

TEST REPORT

Product Name : LED Color Changing Submersible Light
with Remote Control
Brand Mark : NOMA
Model No. : RF12CRGB
FCC ID : 2AQUQGE26182
Report Number : BLA-EMC-202101-A8801
Date of Sample Receipt : 2021/2/2
Date of Test : 2021/2/2 to 2021/2/22
Date of Issue : 2021/2/24
Test Standard : FCC CFR Title 47 Part 15 Subpart C
Section 15.231
Test Result : Pass

Prepared for:

Globe Electric Company Inc.

150, Oneida, Montreal, Quebec, Canada, H9R 1A8

Prepared by:

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2021/2/24



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Report Revise Record

Version No.	Date	Description
00	2021/2/24	Original

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1 TEST SUMMARY

Test Item	Section in CFR 47	Result
Antenna requirement	15.203	Pass
Field strength of the fundamental signal	15.231 (b)	Pass
Spurious emissions	15.231 (b)/15.209	Pass
20dB Bandwidth	15.231(c)	Pass
Dwell time	15.231 (a)(1)	Pass
Conducted Emission	15.207	N/A

Remarks:

N/A: The EUT not applicable of the test item.

Pass: The EUT complies with the essential requirements in the standard.

Test according to ANSI C63.4:2014 and ANSI C63.10:2013.

2 GENERAL INFORMATION

Applicant	Globe Electric Company Inc.
Address	150, Oneida, Montreal, Quebec, Canada, H9R 1A8
Manufacturer	Globe Electric Company Inc.
Address	150, Oneida, Montreal, Quebec, Canada, H9R 1A8
Factory	Globe Electric Company Inc.
Address	150, Oneida, Montreal, Quebec, Canada, H9R 1A8

3 GENERAL DESCRIPTION OF E.U.T.

Product Name:	LED Color Changing Submersible Light with Remote Control
Model No.:	RF12CRGB
Hardware Version	N/A
Software Version	N/A
Operation Frequency:	433.92MHz
Channel numbers:	1
Modulation type:	ASK
Antenna Type:	PCB antenna
Antenna gain:	0dBi(Provided by customer)
Power supply:	DC 3.0V

4 TEST ENVIRONMENT

Environment	Temperature	Voltage
Normal	22°C	DC3.0V

5 TEST MODE

TEST MODE	TEST MODE DESCRIPTION
Transmitting mode	Keep the EUT in continuously transmitting mode with modulation.
Remark: Full battery is used during all test	

6 MEASUREMENT UNCERTAINTY

Parameter	Expanded Uncertainty (Confidence of 95%)
Radiated Emission	±4.34dB
Radiated Emission	±4.24dB
Radiated Emission	±4.68dB
AC Power Line Conducted Emission	±3.45dB

7 DESCRIPTION OF SUPPORT UNIT

Device Type	Manufacturer	Model Name	Serial No.	Remark
N/A	N/A	N/A	N/A	N/A

8 LABORATORY LOCATION

All tests were performed at:

BlueAsia of Technical Services(Shenzhen) Co., Ltd.

Building C, No. 107, Shihuan Road, Shiyan Sub-District, Baoan District, Shenzhen,
Guangdong Province, China

Telephone: TEL: +86-755-28682673 FAX: +86-755-28682673

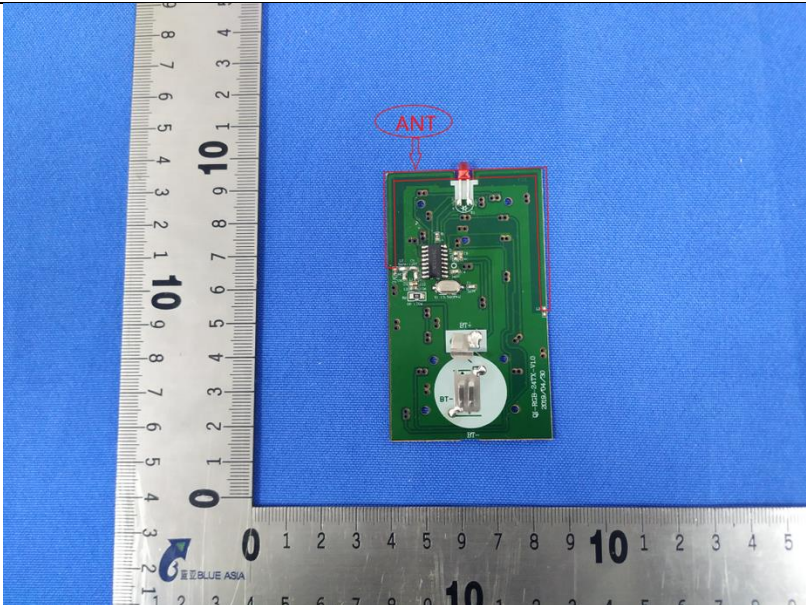
No tests were sub-contracted.

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9 TEST INSTRUMENTSLIST

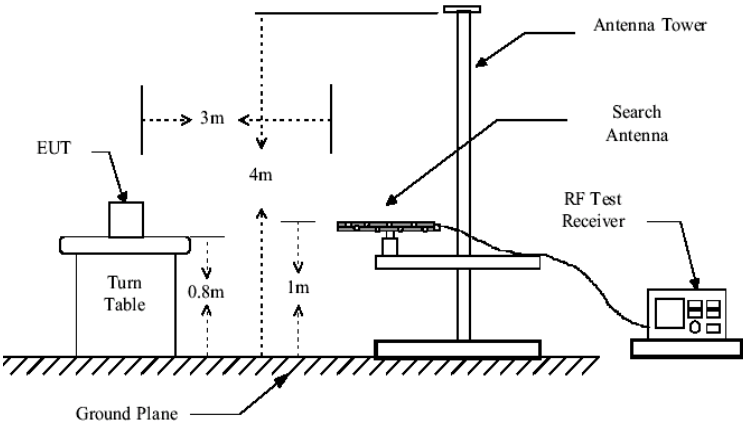
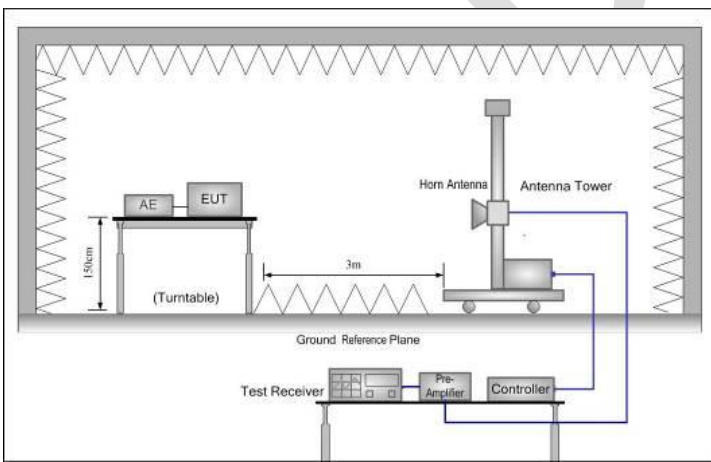
Test Equipment Of Radiated Spurious Emissions					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Chamber	SKET	966	N/A	5/8/2018	5/7/2021
Spectrum	R&S	FSP40	100817	7/4/2020	7/3/2021
Receiver	R&S	ESR7	101199	5/7/2020	5/6/2021
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	7/14/2019	7/13/2021
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	7/14/2019	7/13/2021
Amplifier	SKET	LNPA-0118-45	N/A	7/4/2020	7/3/2021
EMI software	EZ	EZ-EMC	N/A	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2/14/2019	2/13/2021

10 ANTENNA REQUIREMENT

Standard requirement:	FCC Part15 C Section 15.203
<p>15.203 requirement: 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.</p>	
E.U.T Antenna:	
<p>The EUT make use of an PCB antenna, The typical gain of the antenna is 0.0dBi.</p>	
	

11 RADIATED EMISSION

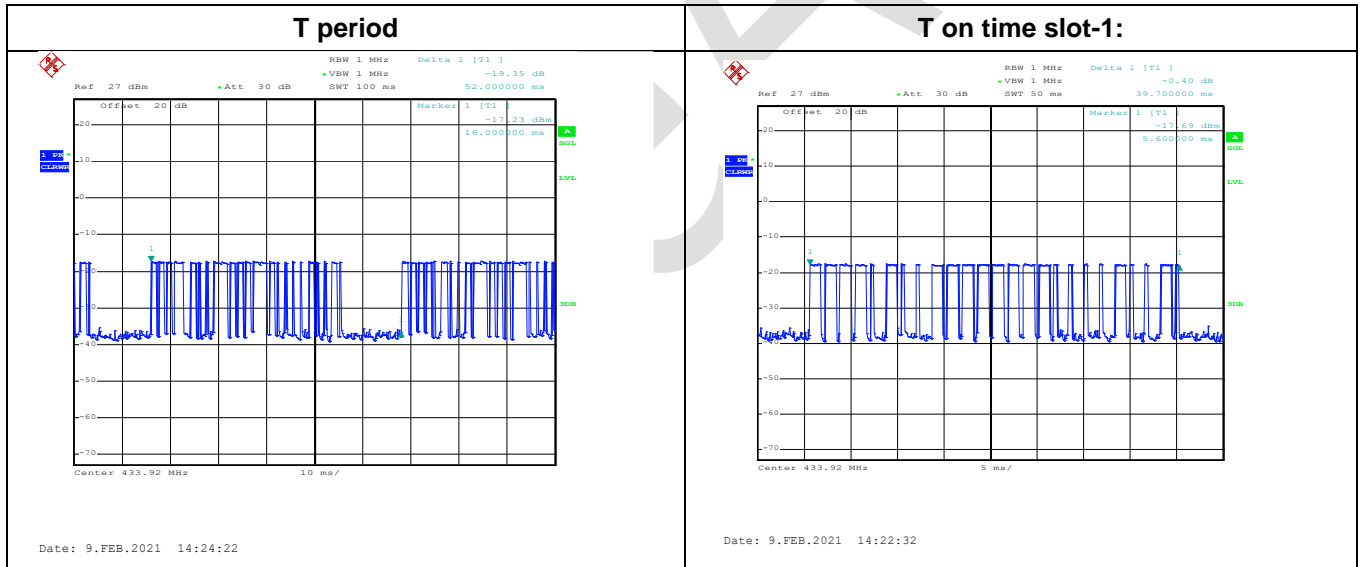
Test Requirement:	FCC Part15 C Section 15.231(b) and 15.209				
Test Method:	ANSI C63.4:2014				
TestFrequencyRange:	30MHz to 5000MHz				
Test site:	Measurement Distance: 3m(Semi-Anechoic Chamber)				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
Limit: (Field strength of the fundamental signal)	Frequency	Limit (dBuV/m @3m)		Remark	
	433.92 MHz	80.8		Average Value	
		100.8		Peak Value	
Limit: (Spurious Emissions)	Frequency	Limit (dBuV/m @3m)		Remark	
	30MHz-88MHz	40.0		Quasi-peak Value	
	88MHz-216MHz	43.5		Quasi-peak Value	
	216MHz-960MHz	46.0		Quasi-peak Value	
	960MHz-1GHz	54.0		Quasi-peak Value	
	Above 1GHz	54.0		Average Value	
		74.0		Peak Value	
Or The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level whichever limit permits higher field strength.					
Test Procedure:	<p>a. The EUT was placed on the top of a rotating table 0.8m(below 1GHz) /1.5m(above 1GHz) above the ground at a 3 meter chamber. The table was rotated 360 degrees to determine the position of the highest radiation.</p> <p>b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</p> <p>c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</p> <p>d. 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 rotating table was turned from 0 degrees to 360 degrees to find the maximum reading.</p> <p>e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</p>				

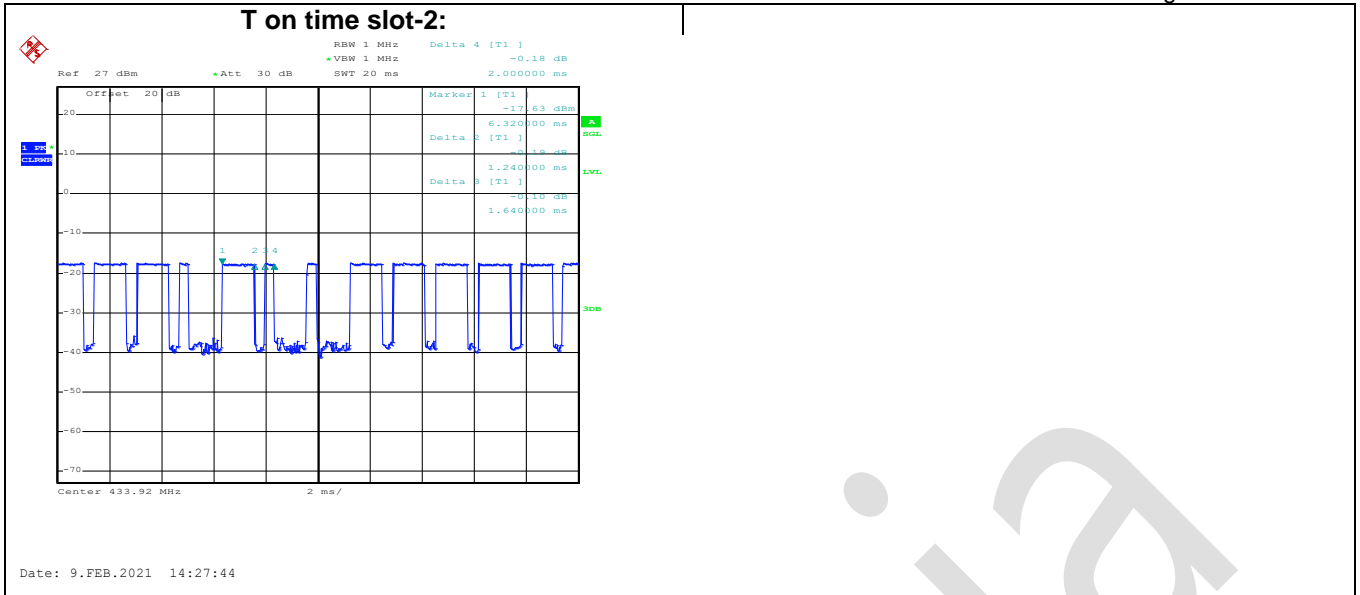
<p>Test setup:</p>	<p>Below 1GHz</p>  <p>Above 1GHz</p> 
<p>Test Instruments:</p>	<p>Refer to section 5.7 for details</p>
<p>Test mode:</p>	<p>Refer to section 5.3 for details</p>
<p>Test results:</p>	<p>Pass</p>

11.1 FIELD STRENGTH OF THE FUNDAMENTAL SIGNAL

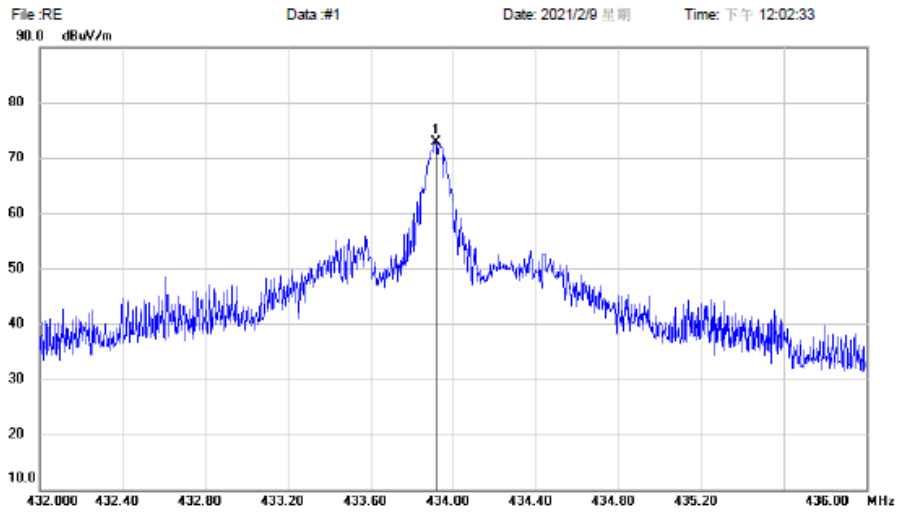
Peak value						
Frequency (MHz)	Read Level (dBuV)	Correct Facor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
433.92	44.48	28.15	72.63	100.80	-28.17	Vertical
433.92	44.71	28.15	72.86	100.80	-27.94	Horizontal
Average value						
Frequency (MHz)	Peak value	Duty cycle factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
433.92	72.63	-7.39	65.24	80.80	-15.56	Vertical
433.92	72.86	-7.39	65.47	80.80	-15.33	Horizontal
Calculate Formula:	Average value = Peak value + Duty Cycle Factor					
	Duty cycle factor = 20log(Duty cycle)					
	Duty cycle = on time/ period					
Test data:	T on time = 1.24ms*15+0.36ms*10=22.2(ms)					
	T period =52.00(ms)					
	Duty cycle =42.69%					
	Duty cycle factor = 20log(Duty cycle) = -7.39					

Test data:





Horizontal Radiated Emission Measurement

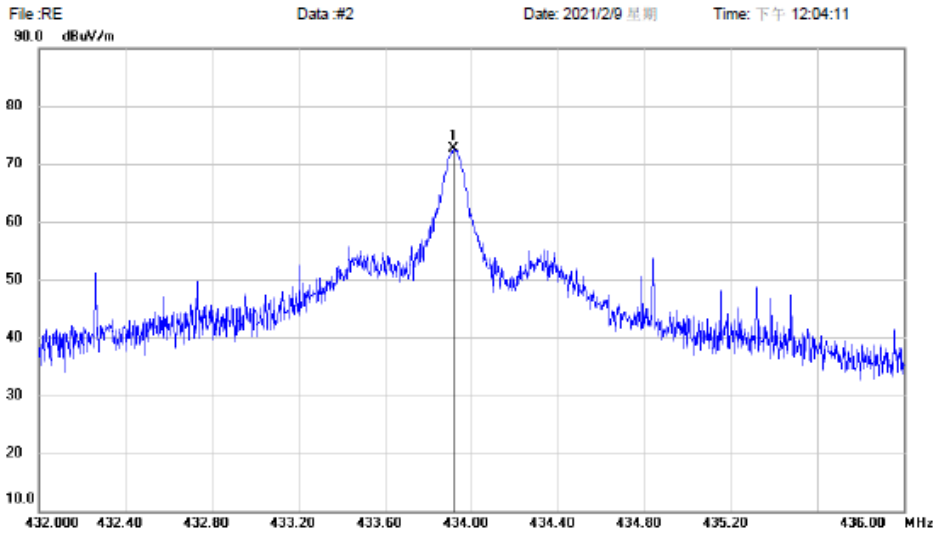


Site Polarization: *Horizontal* Temperature:
 Limit: Power: Humidity: %
 EUT: Remote Control Distance: 3m
 M/N: RF12CRGB
 Mode: TX mode
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree
1	*	433.9160	44.71	28.15	72.86		peak		

Vertical

Radiated Emission Measurement



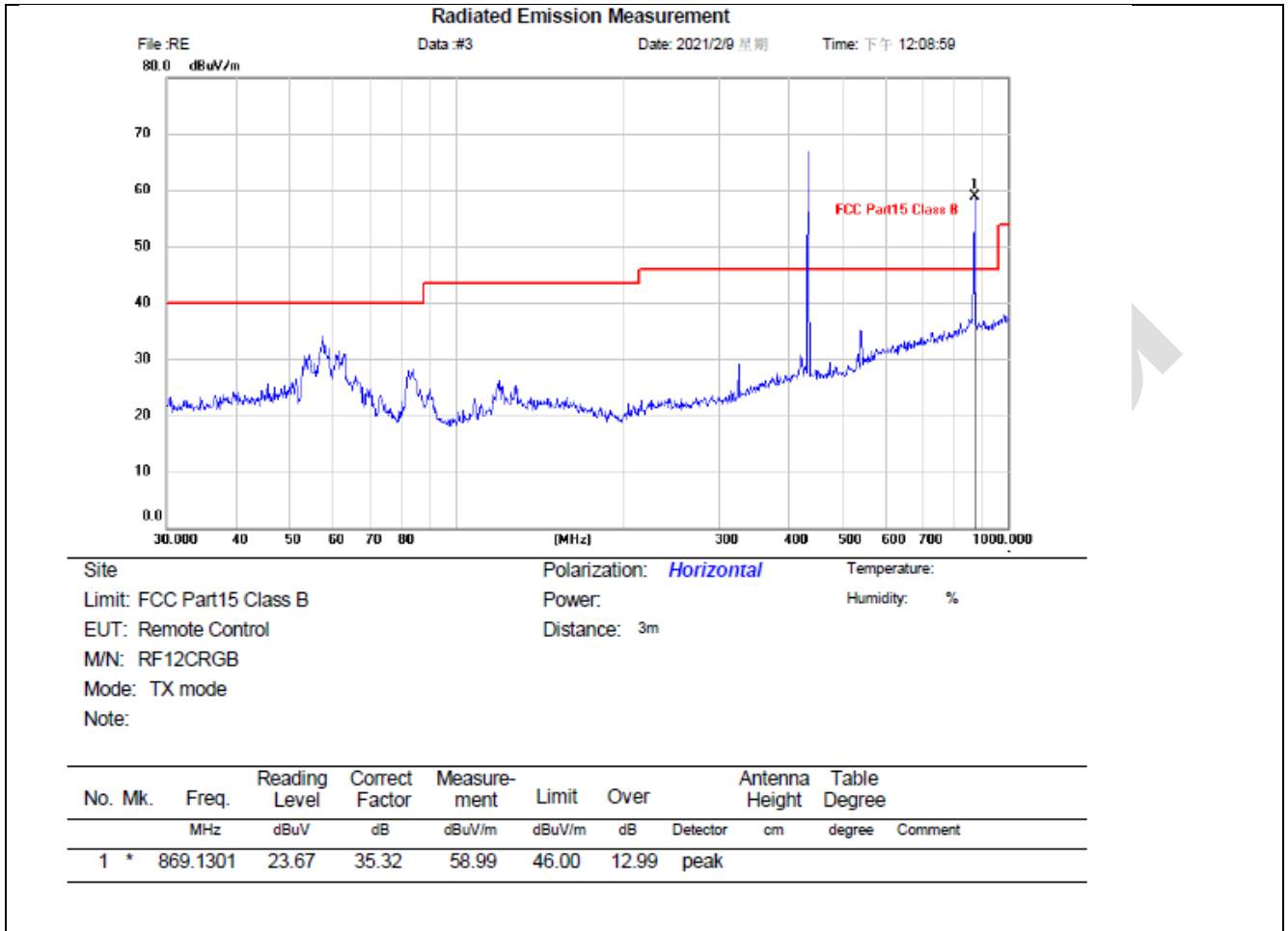
Site: Polarization: *Vertical* Temperature:
 Limit: Power: Humidity: %
 EUT: Remote Control Distance: 3m
 M/N: RF12CRGB
 Mode: TX mode
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1	*	433.9160	44.48	28.15	72.63			peak		Comment

Blue

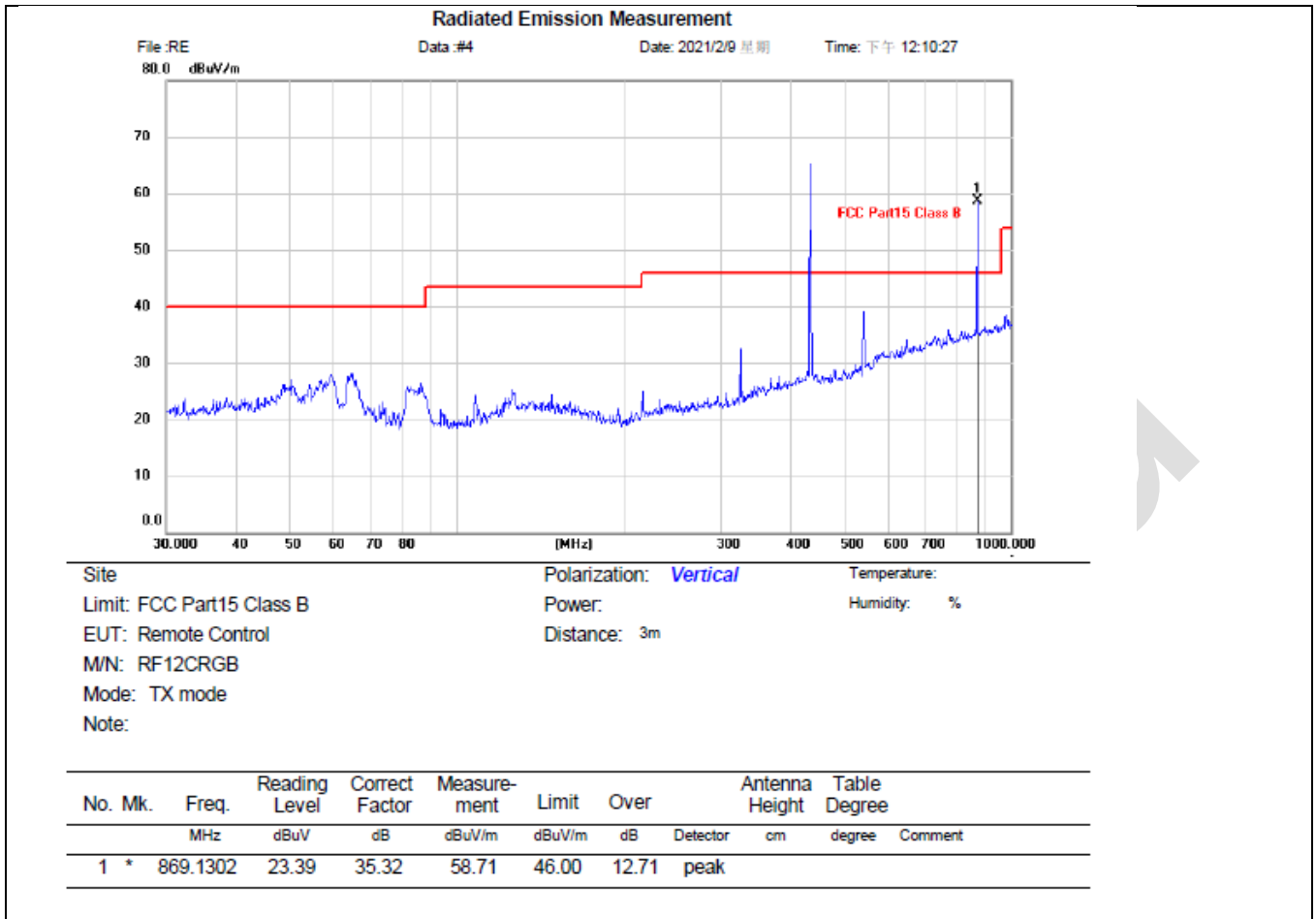
11.2 SPURIOUS EMISSIONS

Below 1G
Horizontal



No.	Frequency	Reading	Correct	Duty cycle factor	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	dB/m		(dBuV/m)	(dBuV/m)		
1	869.1301	23.67	35.32	N/A	58.99	80.8	-21.81	peak
2	869.1301	/	/	-7.39	51.60	60.8	-9.2	Ave

Vertical



No.	Frequency	Reading	Correct	Duty cycle factor	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	dB/m		(dBuV/m)	(dBuV/m)	(dB)	
1	869.1302	23.39	35.32	N/A	58.71	80.8	-22.09	peak
2	869.1302	/	/	-7.39	51.32	60.8	-9.48	Ave

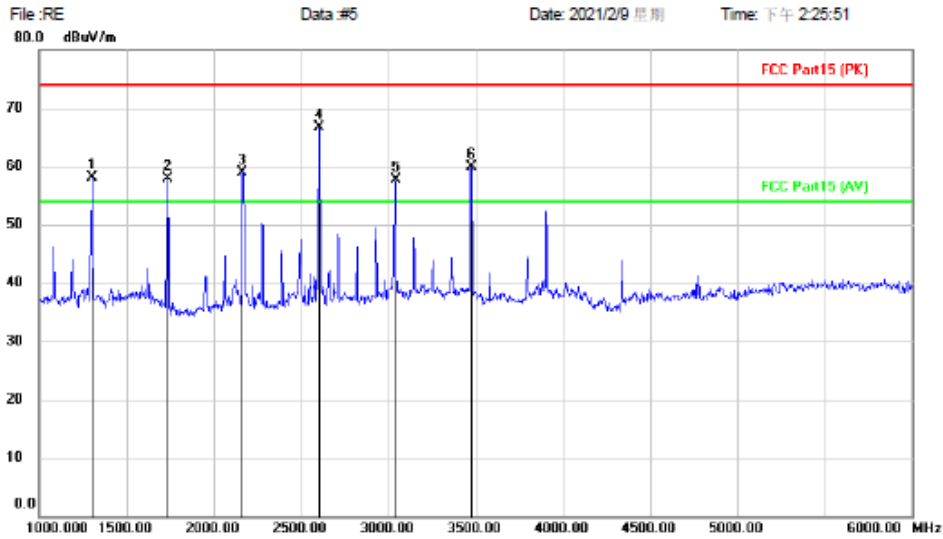
Remark:

1. Final Level = Receiver Read level + Correct factor
2. Correct factor = Antenna Factor + Cable Loss – Pre-amplifier Factor
3. Average value = Peak value + Duty Cycle Factor

Above 1GHz

Horizontal

Radiated Emission Measurement



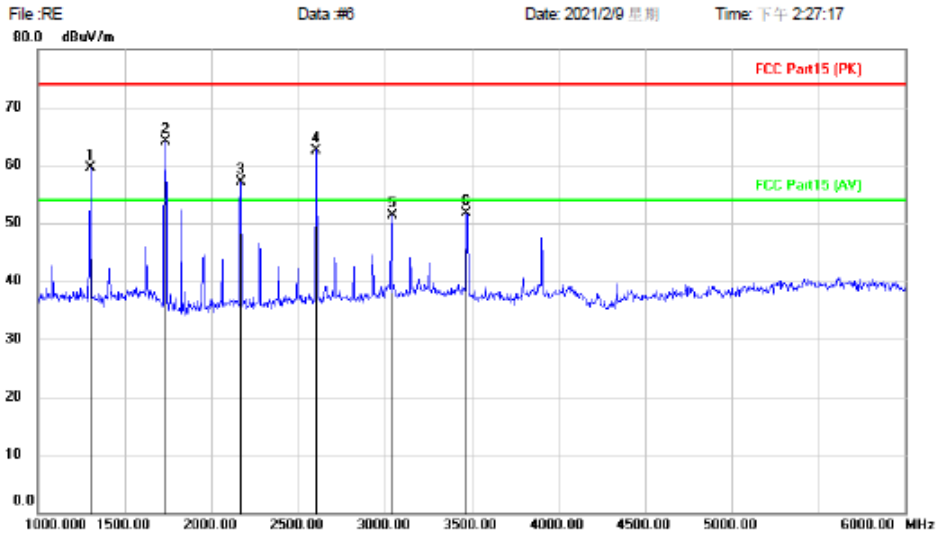
Site: Polarization: *Horizontal* Temperature:
 Limit: FCC Part15 (PK) Power: Humidity: %
 EUT: Remote Control Distance: 3m
 M/N: RF12CRGB
 Mode:TX mode
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree
1		1300.000	77.04	-19.03	58.01	74.00	-15.99	peak	
2		1735.000	78.64	-20.71	57.93	74.00	-16.07	peak	
3		2165.000	77.93	-19.02	58.91	74.00	-15.09	peak	
4	*	2605.000	84.33	-17.64	66.69	74.00	-7.31	peak	
5		3040.000	73.72	-16.09	57.63	74.00	-16.37	peak	
6		3475.000	75.81	-15.91	59.90	74.00	-14.10	peak	

No.	Frequency	Reading	Correct factor	Duty cycle factor	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	dB		(dBuV/m)	(dBuV/m)		
1	2605.000	84.33	-17.64	N/A	66.69	80.8	-14.11	Peak
2	2605.000	/	/	-7.39	59.30	60.8	-1.5	Ave

Vertical

Radiated Emission Measurement



Site: Polarization: **Vertical** Temperature:
 Limit: FCC Part15 (PK) Power: Humidity: %
 EUT: Remote Control Distance: 3m
 M/N: RF12CRGB
 Mode: TX mode
 Note:

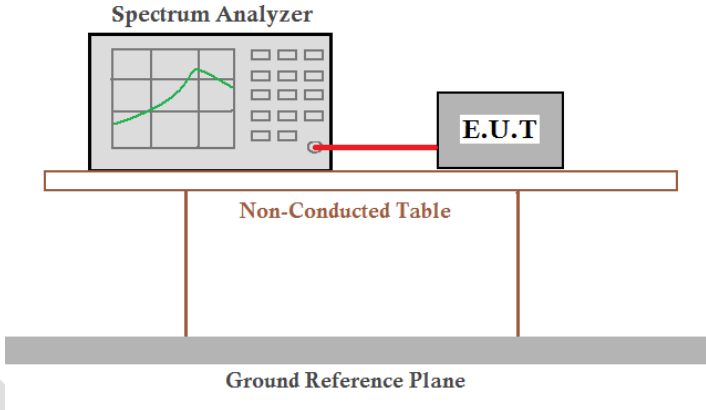
No.	Mk.	Freq.	Reading	Correct	Measurement	Limit	Over	Antenna	Table	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Height	Degree	Comment
1		1300.000	78.45	-19.03	59.42	74.00	-14.58	cm	degree	peak
2	*	1735.000	84.90	-20.71	64.19	74.00	-9.81			peak
3		2170.000	76.11	-19.01	57.10	74.00	-16.90			peak
4		2605.000	80.24	-17.64	62.60	74.00	-11.40			peak
5		3040.000	67.31	-16.09	51.22	74.00	-22.78			peak
6		3470.000	67.67	-15.91	51.76	74.00	-22.24			peak

No.	Frequency	Reading	Correct	Duty cycle	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	factor		(dB)	(dBuV/m)	(dBuV/m)	
1	1735.000	84.90	-20.71	N/A	64.19	80.8	-16.61	Peak
2	1735.000	/	/	-7.39	56.80	60.8	-4.00	Ave
3	2605.00	80.24	-17.64	N/A	62.60	80.8	-18.20	Peak
4	2605.00	/	/	-7.39	55.21	60.8	-5.59	Ave

Remark:

1. Final Level = Receiver Read level + Correct factor
2. Correct factor = Antenna Factor + Cable Loss – Preamplifier Factor
3. Average value = Peak value + Duty Cycle Factor

12 20DB BANDWIDTH

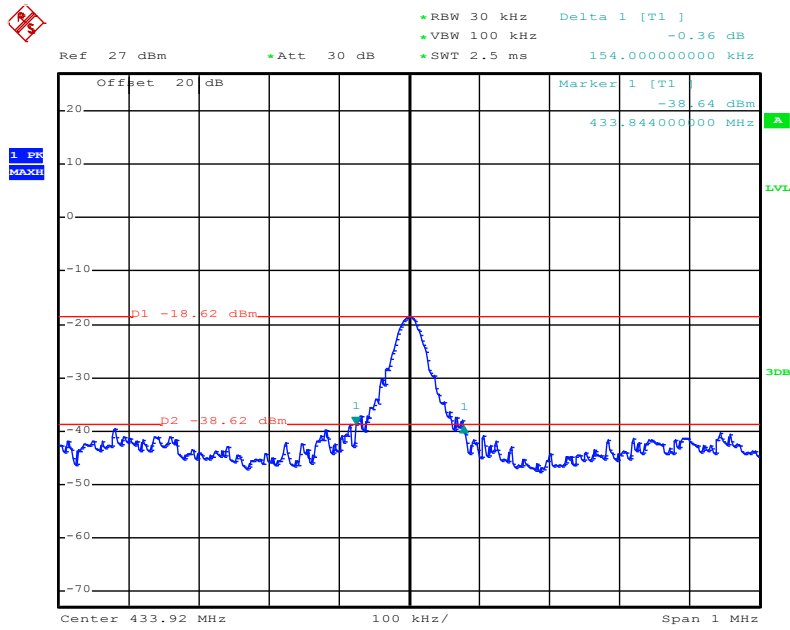
Test Requirement:	FCC Part15 C Section 15.231 (c)
Test Method:	ANSI C63.4:2014
Receiver setup:	RBW=30kHz, VBW=100kHz, detector: Peak
Limit:	The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.
Test Procedure:	<ol style="list-style-type: none"> 1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT. 2. Set the EUT to proper test channel. 3. Max hold the radiated emissions, mark the peak power frequency point and the -20dB upper and lower frequency points. 4. Read 20dB bandwidth.
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data

20dB bandwidth (MHz)	Limit (MHz)	Results
0.154	1.0848	Passed

Note: Limit= Fundamental frequency×0.25%=433.92×0.25%=1.0848MHz

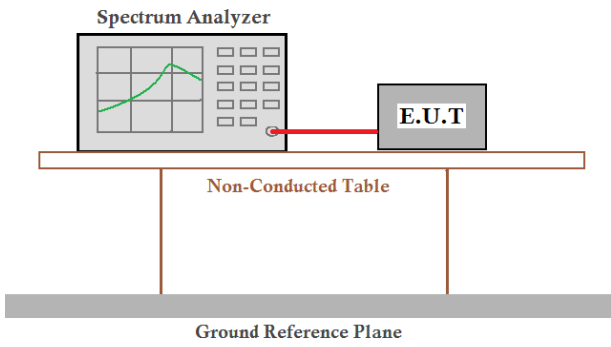
Test plot as follows:



Date: 22.FEB.2021 15:00:51

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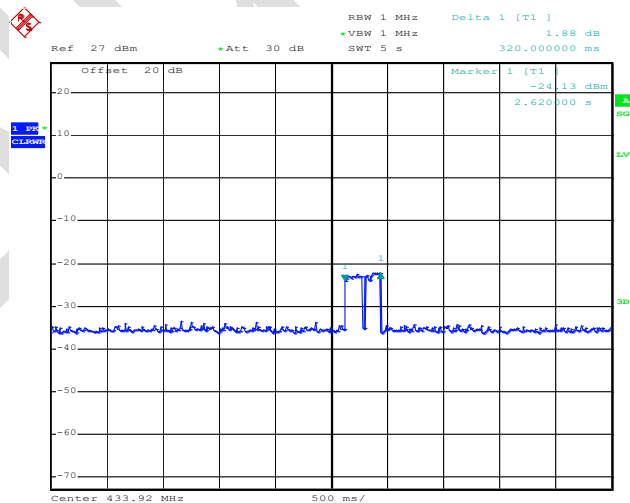
13 DURATION TIME

Test Requirement:	FCC Part15 C Section 15.231 (a) (1)
Test Method:	ANSI C63.4:2014
Receiver setup:	RBW=100kHz, VBW=300kHz, span=0Hz, detector: Peak
Limit:	Not more than 5 seconds
Test mode:	Transmitting mode
Test Procedure:	<ol style="list-style-type: none"> 1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT. 2. Set the EUT to proper test channel. 3. Single scan the transmission, and read the transmission time.
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data

Duration time (second)	Limit (second)	Result
0.32	<5.0	Pass

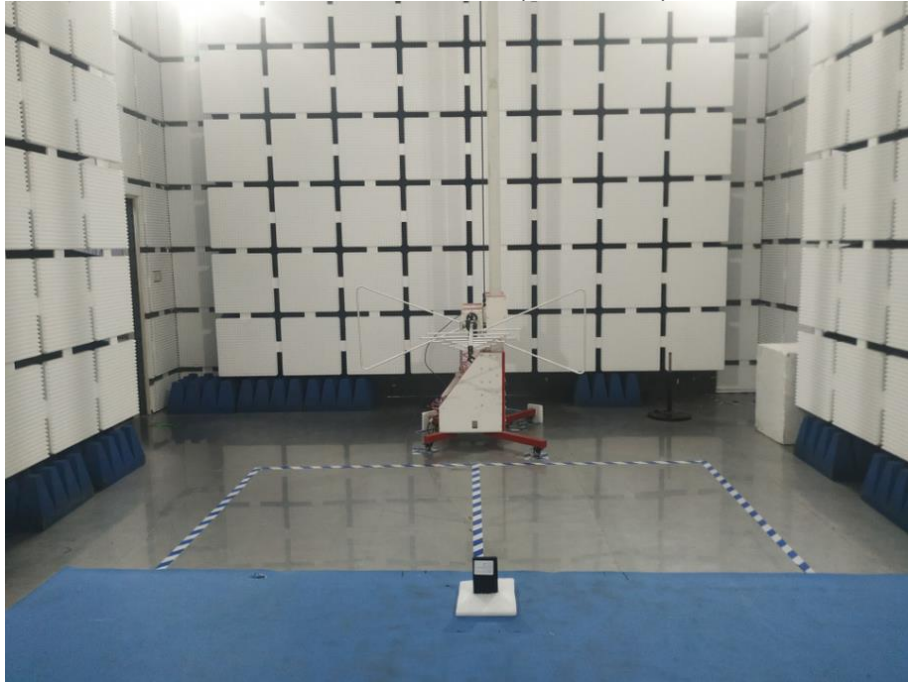
Test plot as follows:



Date: 22.FEB.2021 14:28:26

APPENDIX A: PHOTOGRAPHS OF TEST SETUP

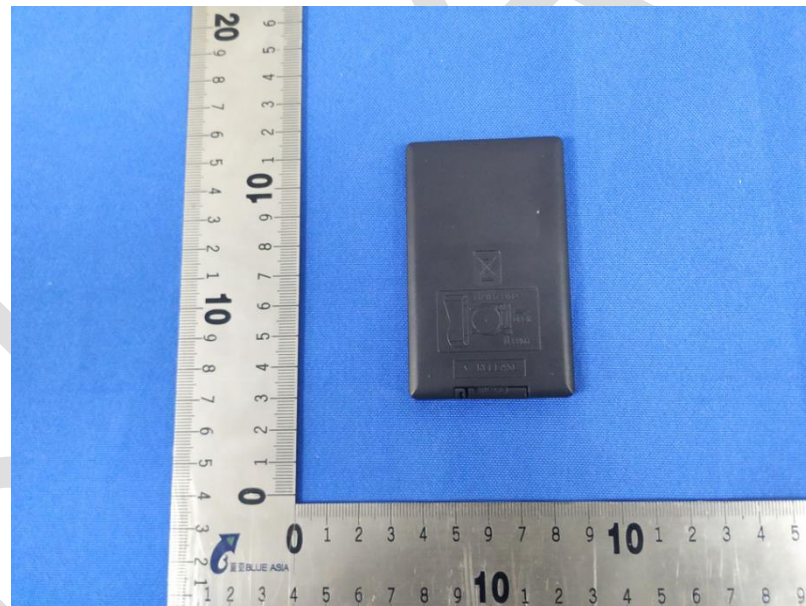
Radiated Emission(below 1G)

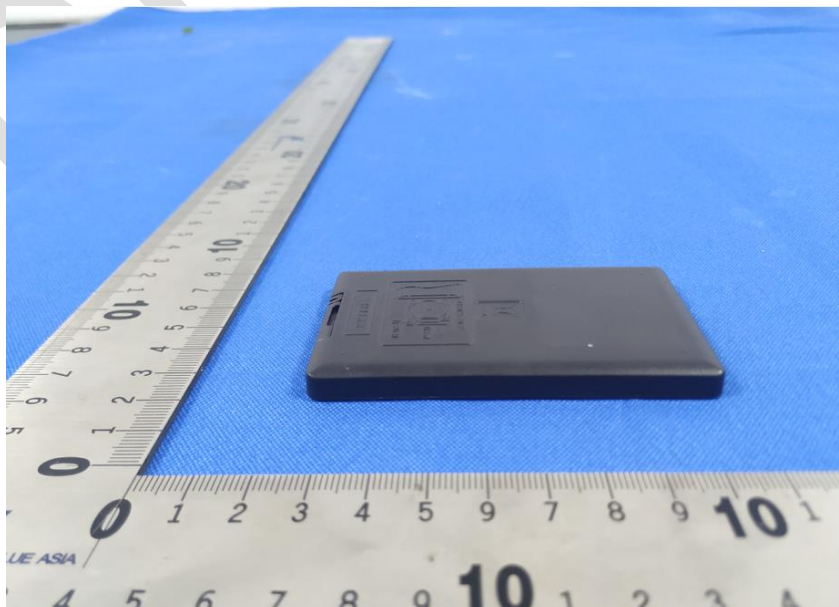
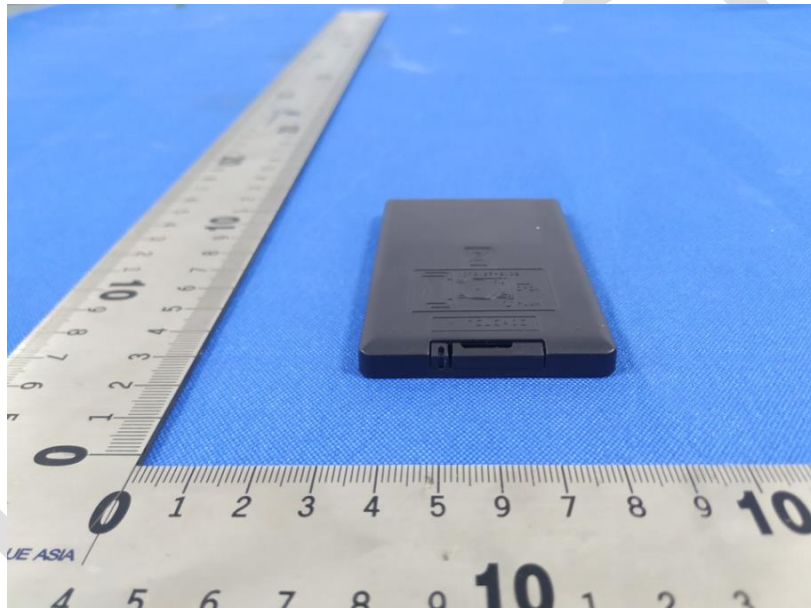
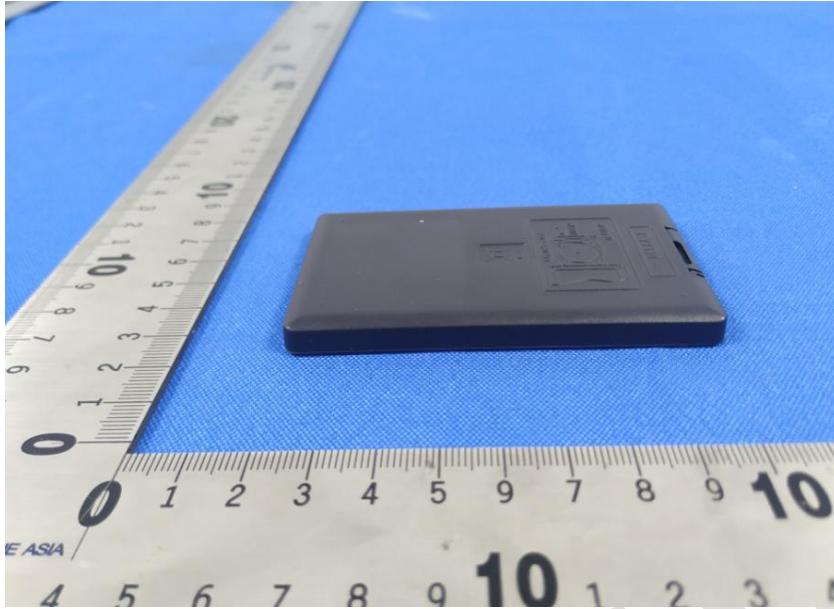


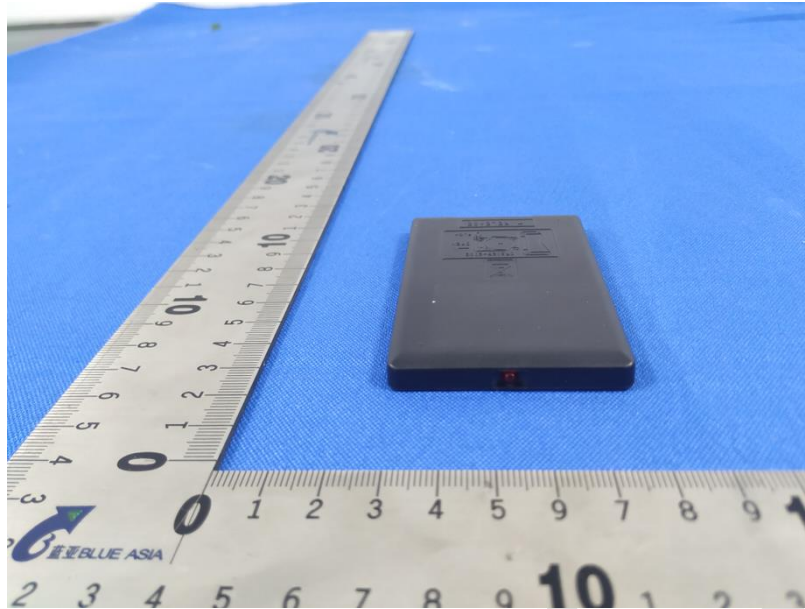
Radiated Emission(above 1G)



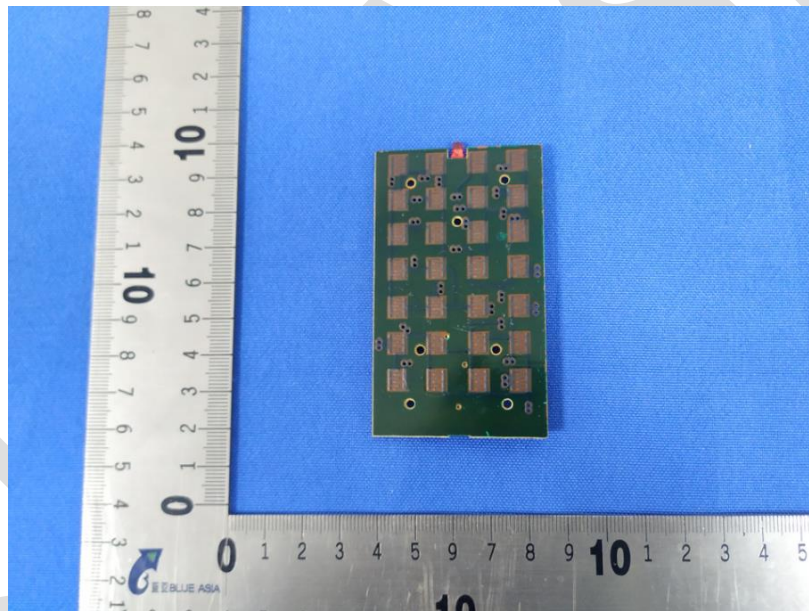
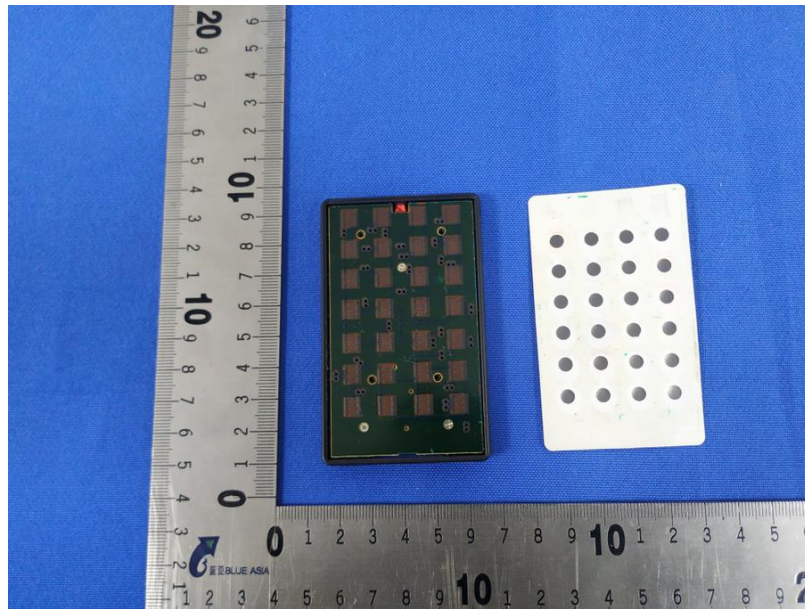
APPENDIX B: PHOTOGRAPHS OF EUT

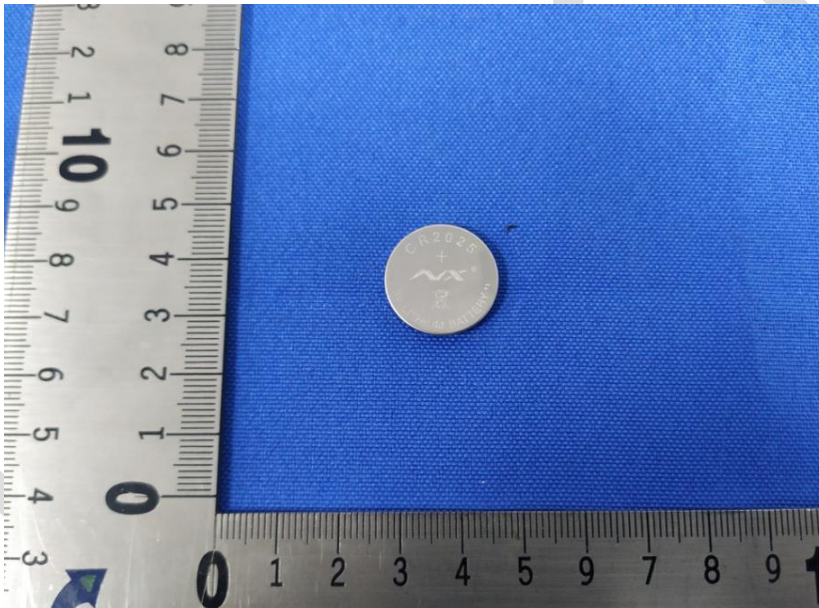
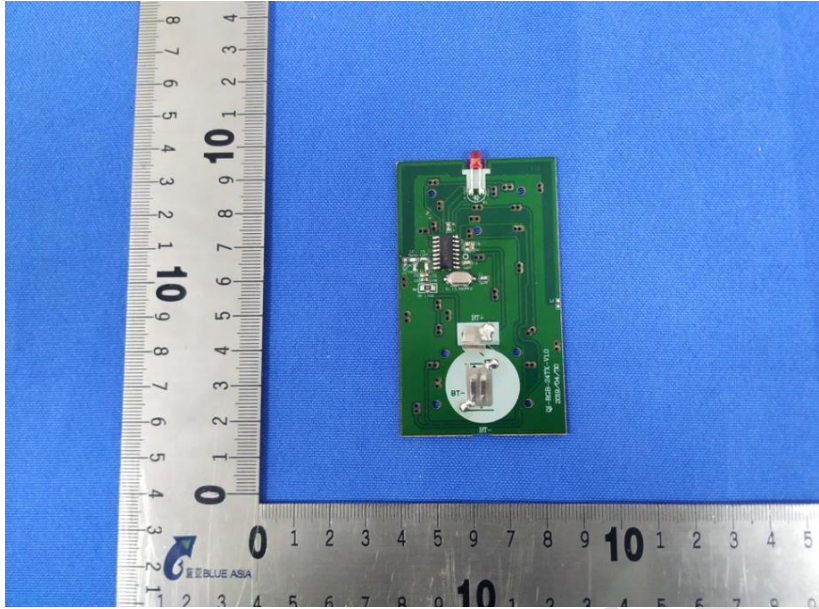


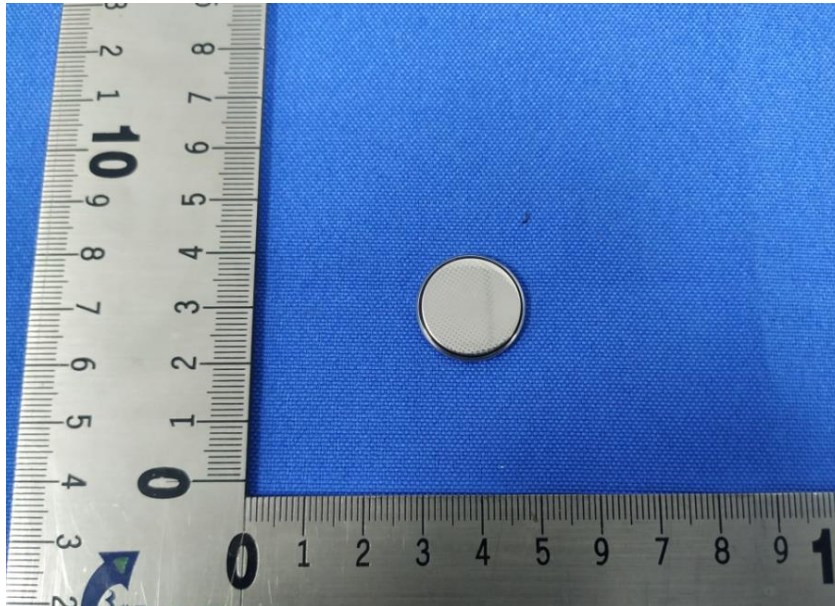




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----END OF REPORT----

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