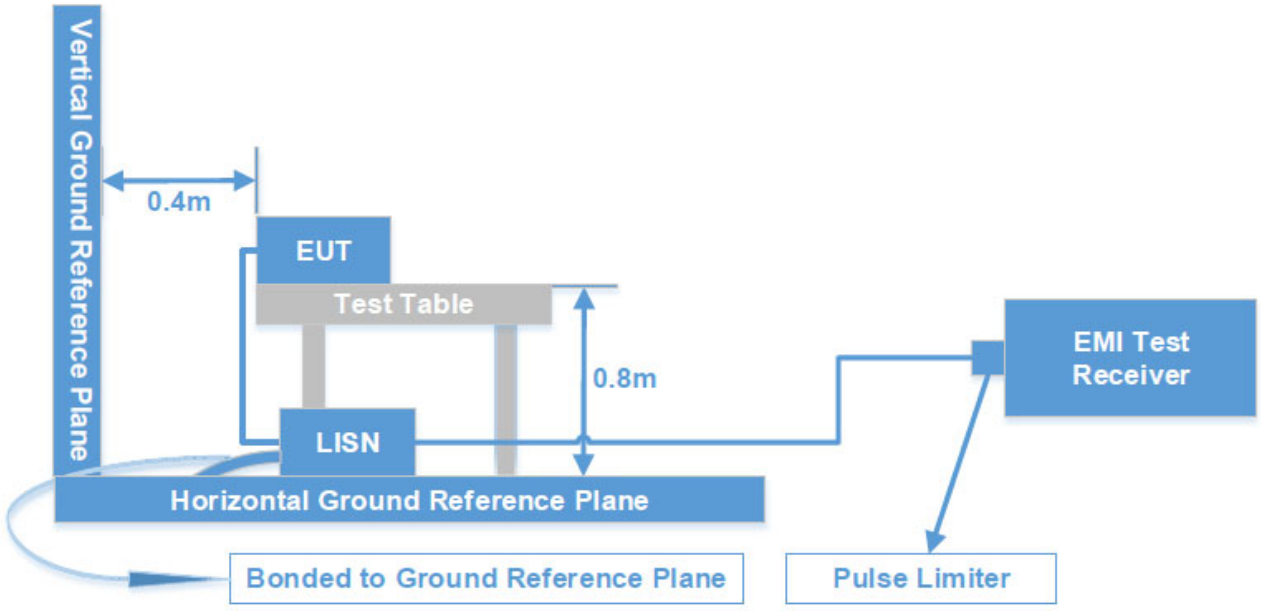
Result: Compliant.

FCC §15.207 (a) – AC POWER LINE CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207(a)

Test System Setup



The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	RBW	VBW
150 kHz - 30 MHz	9 kHz	30 kHz

Test Procedure

During the conducted emission test, the EUT was connected to the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

If the maximum peak value of the emissions is below the average limit, the QP value and average value measurement will not need to be performed and only record the maximum peak measured value to meet the requirements.

Level & Over Limit Calculation

The Level is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation from the Meter Reading. The basic equation is as follows:

Factor (dB) = LISN VDF (dB) + Cable Loss (dB) + Transient Limiter Attenuation (dB)
Level (dBμV) = Read level (dBμV) + Factor (dB)

The "**Over Limit**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over Limit of 7 dB means the emission is 7 dB above the limit. The equation for Over Limit calculation is as follows:

Over Limit (dB) = Level (dBμV) - Limit (dBμV)

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data: See Appendix

FCC §15.205, §15.209, §15.231 (e) - RADIATED EMISSIONS

Applicable Standard

FCC §15.205, §15.209, §15.231 (e)

According to FCC §15.231(e), the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

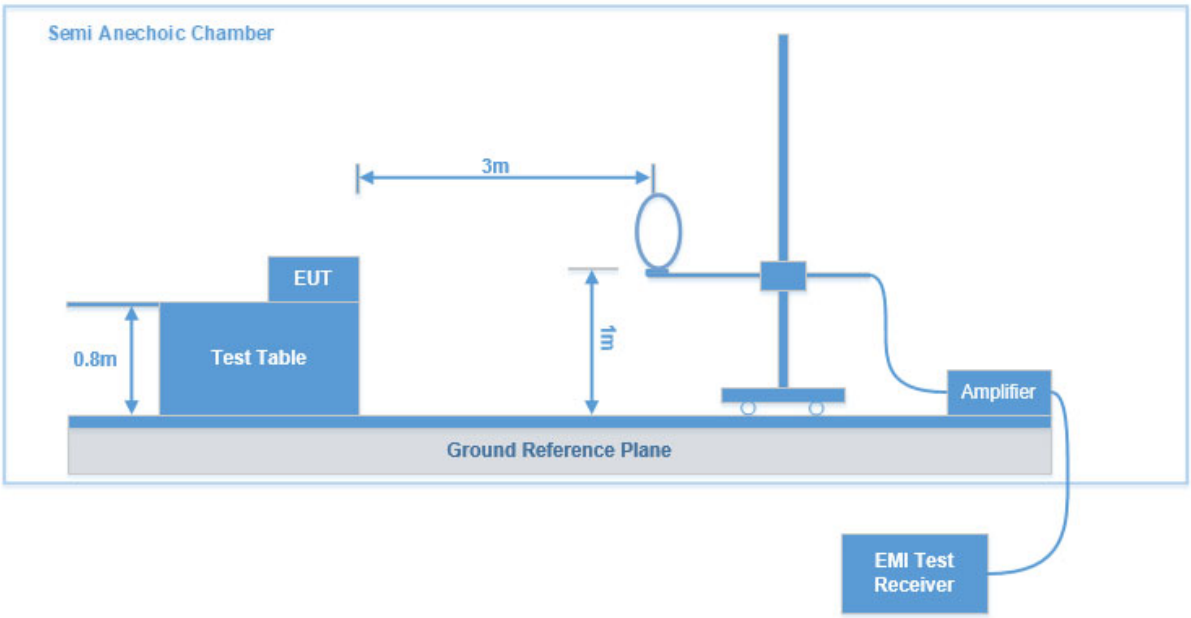
Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500 *	50 to 150 *
174-260	1,500	150
260-470	1,500 to 5,000 *	150 to 500*
Above 470	5,000	500

*Linear interpolations.

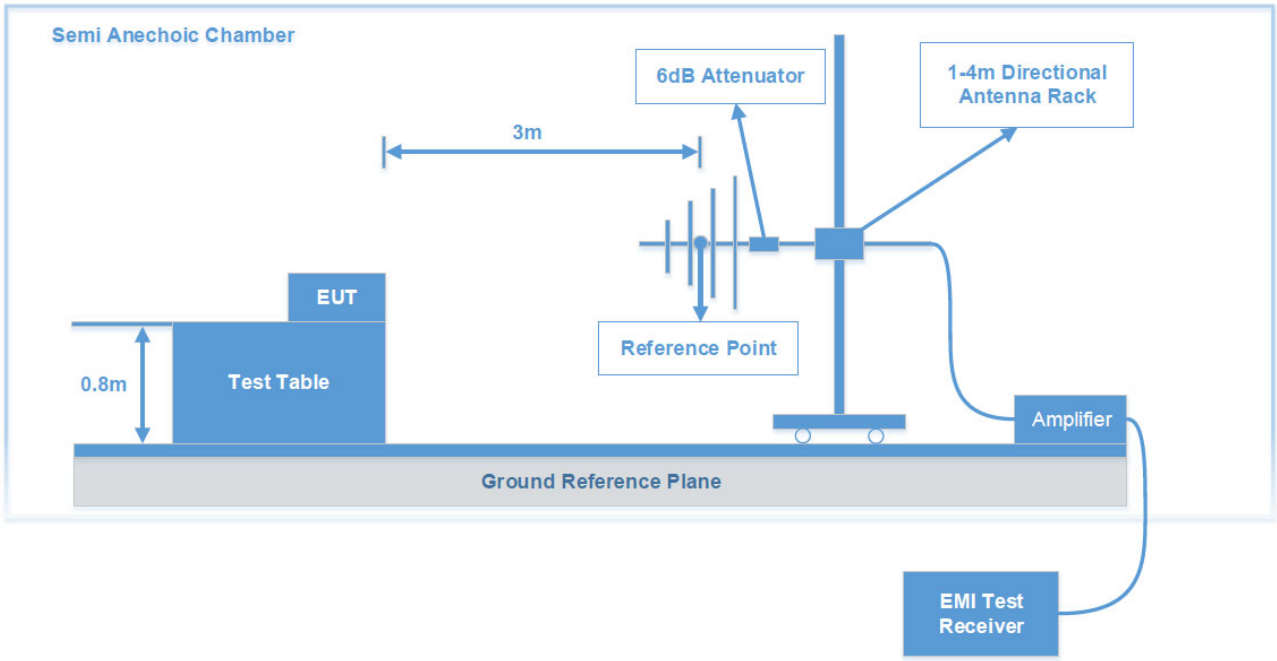
The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

Test System Setup

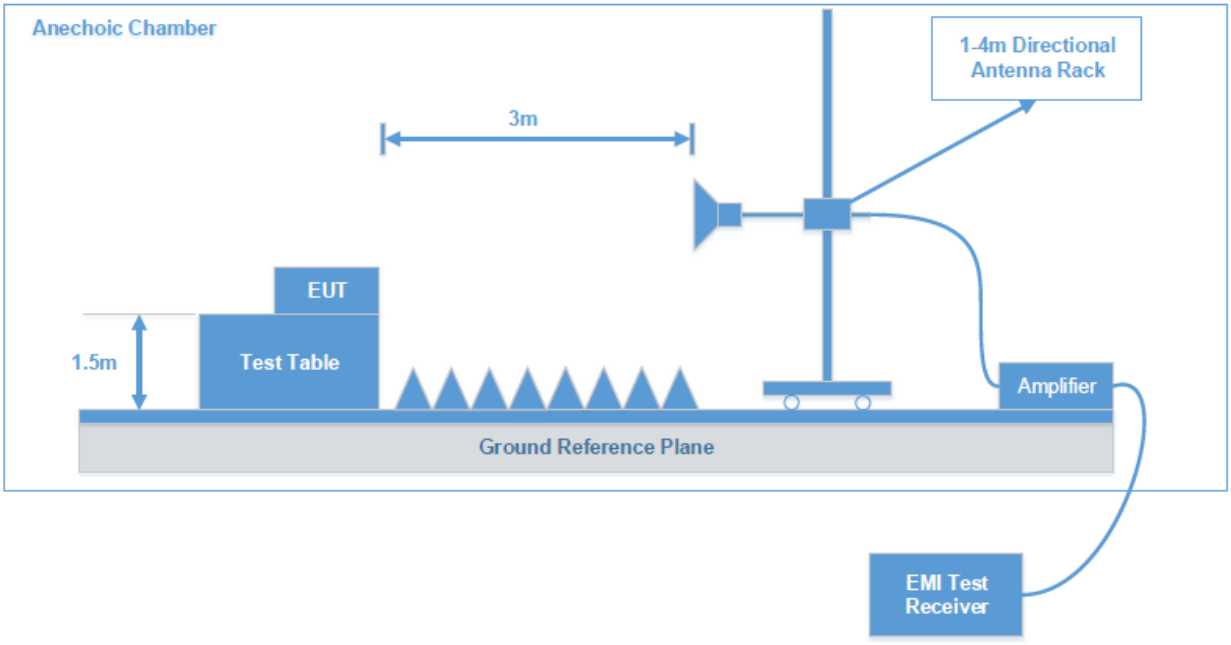
9 kHz–30 MHz:



30MHz-1GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10 - 2013. The specification used was the FCC § 15.209, 15.205 and 15.231.

EMI Test Receiver Setup

During the radiated emission test, the EMI test Receiver was set with the following configurations:

Frequency Range	RBW	VBW	IF B/W	Measurement
9 kHz – 150 kHz	200 Hz	1 kHz	200 Hz	QP/Average
150 kHz – 30 MHz	9 kHz	30 kHz	9 kHz	QP/ Average
30 MHz – 1000 MHz	100 kHz	300 kHz	/	Peak
	/	/	120 kHz	QP
Above 1GHz	1MHz	3 MHz	/	Peak

For 9 kHz-30MHz test, the lowest height of the magnetic antenna shall be 1 m above the ground and three antenna orientations (parallel, perpendicular, and ground-parallel) shall be measured.

If the spurious emissions maximized peak measured value complies with the QP/Average limit, it is unnecessary to perform an QP/Average measurement.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude (dBμV/m) = Meter Reading (dBμV) + Antenna Factor (dB/m) + Cable Loss (dB) - Amplifier Gain (dB)

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin (dB) = Limit (dBμV/m) – Corrected Amplitude (dBμV/m)

Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.205, §15.209, §15.231 (e).

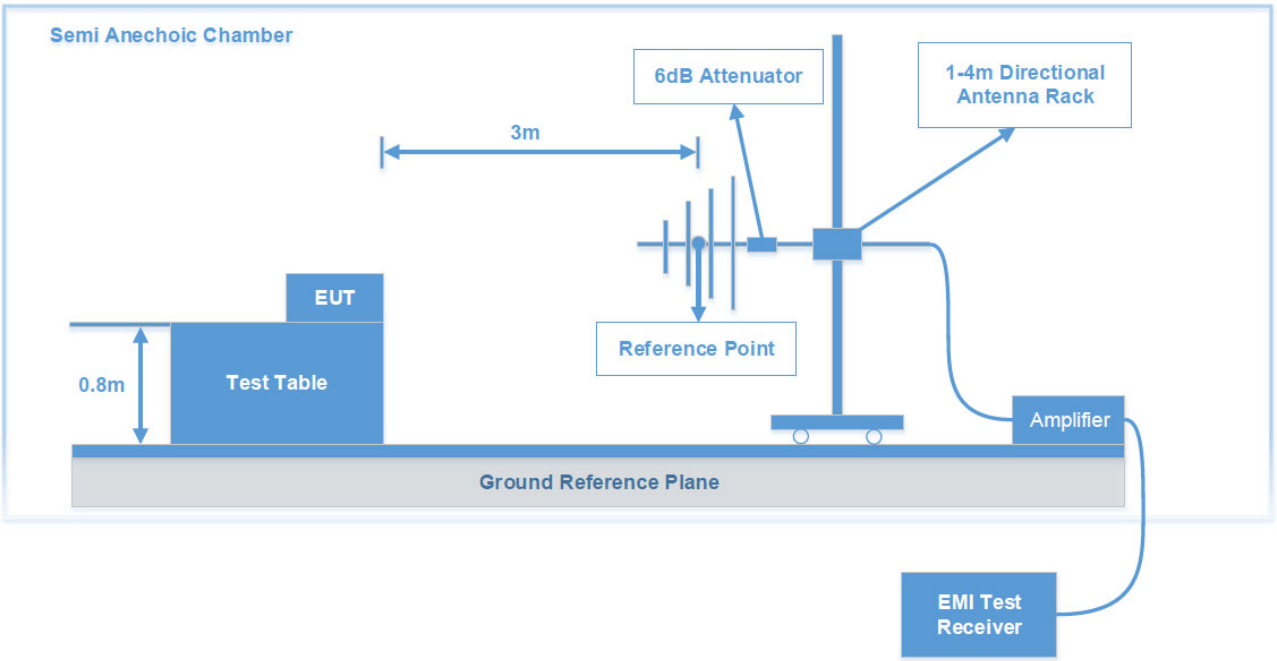
Test Data: See Appendix

FCC §15.231(e) - DEACTIVATION TESTING

Applicable Standard

Per 15.231(e), devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

EUT Setup



The deactivation test was performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10- 2013. The specification used was the FCC 15.231(e) limits.

Test Procedure

1. With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer.
2. Set center frequency of spectrum analyzer=operating frequency.
3. Set the spectrum analyzer as RBW=100 kHz VBW=300 kHz Span=0 Hz.
4. Repeat above procedures until all frequency measured was complete.

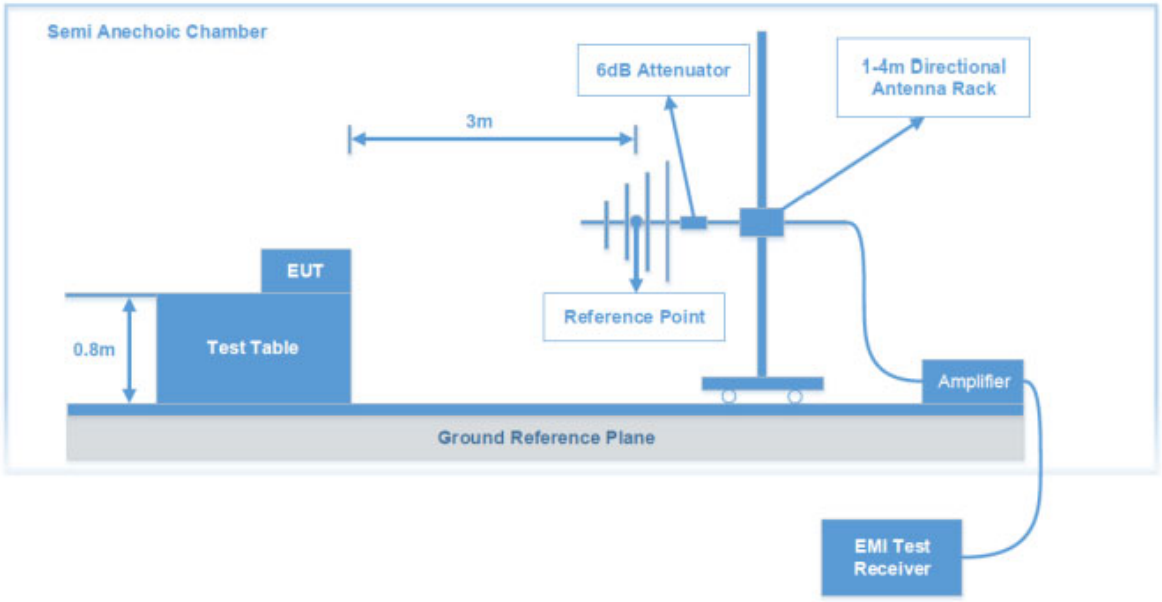
Test Data: See Appendix

FCC §15.231(c) - 20dB EMISSION BANDWIDTH TESTING

Applicable Standard

Per 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Test System Setup



Test Procedure

With the EUT's antenna attached, the waveform was received by the test antenna which was connected to the spectrum analyzer, plot the 20 dB bandwidth.

Test Data: See Appendix

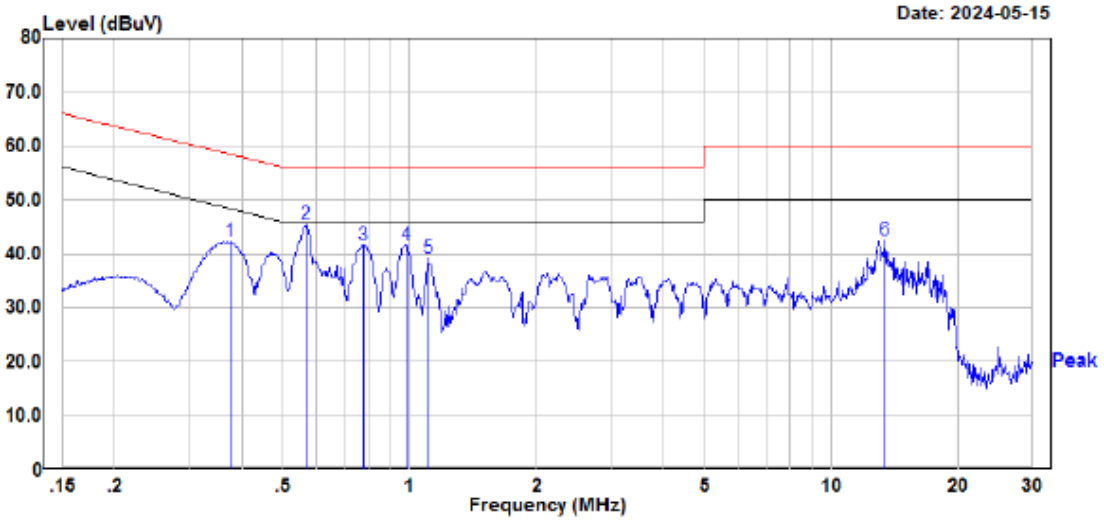
APPENDIX - TEST DATA

Environmental Conditions & Test Information

Test Item:	AC POWER LINE CONDUCTED EMISSIONS	UNDESIRABLE EMISSION & RESTRICTED BANDS	
		9 kHz - 1GHz	1 GHz - 5 GHz
Test Date:	2024-05-15	2024-07-10	2024-06-14
Temperature:	23.5 ℃	24.1 ℃	24.2 ℃
Relative Humidity:	46 %	54 %	55 %
ATM Pressure:	101.6 kPa	100.4 kPa	100.3 kPa
Test Result:	Pass	Pass	Pass
Test Engineer:	Frank Liu	Leah Li	Leah Li

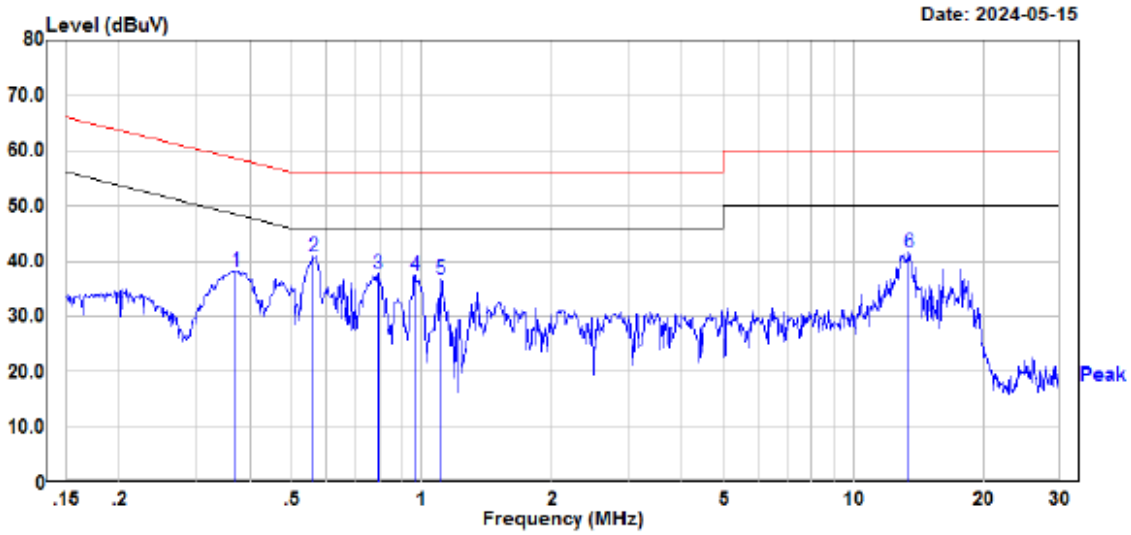
Test Item:	DEACTIVATION TESTING	20dB EMISSION BANDWIDTH TESTING
Test Date:	2024-07-11	2024-07-10
Temperature:	24 ℃	24.1 ℃
Relative Humidity:	50 %	54 %
ATM Pressure:	101.2 kPa	100.4 kPa
Test Result:	Pass	Pass
Test Engineer:	Neil Zhou	Bard Liu

AC POWER LINE CONDUCTED EMISSIONS



Site : CE
Condition : PART 15.207
: DET:Peak
Project No. : RSHA240124005
Model : MTB1
Phase : L
Voltage : 120V/60Hz
Mode : SRD
Test Equipment : ENV216,ESR
Temperature : 23.5℃
Humidity : 46%
Atmospheric pressure: 101.6kPa
Test Engineer : Frank Liu

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.375	22.17	20.06	42.23	58.38	-16.15	Peak
2	0.568	25.23	20.10	45.33	56.00	-10.67	Peak
3	0.777	21.65	19.97	41.62	56.00	-14.38	Peak
4	0.982	21.90	19.77	41.67	56.00	-14.33	Peak
5	1.107	19.31	19.81	39.12	56.00	-16.88	Peak
6	13.380	22.59	19.87	42.46	60.00	-17.54	Peak



Site : CE
Condition : PART 15.207
: DET:Peak
Project No. : RSHA240124005
Model : MTB1
Phase : N
Voltage : 120V/60Hz
Mode : SRD
Test Equipment : ENV216,ESR
Temperature : 23.5℃
Humidity : 46%
Atmospheric pressure: 101.6kPa
Test Engineer : Frank Liu

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	
1	0.372	18.18	20.05	38.23	58.47	-20.24	Peak
2	0.562	20.75	20.09	40.84	56.00	-15.16	Peak
3	0.793	17.71	19.95	37.66	56.00	-18.34	Peak
4	0.963	17.79	19.79	37.58	56.00	-18.42	Peak
5	1.107	16.82	19.81	36.63	56.00	-19.37	Peak
6	13.447	21.83	19.86	41.69	60.00	-18.31	Peak

UNDESIRABLE EMISSION & RESTRICTED BANDS

After pre-scan in the X, Y and Z axes of orientation, the worst case is below:

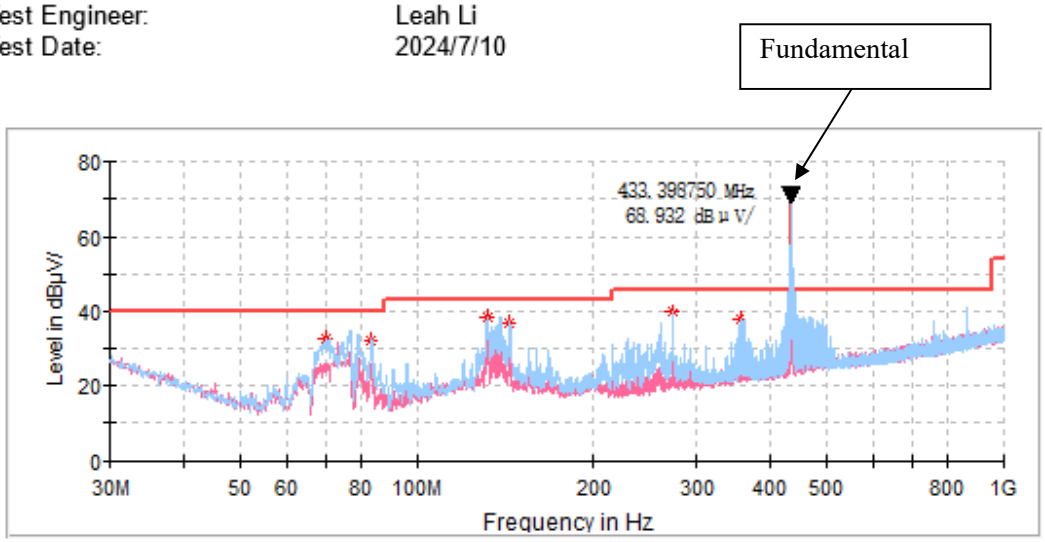
9 kHz-30 MHz:

The amplitude of spurious emissions attenuated more than 20 dB below the limit was not be recorded.

30MHz - 1GHz:

Common Information

Project No:	RSHA240124005
EUT Model:	MTB1
Test Mode:	SRD
Standard:	FCC Part 15.205&15.209&15.231
Test Equipment:	ESCI, JB3, 310N
Temperature:	24.1℃
Humidity:	54%
Barometric Pressure:	100.4kPa
Test Engineer:	Leah Li
Test Date:	2024/7/10



Critical_Freqs

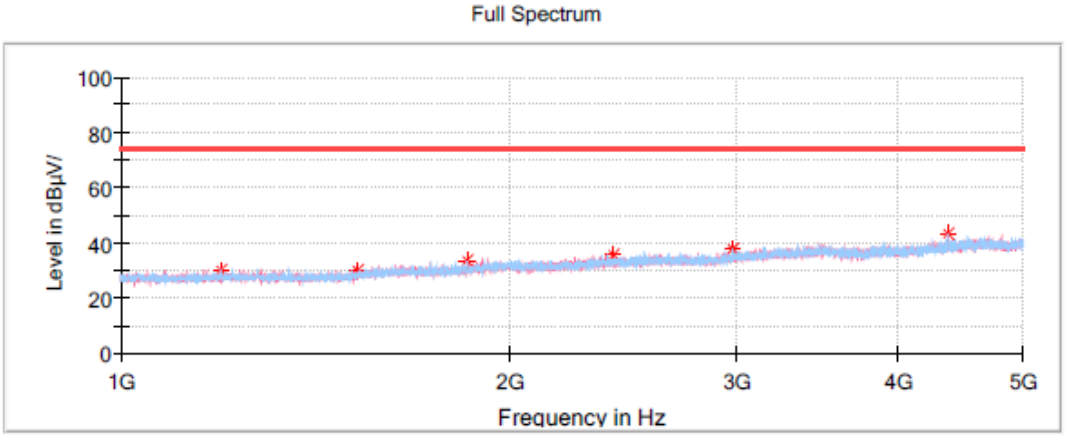
Frequency (MHz)	MaxPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Pol	Corr. (dB)
70.012500	32.70	40.00	7.30	H	-17.1
83.835000	32.30	40.00	7.70	H	-17.2
132.092500	38.26	43.50	5.24	H	-11.2
143.975000	36.66	43.50	6.84	H	-11.6
272.378750	39.55	46.00	6.45	H	-11.1
356.041250	37.53	46.00	8.47	H	-9.1
433.398750	68.93	72.00	3.07	H	-7.3

Note: If the spurious emissions maximized peak measured value complies with QP/Average limit, it is unnecessary to perform QP/Average measurement.

1 GHz - 5 GHz:

Common Information

Project No.:	RSHA240124005
Test Mode:	SRD
Standard:	FCC Part 15.231
Test Engineer:	Klein Zhu



Critical_Freqs

Frequency (MHz)	MaxPeak (dB µ V/m)	Average (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Pol	Corr. (dB/m)
1196.400000	29.82	---	74.00	44.18	H	-15.2
1526.400000	30.16	---	74.00	43.84	V	-14.6
1853.600000	33.78	---	74.00	40.22	H	-12.6
2405.600000	35.35	---	74.00	38.65	V	-10.5
2981.600000	37.60	---	74.00	36.40	H	-8.5
4369.200000	43.62	---	74.00	30.38	H	-4.7

If the spurious emissions maximized peak measured value is 20dB below peak limit, it is unnecessary to perform an Average measurement.

DEACTIVATION TESTING

Deactivation

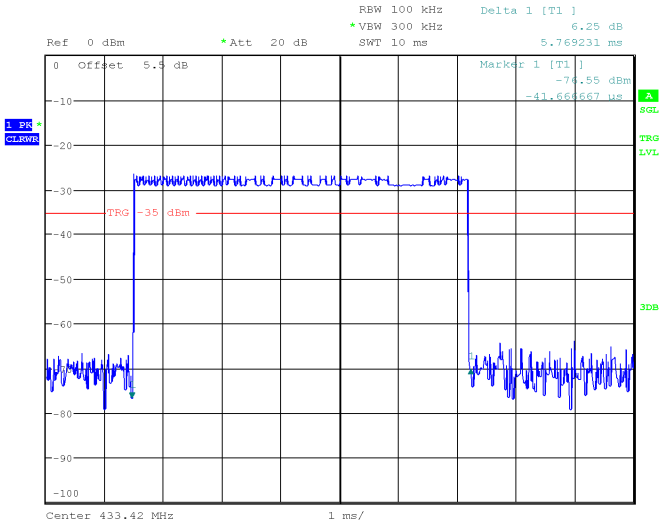
Transmission period (s)	Limit (s)	Result
0.006	< 1	Pass

Silent period

Silent period (s)	Limit (s)	Result
15	>10	Pass

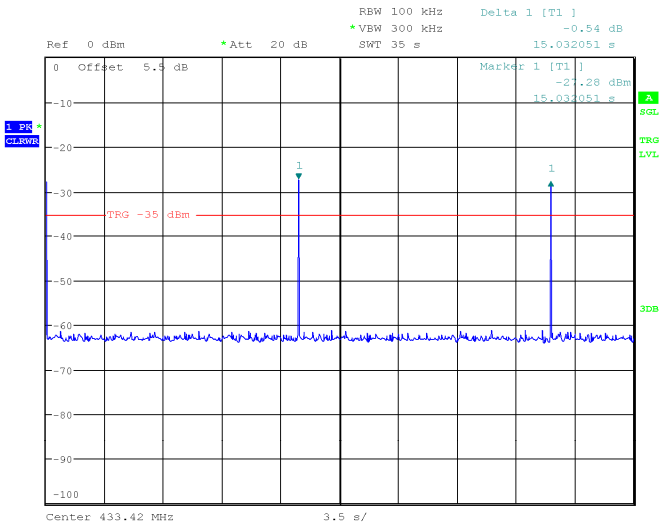
Note:
The silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.
The duration time is 0.006s, 0.006×30 =0.18s.

Transmission period



ProjectNo.:RSHA240124005 Tester:Neil Zhou
Date: 11.JUL.2024 14:08:54

Silent period



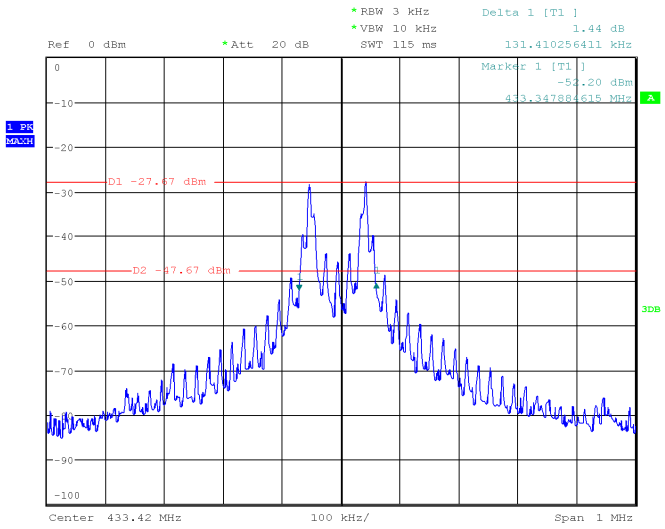
ProjectNo.:RSHA240124005 Tester:Neil Zhou
Date: 11.JUL.2024 13:55:11

20dB EMISSION BANDWIDTH TESTING

Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
433.42	131.41	1083.55	Pass

Note: Limit = 0.25% * Center Frequency = 0.25% * 433.42 MHz = 1083.55 kHz

20 dB Emission Bandwidth



ProjectNo.:RSHA240124005 Tester:Bard Liu
Date: 10.JUL.2024 18:41:20

EUT PHOTOGRAPHS

Please refer to the attachment EXHIBIT A - EUT EXTERNAL PHOTOGRAPHS and EXHIBIT B - EUT INTERNAL PHOTOGRAPHS.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment EXHIBIT D - TEST SETUP PHOTOGRAPHS.

Declarations

1. The laboratory is not responsible for the authenticity of any information provided by the applicant. Information from the applicant that may affect test results is marked with "★".

2. The test data was only valid for the test sample(s).

3. This report is valid only with a valid digital signature. The digital signature may be available only under the Adobe software above version 7.0.

4. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

5. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor k=2 with the 95.45% confidence interval.

******* END OF REPORT *******