

FCC RADIO TEST REPORT

Applicant.....: La Crosse Technology Ltd.

Address...... : 2809 Losey Blvd. South, La Crosse Wisconsin 54601 United States

Manufacturer.....: La Crosse Technology Ltd.

Address...... : 2809 Losey Blvd. South, La Crosse Wisconsin 54601 United States

Factory: La Crosse Technology Ltd.

Address : 2809 Losey Blvd. South, La Crosse Wisconsin 54601 United States

Product Name.....: CYCLONE PRO WIND SENSOR

Brand Name.....: LA CROSSE TECHNOLOGY

Model No.: : TX145WSDR (For additional models and model difference refer to section 2)

FCC ID.....: : OMOTX145WSDR

Measurement Standard......: 47 CFR FCC Part 15, Subpart C (Section 15.231)

Receipt Date of Samples.....: June 02, 2023

Date of Tested.....: June 03, 2023 to July 03, 2023

Date of Report.....: July 12, 2023

This report shows that above equipment is technically compliant with the requirements of the standards above. All test results in this report apply only to the tested sample(s). Without prior written approval of Dongguan Nore Testing Center Co., Ltd, this report shall not be reproduced except in full.

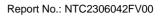
Prepared by

Julie Xiao / Project Engineer



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Revision History

Report Number	Description	Issued Date
NTC2306042FV00	Initial Issue	2023-07-12





1. Summary of Test Result

FCC Rules	Description of Test	Result	Remarks
§15.207 (a)	AC Power Line Conducted Emission	N/A see note 2	
§15.231(b) & 15.209	Radiated Spurious Emission	PASS	
§15.231(c)	20 dB Occupied bandwidth	PASS	
§15.231(a)	Transmission time	PASS	
§15.203	Antenna Requirement	PASS	

Note: 1. The EUT has been tested as an independent unit. And continual transmitting in maximum power (New batteries were used during test)

^{2.} AC Power Conducted Emission is not applicable due to the EUT only can be powered by battery.





2. General Description of EUT

Product Information	
Product Name:	CYCLONE PRO WIND SENSOR
Main Model Name:	TX145WSDR
Additional Model Name:	TX145xxxx, TX145xxxx-xxx, TX145xxxxxx, TX145xxxxxx, TX145xxxx-xx, TX145xxxx-xxx, TX145xxx-xxx, TX145xxxx-xxx, TX145xxxx-xxx, TX145xxxx-xxx, TX145xxxx-xxx, TX145xxxx-xxx, TX145xxxx-xxx, TX145xxxx-xxx, TX145xxxx-xxx, T
Model Difference:	These models have the same circuit schematic, construction, PCB Layout and
	critical components. These differences are model number, color and packaging upgrade version number only due to trading purpose.
S/N:	TX07400001
Brand Name:	LA CROSSE TECHNOLOGY
Hardware Version:	TX074 REV01
Software Version:	XCT074_ SOP16
Rating:	DC 4.5V from AA battery*3
Classification:	Class B
Typical arrangement:	Table-top
I/O Port:	Refer to user's manual
Accessories Information	
Adapter:	N/A
Cable:	N/A
Other:	N/A
Additional Information	
Note:	According to these model differences, all tests were carried on model
	TX145WSDR.
Remark:	All the information above are provided by the manufacturer. More detailed feature
	of the EUT please refers to the user manual.





Technical Specification	
Declaring the Frequency:	433.97MHz
Modulation Type:	ASK
Antenna Type:	Spring antenna
Antenna Gain:	0 dBi (Declared by manufacturer)
Number of Channels:	1





3. Test Channels and Modes Detail

Mode		Test Frequency (MHz)	Modulation	Data Rate (Mbps)	
1	TX	433.97MHz	ASK		

Note: TX mode means that the EUT was programmed to be in continuously transmitting mode.

4. Configuration of EUT



5. Modification of EUT

No modifications are made to the EUT during all test items.

6. Description of Support Device

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

No.	Equipment	Brand	M/N	S/N Cable Specification		Remarks





7. Test Facility and Location

Test Site	:	Dongguan Nore Testing Center Co., Ltd. (Dongguan NTC Co., Ltd.)		
Accreditations and	:	The Laboratory has been assessed and proved to be in compliance with		
Authorizations		CNAS/CL01		
		Listed by CNAS, August 13, 2018		
		ne Certificate Registration Number is L5795.		
		The Certificate is valid until August 13, 2024		
		e Laboratory has been assessed and proved to be in compliance with		
		ISO17025		
		Listed by A2LA, November 01, 2017		
		The Certificate Registration Number is 4429.01		
		Listed by FCC, November 06, 2017		
		Test Firm Registration Number: 907417		
		Listed by Industry Canada, June 08, 2017		
		The Certificate Registration Number. Is 46405-9743A		
Test Site Location	:	Building D, Gaosheng Science and Technology Park, Hongtu Road, Nancheng		
		District, Dongguan City, Guangdong Province, China		





8. Applicable Standards and References

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

Test Standards:

47 CFR Part 15, Subpart C, 15.231 ANSI C63.10-2013

References Test Guidance:

N/A

9. Deviations and Abnormalities from Standard Conditions

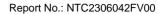
No additions, deviations and exclusions from the standard.

10. Test Conditions

No.	Test Item	Test Mode	Test Voltage	Tested by	Remarks
1.	AC Power Conducted Emission				
2.	Radiated Emission	1	DC 4.5V	Sean	See note 1
3.	20 dB Occupied bandwidth	1	DC 4.5V	Sean	See note 1
4.	Transmission time	1	DC 4.5V	Sean	See note 1
5.	Antenna Requirement				

Note:

- 1. The testing climatic conditions for temperature, humidity, and atmospheric pressure are within: 15~35 °C, 30~70%, 86~106kPa
- 2. As the EUT can be operated multiple positions, all X,Y,Z axis were considered during the test and only the worst case X was recorded.





11. Measurement Uncertainty

No.	Test Item	Frequency	Uncertainty	Remarks
1.	Conducted Emission	150KHz ~ 30MHz	±2.52 dB	
		9kHz ~ 30MHz	±2.60 dB	
	Radiated Emission Test	30MHz ~ 1GHz	±5.04 dB	
2.		1GHz ~ 18GHz	±5.23 dB	
		18GHz ~ 40GHz	±5.23 dB	
3.	Occupied Channel Bandwidth		±1.42 x10 ⁻⁷	

Note:

- 1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
- 2. The measurement uncertainly levels above are estimated and calculated according to CISPR 16-4-2.
- 3. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.





12. Sample Calculations

Conducted Emission							
Freq. (MHz)							
0.1900	30.10	10.60	40.70	79.00	-38.30	QP	

Where,

Freq. = Emission frequency in MHz

Reading Level = Spectrum Analyzer/Receiver Reading

Corrector Factor = Insertion loss of LISN + Cable Loss + RF Switching Unit attenuation

Measurement = Reading + Corrector Factor

Limit = Limit stated in standard

Margin = Measurement - Limit

Detector = Reading for Quasi-Peak / Average / Peak

	Radiated Spurious Emissions							
Freq. Reading Level Correct Factor Measurement Limit Over (MHz) (dBuV) (dB/m) (dBuV/m) (dBuV/m) (dB)								
570.2900	4.74	26.78	31.52	46.00	-14.48	QP		

Where,

Freq. = Emission frequency in MHz

Reading Level = Spectrum Analyzer/Receiver Reading

Corrector Factor = Antenna Factor + Cable Loss - Pre-amplifier

Measurement = Reading + Corrector Factor

Limit = Limit stated in standard

Over = Margin, which calculated by Measurement - Limit

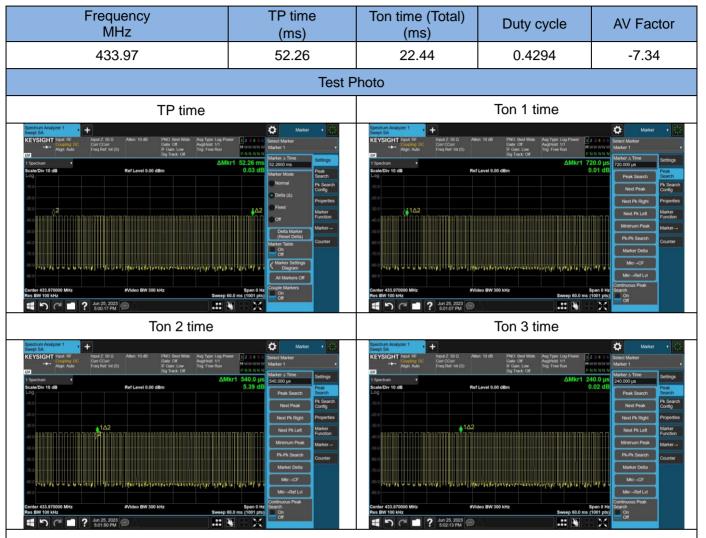
Detector = Reading for Quasi-Peak / Average / Peak

Note: For all conducted test items, the spectrum analyzer offset or transducer is derived from RF cable loss and attenuator factor. The offset or transducer is equal to the RF cable loss plus attenuator factor.





13. Duty Cycle



Note: Duty Cycle = (Total Ton time / TP time) x 100%

Total Ton time = Ton 1 x n1 + Ton 2 x n2 ++ Ton n x n = 0.72*4+0.54*14+0.24*50=22.44ms AV Factor = 20log(Duty Cycle).



14. Test Items and Results

14.1 Conducted Emissions Measurement

LIMIT

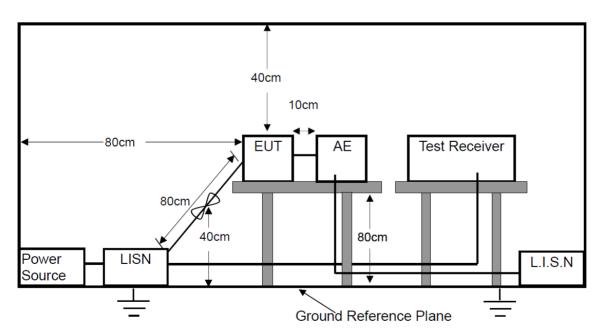
According to the requirements of FCC PART 15.207, the limits are as follows:

Frequency (MHz)	Quasi-peak	Average
0.15 to 0.5	66 to 56	56 to 46
0.5 to 5	56	46
5 to 30	60	50

Note: 1. If the limits for the average detector are met when using the quasi-peak detector, then the limits for the measurements with the average detector are considered to be met.

- 2. The lower limit shall apply at the transition frequencies.
- 3. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5MHz.

BLOCK DIAGRAM OF TEST SETUP



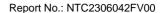


TEST PROCEDURES

- a. The EUT was placed on a wooden table 0.8m height from the metal ground plan and 0.4m from the conducting wall of the shielding room and it was kept at 0.8m from any other grounded conducting surface.
- b. All I/O cables and support devices were positioned as per ANSI C63.10.
- c. Connect mains power port of the EUT to a line impedance stabilization network (LISN).
- d. Connect all support devices to the other LISN and AAN, if needed.
- e. Scan the frequency range from 150KHz to 30MHz at both sides of AC line for maximum conducted interference checking and record the test data.

TEST RESULTS

Not applicable.





14.2 Radiated Spurious Emissions Measurement

LIMIT

Frequency range	Distance Meters	Field Strengths Limit (15.209)		
MHz	Distance Meters	μV/m		
0.009 ~ 0.490	300	2400/F(kHz)		
0.490 ~ 1.705	30	24000/F(kHz)		
1.705 ~ 30	30	30		
30 ~ 88	3	100		
88 ~ 216	3	150		
216 ~ 960	3	200		
Above 960	3	500		

- Remark: (1) Emission level (dB) μ V = 20 log Emission level μ V/m
 - (2) The smaller limit shall apply at the cross point between two frequency bands.
 - (3) As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
 - (4) The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.
 - (5) §15.247(d) specifies that emissions which fall in the restricted bands, as defined in §15.205 comply with radiated emission limits specified in §15.209.





According to 15.231(e), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/ meter)	spurious emissions (microvolts/meter)		
40.66 - 40.70	1000	100		
70 - 130	500	50		
130 - 174	500 to 1500*	50 to 150*		
174 - 260	1500	150		
260 - 470	1500 to 5000*	150 to 500*		
Above 470	5000	500		

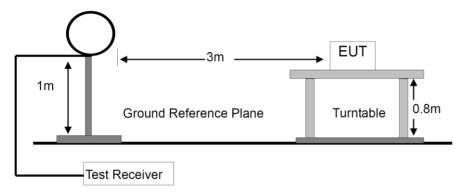
Remark:

- (1) * Linear interpolations
- (2) Emission level (dB) μ V = 20 log Emission level μ V/m.
- (3) The smaller limit shall apply at the cross point between two frequency bands.

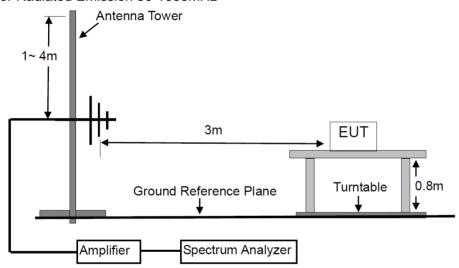


BLOCK DIAGRAM OF TEST SETUP

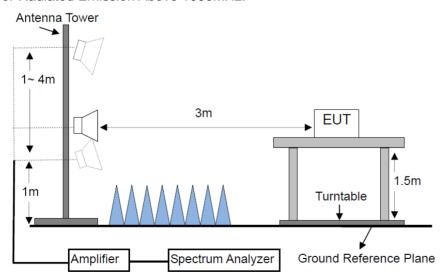
For Radiated Emission below 30MHz



For Radiated Emission 30-1000MHz



For Radiated Emission Above 1000MHz.





TEST PROCEDURES

- a. Below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi- anechoic chamber room.
- b. For the radiated emission test above 1GHz:
 - The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter full anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- c. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The height of antenna 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.
- e. 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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to peak detect function and specified bandwidth with maximum hold mode.
- f. A Quasi-peak measurement was then made for that frequency point for below 1GHz test. PK and AV for above 1GHz emission test.





During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Band (MHz)	Detector	Resolution Bandwidth	Video Bandwidth		
30 to 1000	QP	120 kHz	300 kHz		
Above 1000	Peak	1 MHz	3 MHz		
715575 1000	Average	1 MHz	10 Hz		

TEST RESULTS

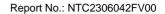
PASS

Please refer to the following pages.

AVG = Peak + AV Factor,

where Peak is the measurement peak level, and AV Factor is calculated by duty cycle, details see section 13 of the report.

Sample calculation, Peak=59.96dBuV/m, AV Factor= -7.34dB, then AVG=59.96+(-7.34)=52.62dBuV/m.



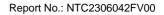


M/N: TX145WSDR	Testing Voltage: DC 4.5V		
Polarization: Horizontal	Detector: QP		
Test Mode: TX	Distance: 3m		

Radiated Emission Measurement Date: 2023/6/25 Time: 9:40:30 82.0 dBuV/m 72 62 FCC_15.231(e)_433M_3m_Peak 52 Margin -6 dB 42 32 22 12 2.0 1000.000 MHz 30.0000 127.000 224.000 321.000 418.000 515.000 612.000 709.000 806.000

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		433.9700	35.74	24.22	59.96			peak	
2		433.9700			52.62	72.87	-20.25	AVG	
3		570.2900	4.74	26.78	31.52	46.00	-14.48	QP	
4		619.7600	6.43	27.58	34.01	46.00	-11.99	QP	
5		731.3100	6.60	29.38	35.98	46.00	-10.02	QP	
6	*	780.7800	6.49	30.05	36.54	46.00	-9.46	QP	
7		867.9400	9.58	31.50	41.08			peak	
8		867.9400			33.74	52.87	-19.13	AVG	

Note: Below 30MHz, the emissions are lower than 20dB below the allowable limit.



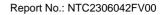


M/N: TX145WSDR	Testing Voltage: DC 4.5V		
Polarization: Vertical	Detector: QP		
Test Mode: TX	Distance: 3m		

Radiated Emission Measurement Date: 2023/6/25 Time: 9:47:53 82.0 dBuV/m 72 62 FCC_15.231(e)_433M_3m_Peak 52 Margin -6 dB 42 32 22 12 2.0 1000.000 MHz 30.0000 127.000 224.000 321.000 418.000 515.000 612.000 709.000 806.000

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over			
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment	
1	*	433.9700	48.05	23.22	71.27			peak		
2		433.9700			63.93	72.87	-8.94	AVG		
3		645.9500	5.73	27.55	33.28	46.00	-12.72	QP		
4		681.8400	5.90	28.58	34.48	46.00	-11.52	QP		
5		718.7000	5.81	29.22	35.03	46.00	-10.97	QP		
6		774.9600	5.73	29.97	35.70	46.00	-10.30	QP		
7		867.9400	10.41	31.50	41.91			peak		
8		867.9400			34.57	52.87	-17.30	AVG		

Note: Below 30MHz, the emissions are lower than 20dB below the allowable limit.

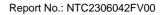




M/N: TX145WSDR	Testing Voltage: DC 4.5V		
Polarization: Horizontal	Detector: Peak & AVG		
Test Mode: TX	Distance: 3m		

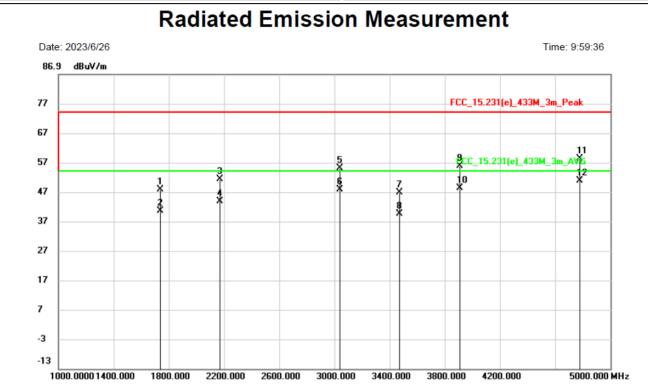
Radiated Emission Measurement Time: 9:53:28 Date: 2023/6/26 86.9 dBuV/m FCC_15.231(e)_433M_3m_Peak 77 67 9 IICC_15.231(e)_433M_3r 10 57 47 37 27 17 7 -3 -13 1000.00001400.000 3800.000 4200.000 5000.000 MHz 1800.000 2200.000 2600.000 3000.000 3400.000

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		1735.880	59.37	-4.33	55.04	74.00	-18.96	peak	
2		1735.880			47.70	54.00	-6.30	AVG	
3		2169.850	54.66	-0.47	54.19	74.00	-19.81	peak	
4		2169.850			46.85	54.00	-7.15	AVG	
5		3037.790	58.22	1.85	60.07	74.00	-13.93	peak	
6		3037.790			52.73	54.00	-1.27	AVG	
7		3471.760	47.67	2.68	50.35	74.00	-23.65	peak	
8		3471.760			43.01	54.00	-10.99	AVG	
9		3905.730	55.04	3.75	58.79	74.00	-15.21	peak	
10		3905.730			51.45	54.00	-2.55	AVG	
11		4773.670	54.72	6.19	60.91	74.00	-13.09	peak	
12	*	4773.670			53.57	54.00	-0.43	AVG	





M/N: TX145WSDR	Testing Voltage: DC 4.5V		
Polarization: Vertical	Detector: Peak & AVG		
Test Mode: TX	Distance: 3m		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	Comment
1		1735.880	52.19	-4.33	47.86	74.00	-26.14	peak	
2		1735.880			40.52	54.00	-13.48	AVG	
3		2169.850	51.67	-0.47	51.20	74.00	-22.80	peak	
4		2169.850			43.86	54.00	-10.14	AVG	
5		3037.790	53.22	1.85	55.07	74.00	-18.93	peak	
6		3037.790			47.73	54.00	-6.27	AVG	
7		3471.760	44.07	2.68	46.75	74.00	-27.25	peak	
8		3471.760			39.41	54.00	-14.59	AVG	
9		3905.730	51.91	3.75	55.66	74.00	-18.34	peak	
10		3905.730			48.32	54.00	-5.68	AVG	
11		4773.670	51.98	6.19	58.17	74.00	-15.83	peak	
12	*	4773.670			50.83	54.00	-3.17	AVG	



14.3 20dB Occupied Bandwidth

LIMIT

According to 15.231(C), the bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz.

Limit = 433.97MHz*0.25% = 1084.9 KHz

BLOCK DIAGRAM OF TEST SETUP



TEST PROCEDURES

- 1. The output port (antenna) from the transmitter was connected to an attenuator and then to the input of the RF Spectrum analyzer.
- 2. Spectrum analyzer set the corresponding parameters for measurement and record the tested data





TEST RESULTS

PASS

Please refer to the following table.





14.4 Transmission time

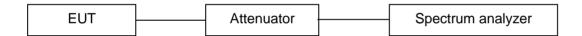
LIMIT

15.231 (a) (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

15.231(a) (2) A transmitter activated automatically shall cease transmission within 5seconds after activation.

15.231(e), 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 transmission but in no case less than 10 seconds.

BLOCK DIAGRAM OF TEST SETUP



TEST PROCEDURES

- 1. The output port (antenna) from the transmitter was connected to an attenuator and then to the input of the RF Spectrum analyzer.
- 2. Spectrum analyzer set the corresponding parameters for measurement and record the tested data.

TEST RESULTS

PASS

Please refer to the following table.





Frequency (MHz)	Transmission time (sec)	Limit (sec)	The silent period time (sec)	Limit (sec)	Result
433.97	0.35	<1	31.05	>10	PASS

Test Photo















14.5 Antenna Requirement

STANDARD APPLICABLE

According to of FCC part 15C 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, 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.

ANTENNA CONNECTED CONSTRUCTION

The antenna is Spring antenna that no antenna other than furnished by the responsible party shall be used with the device, and the best case gain of the antenna is 0dBi, Therefore, the antenna is consider meet the requirement.





15. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCI7	100837	Mar. 13, 2023	1 Year
2.	Antenna	Schwarzbeck	VULB9162	9162-010	Mar. 23, 2022	2 Year
3.	Spectrum Analyzer	Rohde & Schwarz	FSU26	200409/026	Mar. 13, 2023	1 Year
4.	Spectrum Analyzer	Keysight	N9020A	MY54200831	Mar. 13, 2023	1 Year
5.	Spectrum Analyzer	Rohde & Schwarz	FSV40	101094	Mar. 13, 2023	1 Year
6.	Horn Antenna	Schwarzbeck	BBHA9170	9170-172	Mar. 23, 2022	2 Year
7.	Power Sensor	DARE	RPR3006W	15I00041SNO 64	Mar. 13, 2023	1 Year
8.	Horn Antenna	COM-Power	AH-118	071078	Mar. 23, 2023	1 Year
9.	Pre-Amplifier	HP	HP 8449B	3008A00964	Mar. 13, 2023	1 Year
10.	Pre-Amplifier	HP	HP 8447D	1145A00203	Mar. 13, 2023	1 Year
11.	Loop Antenna	Schwarzbeck	FMZB 1513	1513-272	Mar. 23, 2022	2 Year
12.	Test Receiver	Rohde & Schwarz	ESCI	101152	Mar. 13, 2023	1 Year
13.	L.I.S.N	Rohde & Schwarz	ENV 216	101317	Mar. 13, 2023	1 Year
14.	RF Switching Unit	Compliance Direction Systems Inc.	RSU-M2	38311	Mar.13, 2023	1 Year
15.	Temporary antenna connector	TESCOM	SS402	N/A	N/A	N/A
16.	Test Software	EZ	EZ_EMC NTC-3A1.1	N/A	N/A	N/A

Note: For photographs of EUT and measurement, please refer to appendix in separate documents.