FCC RADIO TEST REPORT

The device described below is tested by Dongguan Nore Testing Center Co., Ltd. to determine the maximum emission levels emanating from the device, the severe levels which the device can endure and E.U.T.'s performance criterion. The test results, data evaluation, test procedures, and equipment of configurations shown in this report were made in accordance with the procedures in ANSI C63.10(2013).

Applicant	:	La Crosse Technology Ltd.
Address	:	2809 Losey Blvd. South La Crosse Wisconsin 54601 United States
Manufacturer/ Factory	:	La Crosse Technology Ltd.
Address	:	2809 Losey Blvd. South La Crosse Wisconsin 54601 United States
E.U.T.	:	TH SENSOR
Brand Name	:	La Crosse
Model No.	:	TX147, TX147-INT, TX147vX ,TX147vX-INT, TX147-XX, TX147-XX-INT, TX147XX, TX147XX-INT (X can be 0~9 or A~Z, the difference for different version are the product shell color , software, and packaging upgrade version number, when upgrade a version the number progressed to next number)
FCC ID	:	OMOTX147
Measurement Standard	:	FCC PART 15.231
Date of Receiver	:	August 26, 2020
Date of Test	:	August 26, 2020 to September 14, 2020
Date of Report	:	September 14, 2020

This Test Report is Issued Under the Authority of :

Prepared by	Approved & Authorized Signer
Sundiy Jiang / Engineer	Iori Fan / Authorized Signatory

This test report is for the customer shown above and their specific product only. This report applies to above tested sample only and shall not be reproduced in part without written approval of Dongguan Nore Testing Center Co., Ltd.

TEL: +86-769-22022444 FAX: +86-769-22022799 Web: www.ntc-c.com
Address: Building D, Gaosheng Science and Technology Park, Hongtu Road, Nancheng District, Dongguan City, Guangdong Province, China

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Revision History

Report Number	Description	Issued Date
NTC2008287FV00	Initial Issue	2020-09-14

1.GENERAL INFORMATION

1.1 Product Description for Equipment under Test

E.U.T.	:	TH SENSOR
Main Model Name	:	TX147
Additional Model Name	:	TX147-INT, TX147vX ,TX147vX-INT, TX147-XX, TX147-XX-INT, TX147XX, TX147XX-INT (X can be 0~9 or A~Z, the difference for different version are the product shell color , software, and packaging upgrade version number, when upgrade a version the number progressed to next number)
Brand Name	:	La Crosse
Rating	:	DC 3V (From 1.5V AAA Battery *2)
Test Voltage	:	DC 3V
Hardware Version	:	V1.0
Software Version	:	V1.0
S/N	:	2039-1
Description of Model Difference	:	1. These models have the same circuitry, electrical mechanical, PCB layout and physical construction. The difference is model number, shell color and software due to trading purpose. 2. The software version does not involve changes to RF information.
Note	:	According to the model difference, all tests were performed on model TX147.

Technical parameters (433MHz Transmitter)

Declaring the Frequency	:	433.92MHz
Modulation	:	ASK
Antenna Type	:	Integral Antenna
Antenna Gain	:	0 dBi
Channelized system/ Non-channelized system	:	Non-channelized system

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: OMOTX147 filing to comply with Section 15.231 of the FCC Part 15, Subpart C Rule.

1.3 Test Methodology

The radiated emission measurement was performed according to the procedures in ANSI C63.10 (2013). Radiated emission measurement was performed in semi-anechoic chamber. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters.

1.4 Equipment Modifications

Not available for this EUT intended for grant.

1.5 Support Device

N/A

1.6 Test Facility and Location

Site Description

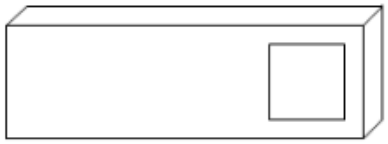
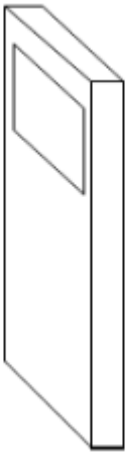
EMC Lab	:	Listed by CNAS, August 13, 2018 The certificate is valid until August 13, 2024 The Laboratory has been assessed and proved to be in compliance with CNAS/CL01 The Certificate Registration Number is L5795. Listed by A2LA, November 01, 2017 The certificate is valid until December 31, 2021 The Laboratory has been assessed and proved to be in compliance with ISO17025 The Certificate Registration Number is 4429.01 Listed by FCC, November 06, 2017 The Designation Number is CN1214 Test Firm Registration Number: 907417 Listed by Industry Canada, June 08, 2017 The Certificate Registration Number is 46405-9743A
Name of Firm	:	Dongguan Nore Testing Center Co., Ltd. (Dongguan NTC Co., Ltd.)
Site Location	:	Building D, Gaosheng Science and Technology Park, Hongtu Road, Nancheng District, Dongguan City, Guangdong Province, China

1.7 Summary of Test Results

FCC Rules	Description Of Test	Result
§15.207	AC Power Conducted Emission	N/A see note 2
§15.231&15.209	Radiated Emission	Compliant
§15.231(c)	Occupied bandwidth	Compliant
§15.231(e)	Transmission time	Compliant
§15.203	Antenna Requirement	Compliant

Note: 1. The EUT has been tested as an independent unit. And Continual transmitting in maximum power.
2. This product will not be connected to the AC mains during normal use, therefore the AC Power Conducted Emission project test is not applicable.
3. The EUT operating multiple positions, therefore the EUT shall be performed three orthogonal planes. The worst plane is X.

Example:

X Plane	Y Plane	Z Plane
		

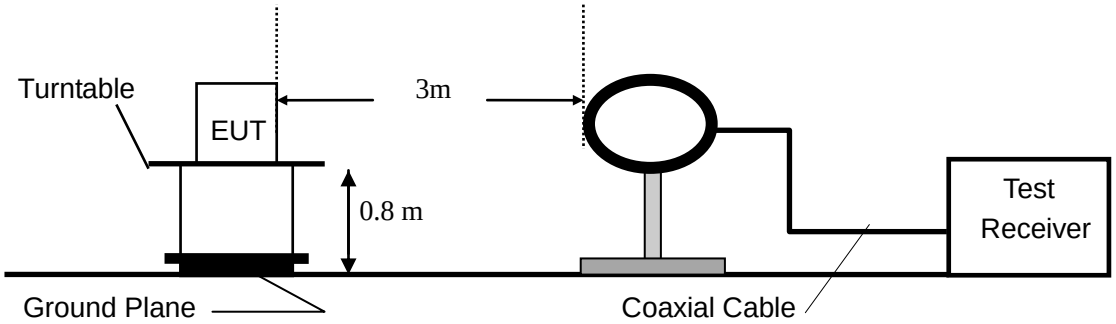
1.8 Deviations and Abnormalities from Standard Conditions

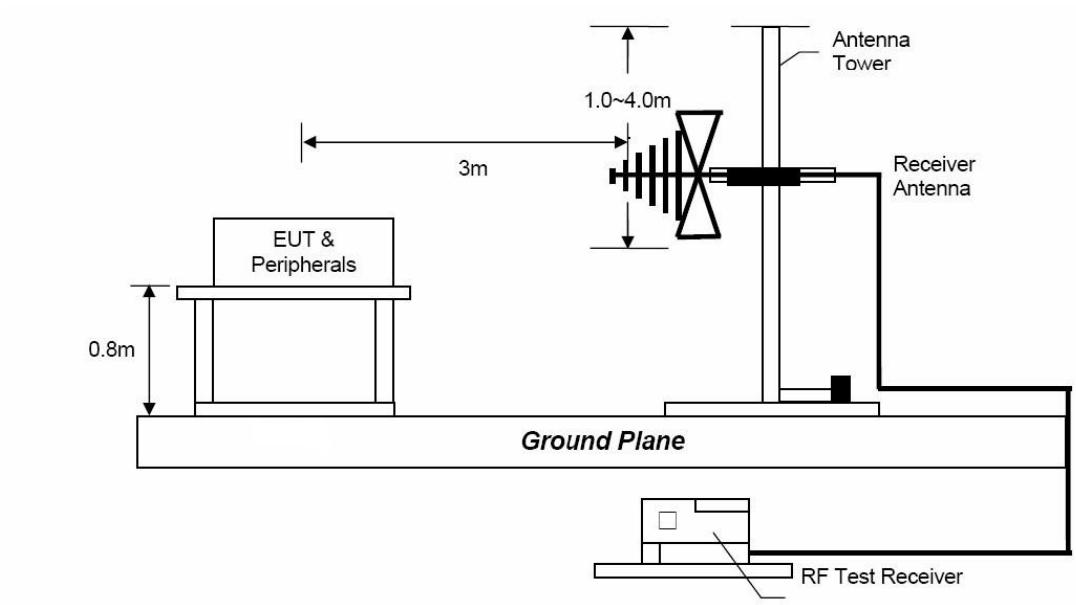
No additions, deviations and exclusions from the standard.

2. Radiated Emission Test

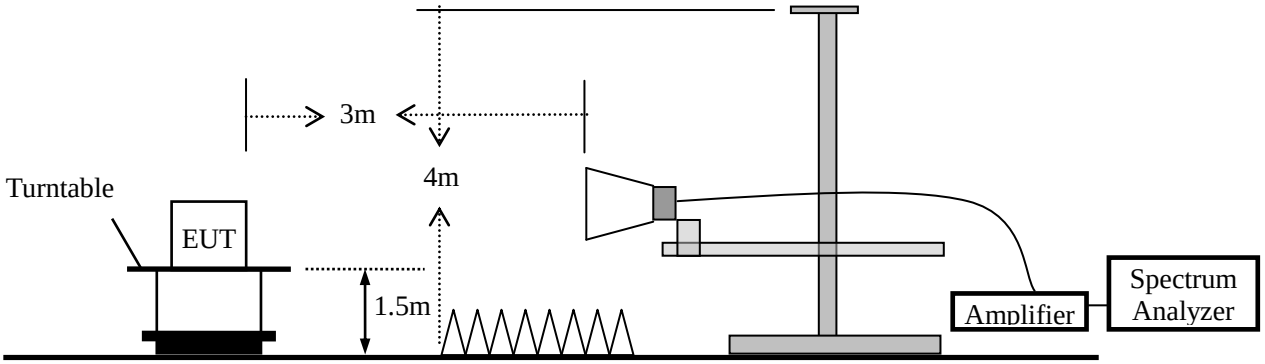
2.1 Test SET-UP (Block Diagram of Configuration)

(1)Radiated Emission Test Set-Up, Frequency Below 30MHz and 30-1000MHz.





(2) Radiated Emission Test Set-Up, Frequency above 1GHz



2.2 Measurement Procedure

a. Blow 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)	Level	Resolution Bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	3 MHz
	Average	Peak+ AV Factor	

Note: (1) Emission Level= Reading Level+Probe Factor +Cable Loss
(2) Factor= Antenna Gain + Cable Loss – Amplifier Gain
(3) Measurement uncertainty: ±4.68dB
(4) Emission (the row indicated by bold) within the restricted band meets the requirement of FCC part 15 Section 15.205.
(5) Horn antenna used for the emission over 1000MHz.

2.3 Limit

Table A [0.009MHz~1GHz]

Frequency range MHz	Distance Meters	Field Strengths Limit (15.209) 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)μV = 20 log Emission level μV/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.

Table B

Fundamental Frequency (MHz)	**Field Strength of Fundamental**		**Field Strength of Spurious Emissions**	
	μV/m	**dBμV/m**	**μV/m**	**dBμV/m**
40.66-40.70	1000	60.00	100	40.00
70-130	500	54.00	50	34.00
130-174	500-1500**	54.00-63.52	50-150**	34.00-43.52
174-260	1500	63.52	150	43.52
260-470	1500-5000**	63.52-74.00	150-500**	43.52-54.00
Above 470	5000	74.00	500	54.00

**) Linear interpolations

2.4 Measurement Results

Pass

Please refer to the following pages.

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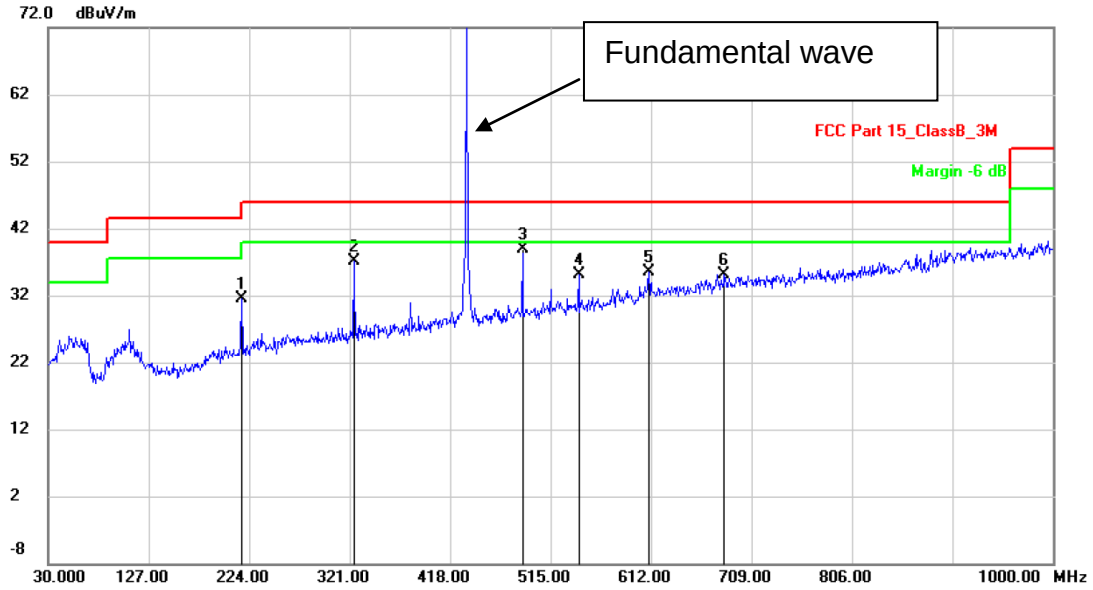
Radiated Emission Measurement

File :TX147 Data :#16 Date: 2020/9/9 Time: 21:16:02



Site		Polarization:	***Horizontal***	Temperature:	26
Limit:	FCC Part 15_ClassB_3M	Power:	DC3V	Humidity:	47 %
EUT:	TH SENSOR	Distance:	3m		
M/N:	TX147				
Mode:	TX				
Note:					

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		217.2100	12.17	19.42	31.59	46.00	-14.41	QP			
2		324.8800	15.06	22.09	37.15	46.00	-8.85	QP			
3	*	488.1600	13.69	25.25	38.94	46.00	-7.06	QP			
4		542.1599	8.95	26.15	35.10	46.00	-10.90	QP			
5		610.0600	8.03	27.45	35.48	46.00	-10.52	QP			
6		682.8100	6.44	28.60	35.04	46.00	-10.96	QP			

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

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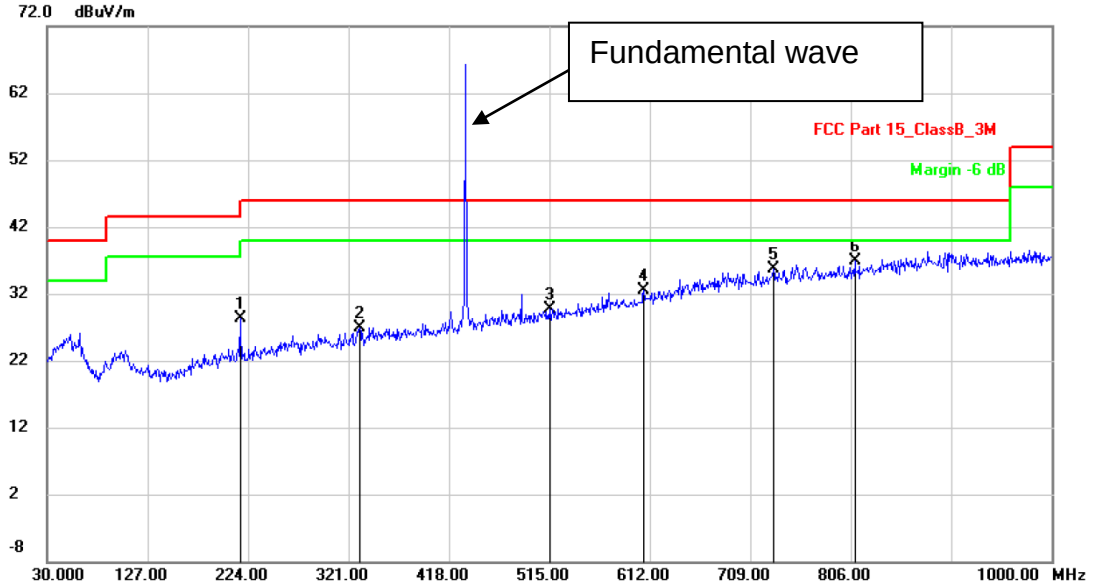
Radiated Emission Measurement

File :TX147 Data :#17 Date: 2020/9/9 Time: 21:25:19



Site
Limit: FCC Part 15_ClassB_3M
EUT: TH SENSOR
M/N: TX147
Mode: TX
Note:

Polarization: ***Vertical***
Power: DC3V
Distance: 3m

Temperature: 26
Humidity: 47 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		216.2400	9.92	18.40	28.32	46.00	-17.68	QP			
2		331.6700	5.55	21.31	26.86	46.00	-19.14	QP			
3		515.0000	5.08	24.69	29.77	46.00	-16.23	QP			
4		606.1800	6.10	26.43	32.53	46.00	-13.47	QP			
5		731.3100	6.28	29.38	35.66	46.00	-10.34	QP			
6	*	809.8800	6.34	30.50	36.84	46.00	-9.16	QP			

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

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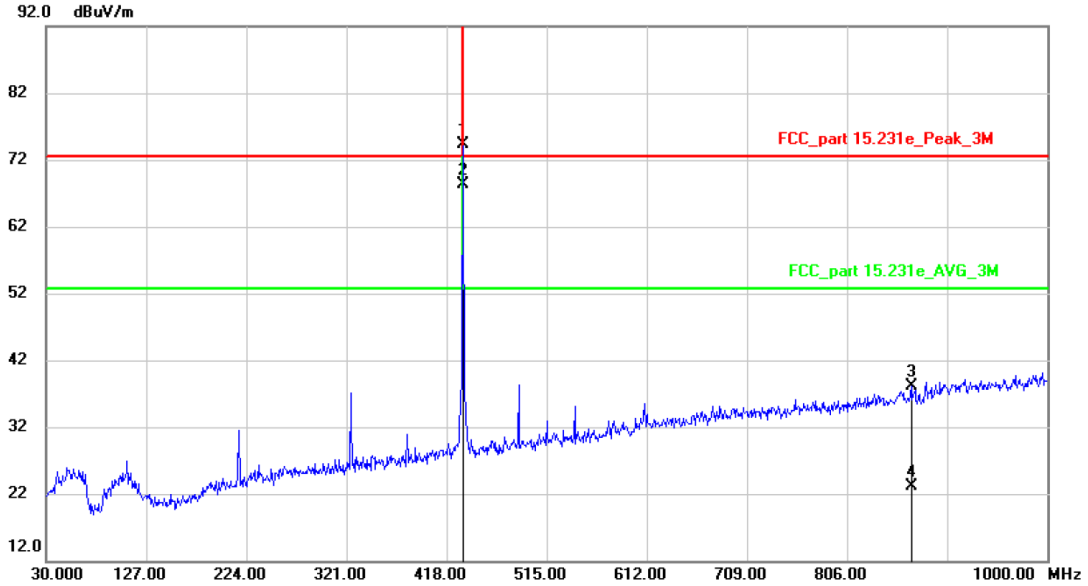
Radiated Emission Measurement

File :TX147 Data :#18 Date: 2020/9/9 Time: 21:16:02



Site
Limit: FCC_part 15.231e_Peak_3M
EUT: TH SENSOR
M/N: TX147
Mode: TX
Note:

Polarization: ***Horizontal***
Power: DC3V
Distance: 3m

Temperature: 26
Humidity: 47 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		433.9200	50.13	24.22	74.35	92.60	-18.25	peak			
2	*	433.9200	44.11	24.22	68.33	72.60	-4.27	AVG			
3		867.8400	6.67	31.50	38.17	72.60	-34.43	peak			
4		867.8400	-8.30	31.50	23.20	52.60	-29.40	AVG			

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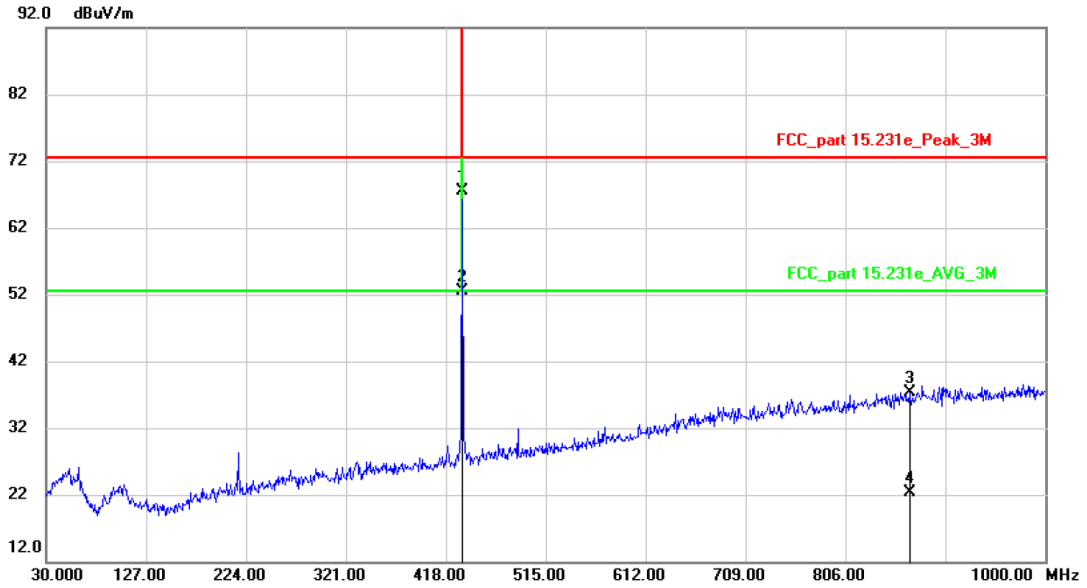
Radiated Emission Measurement

File :TX147 Data :#19 Date: 2020/9/9 Time: 21:25:19



Site
Limit: FCC_part 15.231e_Peak_3M
EUT: TH SENSOR
M/N: TX147
Mode: TX
Note:

Polarization: ***Vertical***
Power: DC3V
Distance: 3m

Temperature: 26
Humidity: 47 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		433.9200	44.20	23.22	67.42	92.60	-25.18	peak			
2	*	433.9200	29.21	23.22	52.43	72.60	-20.17	AVG			
3		867.8400	5.71	31.50	37.21	72.60	-35.39	peak			
4		867.8400	-9.20	31.50	22.30	52.60	-30.30	AVG			

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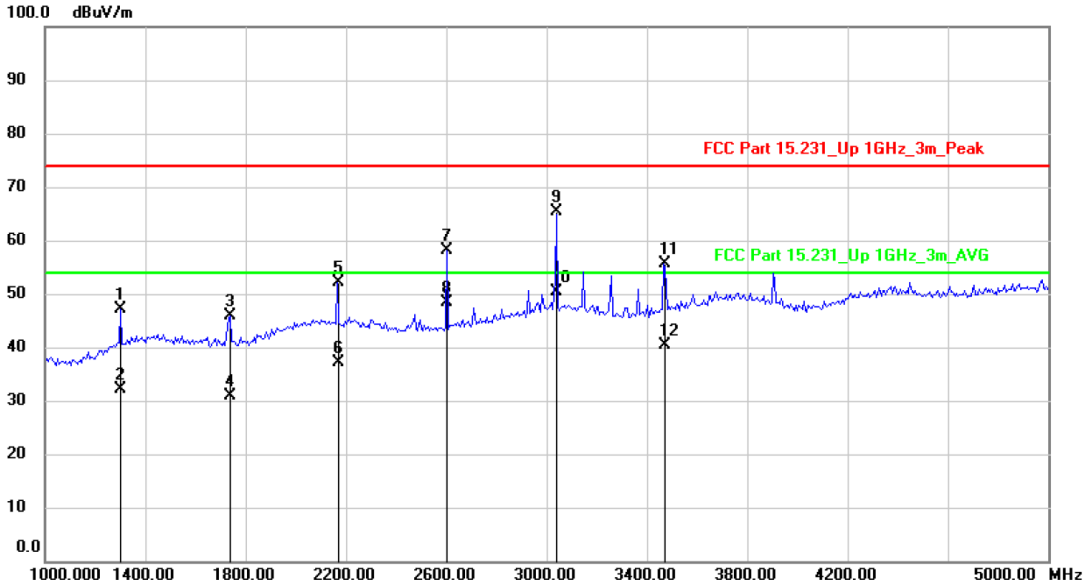
Radiated Emission Measurement

File :TX147 Data :#14 Date: 2020/9/9 Time: 21:00:52



Site
Limit: FCC Part 15.231_Up 1GHz_3m_Peak
EUT: TH SENSOR
M/N: TX147
Mode: TX
Note:

Polarization: ***Horizontal***
Power: DC3V
Distance: 3m

Temperature: 26
Humidity: 47 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		1301.282	54.65	-7.61	47.04	74.00	-26.96	peak			
2		1301.282	39.71	-7.61	32.10	54.00	-21.90	AVG			
3		1737.179	50.13	-4.30	45.83	74.00	-28.17	peak			
4		1737.179	35.10	-4.30	30.80	54.00	-23.20	AVG			
5		2166.667	52.53	-0.48	52.05	74.00	-21.95	peak			
6		2166.667	37.58	-0.48	37.10	54.00	-16.90	AVG			
7		2602.564	57.46	0.76	58.22	74.00	-15.78	peak			
8		2602.564	47.74	0.76	48.50	54.00	-5.50	AVG			
9		3038.461	63.51	1.86	65.37	74.00	-8.63	peak			
10	*	3038.461	48.52	1.86	50.38	54.00	-3.62	AVG			
11		3467.949	52.93	2.66	55.59	74.00	-18.41	peak			
12		3467.949	37.84	2.66	40.50	54.00	-13.50	AVG			

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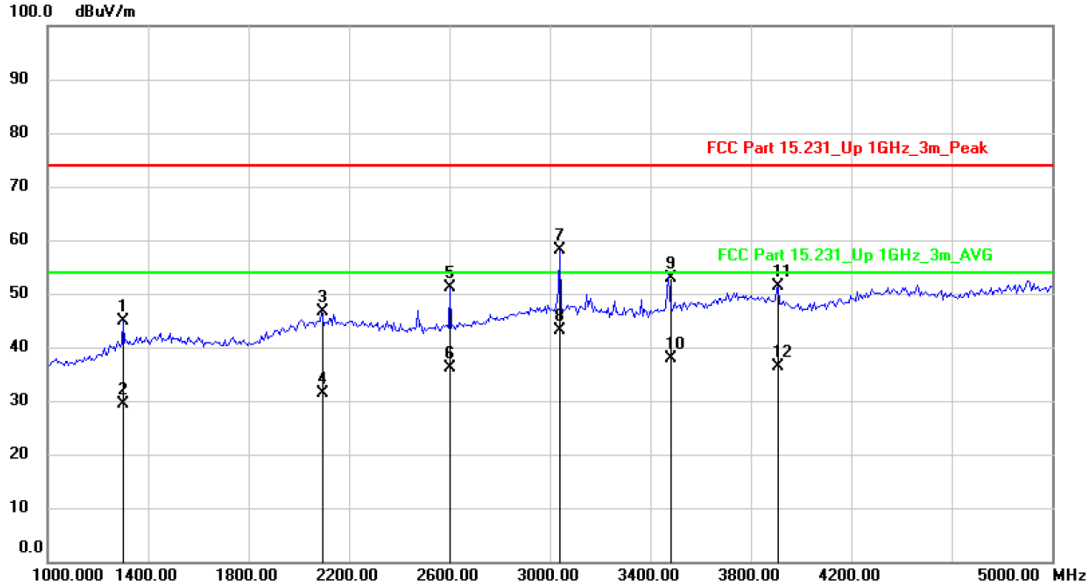
Radiated Emission Measurement

File :TX147 Data :#15 Date: 2020/9/9 Time: 21:09:23



Site
Limit: FCC Part 15.231_Up 1GHz_3m_Peak
EUT: TH SENSOR
M/N: TX147
Mode: TX
Note:

Polarization: ***Vertical***
Power: DC3V
Distance: 3m

Temperature: 26
Humidity: 47 %

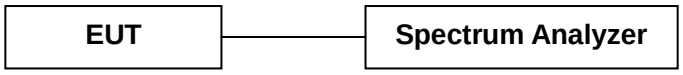
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		1301.282	52.57	-7.61	44.96	74.00	-29.04	peak			
2		1301.282	37.11	-7.61	29.50	54.00	-24.50	AVG			
3		2089.744	47.19	-0.65	46.54	74.00	-27.46	peak			
4		2089.744	32.15	-0.65	31.50	54.00	-22.50	AVG			
5		2602.564	50.29	0.76	51.05	74.00	-22.95	peak			
6		2602.564	35.34	0.76	36.10	54.00	-17.90	AVG			
7		3038.461	56.29	1.86	58.15	74.00	-15.85	peak			
8	*	3038.461	41.34	1.86	43.20	54.00	-10.80	AVG			
9		3474.359	50.24	2.69	52.93	74.00	-21.07	peak			
10		3474.359	35.21	2.69	37.90	54.00	-16.10	AVG			
11		3910.256	47.69	3.76	51.45	74.00	-22.55	peak			
12		3910.256	32.74	3.76	36.50	54.00	-17.50	AVG			

3. Occupied Bandwidth

3.1 Measurement Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW was chosen so that the display was a result of the hopping channel modulation. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. Use the spectrum 20dB down delta function to measure the bandwidth.

3.2 Test SET-UP (Block Diagram of Configuration)



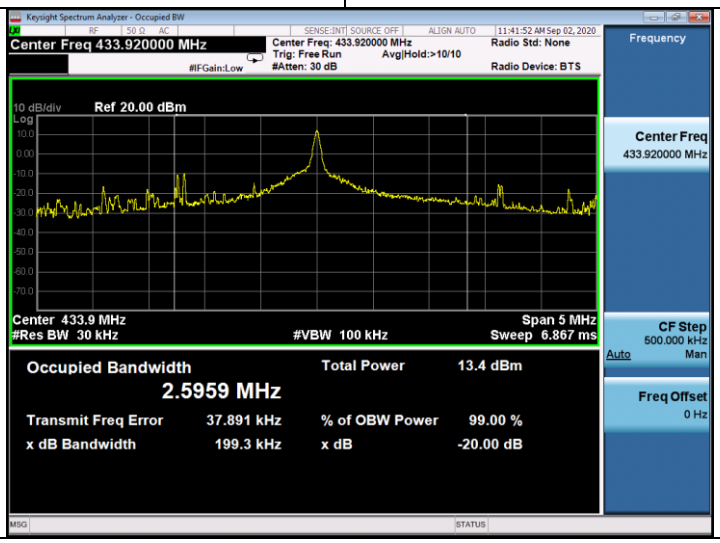
3.3 Limit

Please refer section 15.231
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 = 433.92*0.25% = 1.08 MHz

3.4 Measurement Results

20dB Bandwidth	Limit
199.3KHz	1.08MHz



4 Transmission Time

4.1 Measurement Procedure

Same as section 3.1.

4.2 Test SET-UP (Block Diagram of Configuration)

Same as section 3.2.

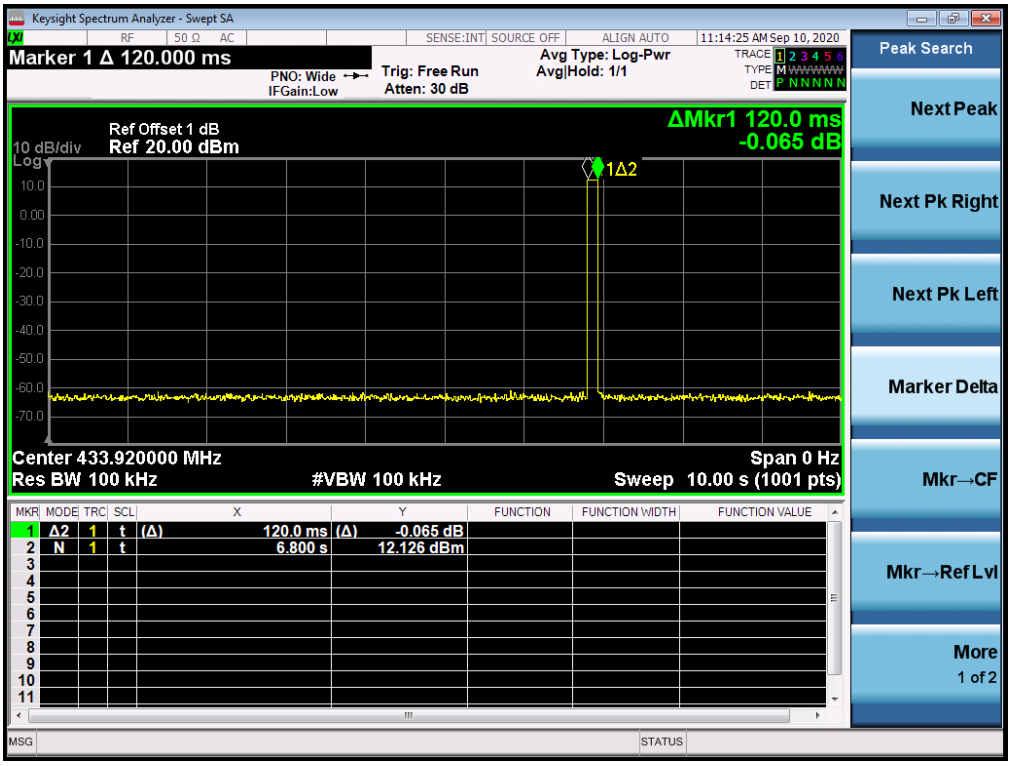
4.3 Limit

According to 15.231(e), Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section. 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.

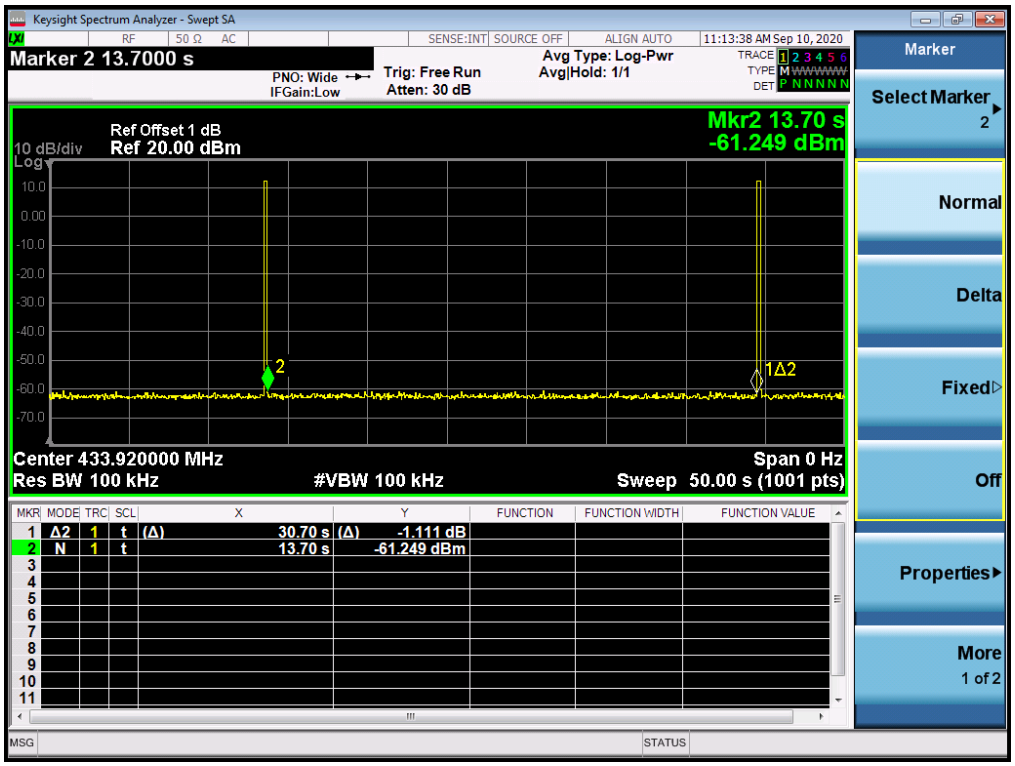
4.4 Measurement Results

Transmission Time	Limit
0.12 s	1 s
Silent Period Between Transmissions	Limit
30.7 s	＞10s

Transmission Time



Silent Period between Transmissions



5. Antenna Application

5.1 Antenna requirement

According to of FCC part 15C section 15.203 and 15.240:

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.

5.2 Measurement Results

The antenna is integral antenna and no consideration of replacement, and the best case gain of the antenna is 0dBi. Therefore, the antenna is consider meet the requirement.

6. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCI7	100837	Mar. 13, 2020	1 Year
2.	Antenna	Schwarzbeck	VULB9162	9162-010	Mar. 23, 2020	1 Year
3.	Spectrum Analyzer	Rohde & Schwarz	FSU26	200409/026	Mar. 13, 2020	1 Year
4.	Spectrum Analyzer	Keysight	N9020A	MY54200831	Mar. 13, 2020	1 Year
5.	Spectrum Analyzer	Rohde & Schwarz	FSV40	101094	Mar. 13, 2020	1 Year
6.	Horn Antenna	Schwarzbeck	BBHA9170	9170-172	Mar. 22, 2019	2 Year
7.	Power Sensor	DARE	RPR3006W	15I00041SNO64	Mar. 13, 2020	1 Year
8.	Power Sensor	DARE	RPR3006W	15I00041SNO88	Mar. 13, 2020	1 Year
9.	Communication Tester	Rohde & Schwarz	CMW500	149004	Mar. 13, 2020	1 Year
10.	Horn Antenna	COM-Power	AH-118	071078	Mar. 23, 2020	1 Year
11.	Pre-Amplifier	HP	HP 8449B	3008A00964	Mar. 13, 2020	1 Year
12.	Pre-Amplifier	HP	HP 8447D	1145A00203	Mar. 13, 2020	1 Year
13.	Loop Antenna	Schwarzbeck	FMZB 1513	1513-272	Mar. 23, 2020	1 Year
14.	Test Receiver	Rohde & Schwarz	ESCI	101152	Mar. 14, 2020	1 Year
15.	L.I.S.N	Rohde & Schwarz	ENV 216	101317	Mar. 13, 2020	1 Year
16.	L.I.S.N	Rohde & Schwarz	ESH2-Z5	893606/014	Mar. 13, 2020	1 Year
17.	RF Switching Unit	Compliance Direction Systems Inc.	RSU-M2	38311	Mar.13, 2020	1 Year
18.	Temperature & Humidity Chamber	REMAFEE	SYHR225L	N/A	Mar. 13, 2020	1 Year
19.	DC Source	Maynuo	MY8811	N/A	Mar. 13, 2020	1 Year
20.	Temporary antenna connector	TESCOM	SS402	N/A	N/A	N/A
21.	Chamber	SAEMC	9*7*7m	N/A	Jun. 20, 2019	2 Year
22.	Test Software	EZ	EZ_EMC	N/A	N/A	N/A

Note: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

---End---