

TEST REPORT

FCC ID.	2AZLA-CABINET
Test Report No.	TCT210409E019
Date of issue	Jul. 02, 2021
Testing laboratory	SHENZHEN TONGCE TESTING LAB
Testing location/ address:	TCT Testing Industrial Park Fuqiao 5th Industrial Zone, Fuhai Street, Bao'an District Shenzhen, Guangdong, 518103, People's Republic of China
Applicant's name	Alli Products Co., Limited.
Address	3F, Bldg 3, NanYu Industrial Park, Dalang, Longhua, Shenzhen, Guangdong, 518109, China
Manufacturer's name	Alli Products Co., Limited.
Address	3F, Bldg 3, NanYu Industrial Park, Dalang, Longhua, Shenzhen, Guangdong, 518109, China
Standard(s)	FCC CFR Title 47 Part 15 Subpart C Section 15.231
Test item description	Luminoodle UNDER CABINET
Trade Mark	POWER PRACTICAL
Model/Type reference	RMT-CAB
Rating(s)	Button Battery: DC 3V
Date of receipt of test item	Apr. 09, 2021
Date (s) of performance of test	See dates for each test case
Tested by (+signature)	Brews Xu
Check by (+signature)	Beryl Zhao
Approved by (+signature) :	Tomsin



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1. General Product Information

1.1. EUT description

Test item description	Luminoodle UNDER CABINET
Model/Type reference	RMT-CAB
Sample Number	TCT210409E019-0101
Operation Frequency	433.91MHz
Modulation Technology	FSK
Antenna Type	PCB Antenna
Antenna Gain	2dBi
Rating(s)	Button Battery: DC 3V
Remark	/

Note: The antenna gain listed in this report is provided by applicant, and the test laboratory is not responsible for this parameter.

1.2. Model(s) list

None.

2. Test Result Summary

Requirement	CFR 47 Section	Result
Conduction Emission, 0.15MHz to 30MHz	§15.207	N/A
Manually Activated Transmitter	§15.231(a)	PASS
Radiation Emission	§15.231(b), §15.205, §15.209, §15.35	PASS
Occupied Bandwidth	§15.231(c)	PASS

Note:

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

3. General Information

3.1. Test Environment and Mode

Operating Environment:		
Condition	Conducted Emission	Radiated Emission
Temperature:	25.0 °C	25.0 °C
Humidity:	55 % RH	55 % RH
Test Mode:		
Operation mode:	Keep the EUT in continuous transmitting with modulation	
<p>The sample was placed (0.8m below 1GHz, 1.5m above 1GHz) above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case (Y axis) are shown in Test Results of the following pages.</p>		

Per-test mode.

We have verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which was shown in this test report and defined as follows:

Axis	X	Y	Z
Field Strength(dBuV/m)	52.47	55.31	52.59

Final Test Mode:

According to ANSI C63.10 standards, the test results are both the "worst case" and "worst setup": Y axis (see the test setup photo)

3.2. Description of Support Units

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.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note: TPMS Service tool T1000 has passed FCC DoC test certification and meets the requirements of auxiliary device.

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4. Facilities and Accreditations

4.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 645098
SHENZHEN TONGCE TESTING LAB.
Designation Number: CN1205

The testing lab has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1
SHENZHEN TONGCE TESTING LAB
CAB identifier: CN0031

The testing lab has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

4.2. Location

SHENZHEN TONGCE TESTING LAB

Address: TCT Testing Industrial Park Fuqiao 5th Industrial Zone, Fuhai Street, Bao'an District Shenzhen, Guangdong, 518103, People's Republic of China

TEL: +86-755-27673339

4.3. Measurement Uncertainty

The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	± 3.10 dB
2	RF power, conducted	± 0.12 dB
3	Spurious emissions, conducted	± 0.11 dB
4	All emissions, radiated(<1 GHz)	± 4.56 dB
5	All emissions, radiated(1 GHz - 18 GHz)	± 4.22 dB
6	All emissions, radiated(18 GHz- 40 GHz)	± 4.36 dB
7	Temperature	$\pm 0.1^\circ\text{C}$
8	Humidity	$\pm 1.0\%$

5. Test Results and Measurement Data

5.1. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
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15.203 requirement:

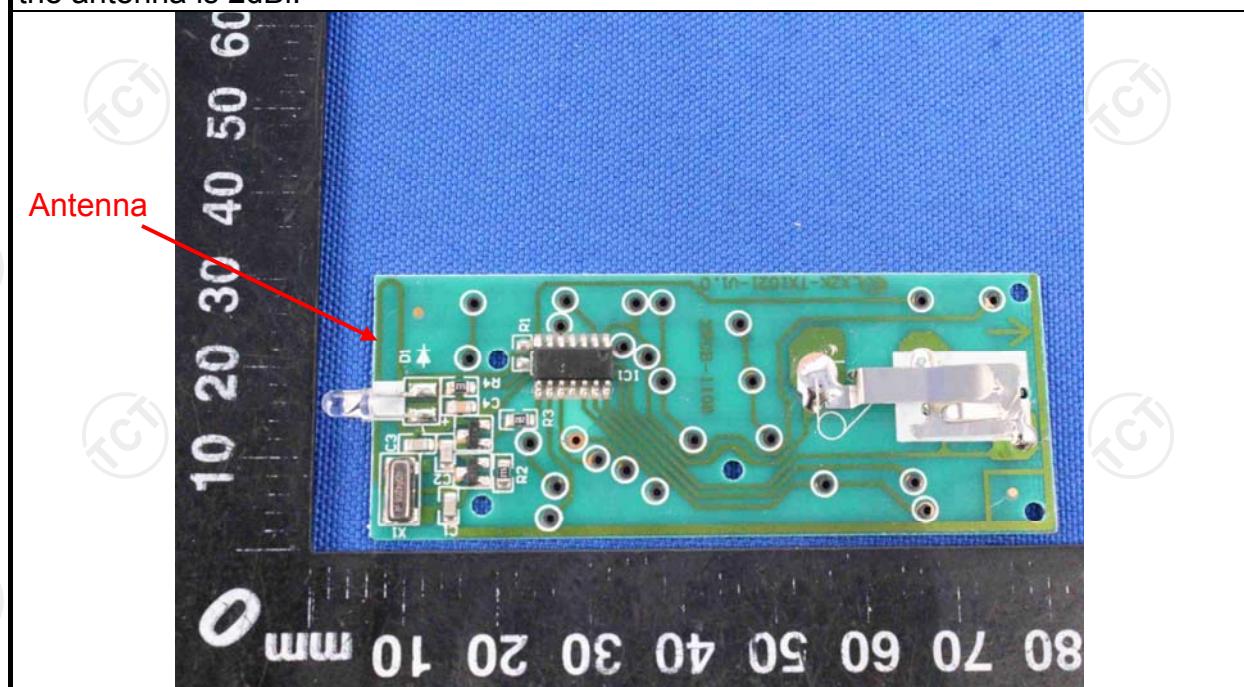
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

E.U.T Antenna:

The antenna is PCB antenna which permanently attached, and the best case gain of the antenna is 2dBi.



5.2. Conducted Emission

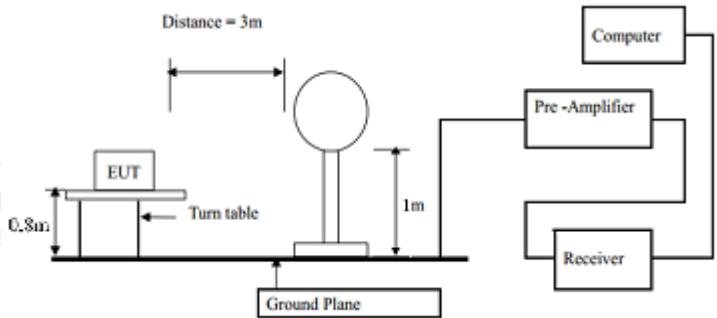
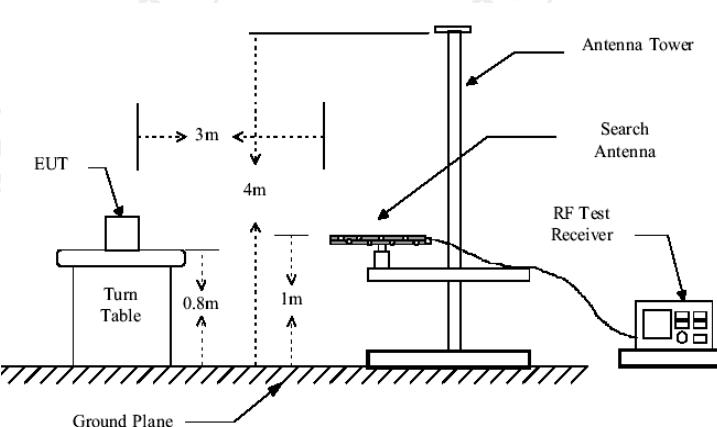
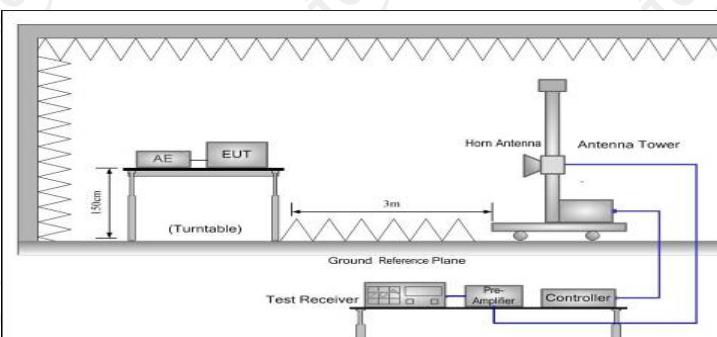
5.2.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.207														
Test Method:	ANSI C63.4:2014														
Frequency Range:	150 kHz to 30 MHz														
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto														
Limits:	<table border="1"> <thead> <tr> <th rowspan="2">Frequency range (MHz)</th> <th colspan="2">Limit (dBuV)</th> </tr> <tr> <th>Quasi-peak</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15-0.5</td> <td>66 to 56*</td> <td>56 to 46*</td> </tr> <tr> <td>0.5-5</td> <td>56</td> <td>46</td> </tr> <tr> <td>5-30</td> <td>60</td> <td>50</td> </tr> </tbody> </table>	Frequency range (MHz)	Limit (dBuV)		Quasi-peak	Average	0.15-0.5	66 to 56*	56 to 46*	0.5-5	56	46	5-30	60	50
Frequency range (MHz)	Limit (dBuV)														
	Quasi-peak	Average													
0.15-0.5	66 to 56*	56 to 46*													
0.5-5	56	46													
5-30	60	50													
Test Setup:	<p style="text-align: center;">Reference Plane</p> <p><i>Remark:</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>														
Test Mode:	Transmitting Mode														
Test Procedure:	<ol style="list-style-type: none"> 1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement. 														
Test Result:	N/A														

5.3. Radiated Emission Measurement

5.3.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.231(a) and 15.209				
Test Method:	ANSI C63.4: 2014 and ANSI C63.10:2013				
Frequency Range:	9 kHz to 5 GHz				
Measurement Distance:	3 m				
Antenna Polarization:	Horizontal & Vertical				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
9KHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value	
	150kHz- 30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value	
	Peak	1MHz	3MHz	Peak Value	
	Peak	1MHz	10Hz	Average Value	
	<ol style="list-style-type: none"> 1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber in below 1GHz, 1.5m above the ground in above 1GHz. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. 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. 4. 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. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. 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. 				

Test setup:	For radiated emissions below 30MHz 
	30MHz to 1GHz 
	Above 1GHz 
	Test Mode: Transmitting Mode Test results: PASS

5.3.2. Limit

Fundamental Frequency (MHz)	Filed Strength of Fundamental (microvolts/meter)	Filed Strength of Spurious Emission (microvolts/meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750*	125 to 375*
174-260	3750	375
260-470	3750 to 12500*	375 to 1250*
Above 470	12500	1250
Horn Antenna	Schwarzbeck	BBHA 9120D

*Linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows:

For the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $56.81818(F) - 6136.3636$;

for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $41.6667(F) - 7083.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

For EUT

Fundamental Frequency (MHz)	Filed Strength of Fundamental ($\text{dB}\mu\text{V/m}$)	Filed Strength of Spurious Emission($\text{dB}\mu\text{V/m}$)
433.91	80.82	60.82

Note:

1. Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions.
2. According to 15.35, on any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test.
3. According to 15.231(b), The limits on the field strength of the spurious emissions in the above table is based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits one higher field strength.

Frequencies in restricted band are complied to limit on Paragraph 15.209

Frequency Range (MHz)	Distance (m)	Field strength (dB μ V/m)
0.009-0.490	3	20log 2400/F (kHz) + 80
0.490-1.705	3	20log 24000/F (kHz) + 40
1.705-30	3	20log 30 + 40
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

Note:

1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT
4. The radiated emissions should be tested under 3-axes position (Lying, Side, and Stand), After pre-test. It was found that the worse radiated emission was get at the lying position.
5. If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula $Ld1 = Ld2 * (d2/d1)$

5.3.3. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
ESPI Test Receiver	ROHDE&SCHWARZ	ESIB7	100197	Jul. 27, 2021
Spectrum Analyzer	ROHDE&SCHWARZ	FSQ40	200061	Sep. 11, 2021
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep. 02, 2021
Pre-amplifier	HP	8447D	2727A05017	Sep. 02, 2021
Loop antenna	ZHINAN	ZN30900A	12024	Sep. 05, 2022
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 04, 2022
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 04, 2022
Horn Antenna	A-INFO	LB-180400-KF	J211020657	Sep. 04, 2022
Line-4	TCT	RE-high-04	N/A	Sep. 02, 2021
Line-8	TCT	RE-01	N/A	Jul. 27, 2021
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

5.3.4. Test Data

Duty Cycle Test Data:

433.91MHz:

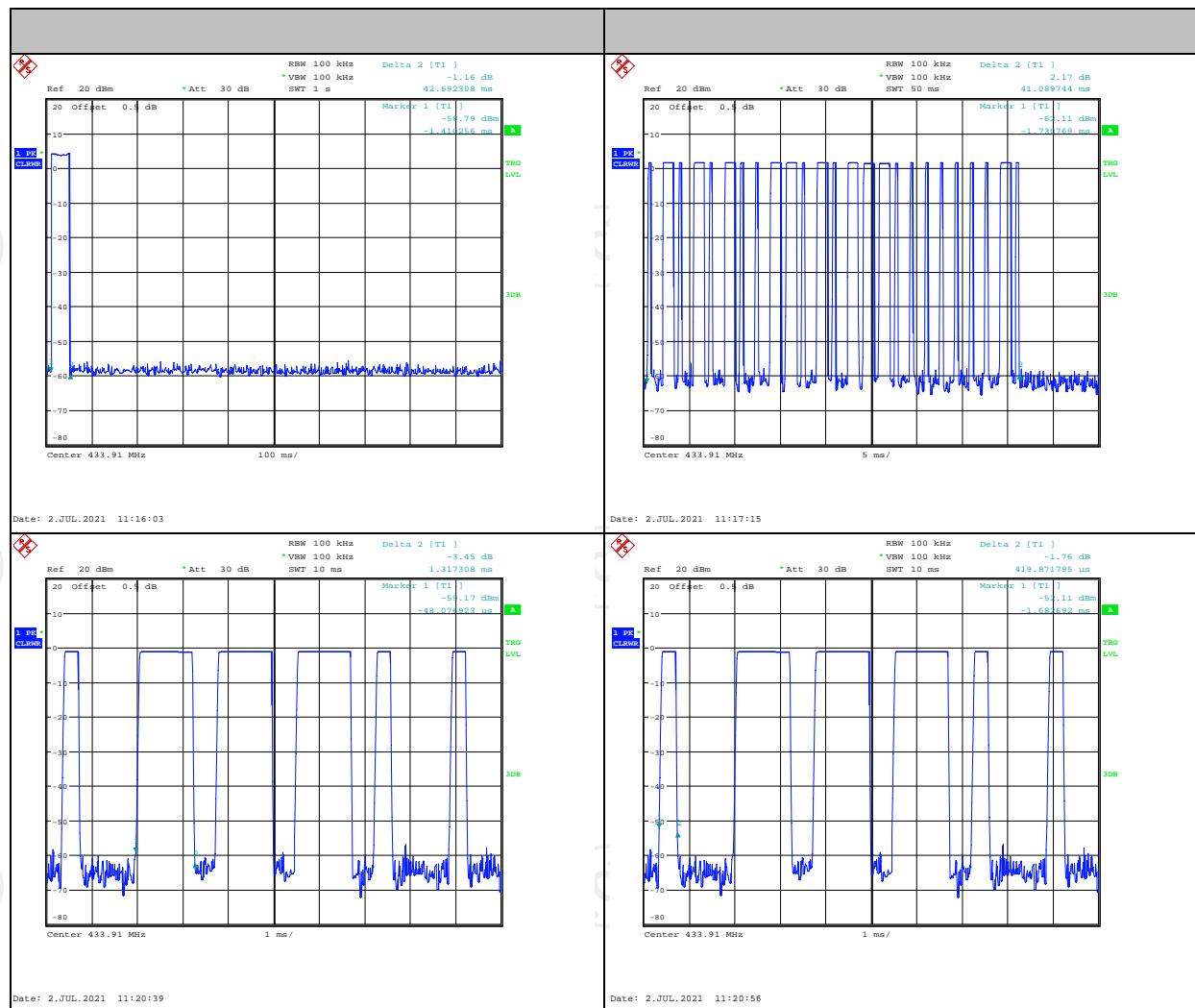
Total time one cycle(ms)	Effective time one cycle(ms)	Duty Cycle	AV Factor(dB)
100	19.50	0.195	-14.2

Note:

Effective time one cycle= 19.50

Duty Cycle= Effective time one cycle/ Total time one cycle= 0.195

AV Factor = $20 \log(\text{Duty Cycle})$ = -14.2



Field Strength of Fundamental

Frequency (MHz)	Emission PK (dBuV/m)	Horizontal /Vertical	Limits PK (dBuV/m)	Margin (dB)
433.91	75.28	H	100.82	-25.54
433.91	74.53	V	100.82	-26.29

Frequency (MHz)	Emission PK (dBuV/m)	AV Factor(dB)	Horizontal /Vertical	Emission AVG (dBuV/m)	Limits AV (dBuV/m)	Margin (dB)
433.91	75.28	-14.2	H	61.08	80.82	-19.74
433.91	74.53	-14.2	V	60.33	80.82	-20.49

Harmonics and Spurious Emissions

Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dB μ V/m)	Limit@3m (dB μ V/m)
--	--	--
--	--	--
--	--	--
--	--	--

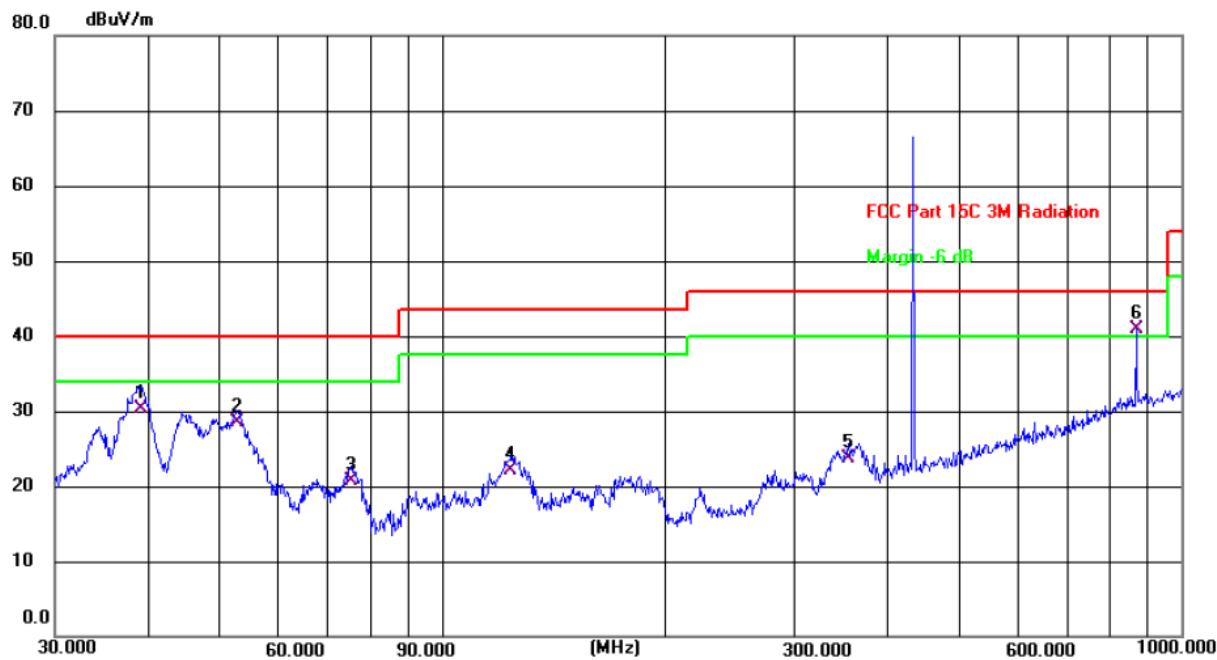
Note: 1. Emission Level=Reading+ Cable loss-Antenna factor-Amp factor

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

Please refer to following diagram for individual

Below 1GHz

Horizontal:



Site

Polarization: **Horizontal**

Temperature: 22.3(C)

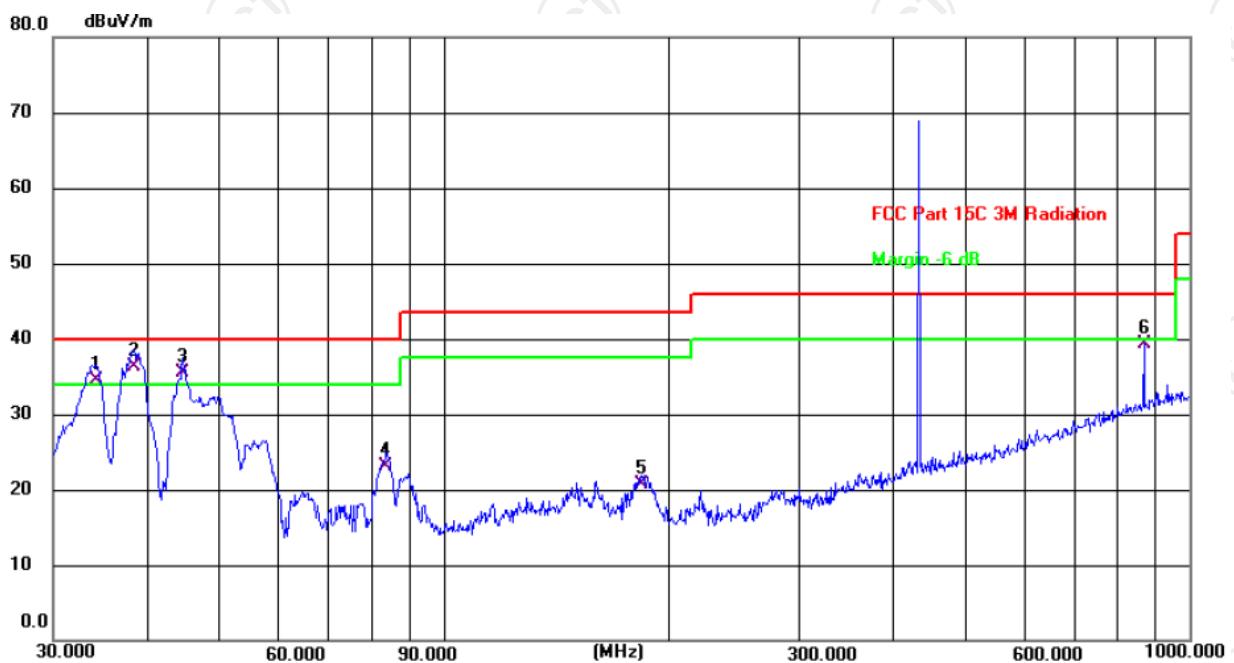
Limit: FCC Part 15C 3M Radiation

Power: AC 120V/60Hz

Humidity: 45 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	39.0245	16.46	13.84	30.30	40.00	-9.70	QP	P	
2	52.9453	14.92	13.58	28.50	40.00	-11.50	QP	P	
3	75.4462	10.57	10.13	20.70	40.00	-19.30	QP	P	
4	124.1329	9.97	12.23	22.20	43.50	-21.30	QP	P	
5	355.4272	8.01	15.69	23.70	46.00	-22.30	QP	P	
6 *	869.1301	14.87	26.05	40.92	46.00	-5.08	QP	P	

Vertical:



Site

 Polarization: **Vertical**

Temperature: 22.3(C)

Limit: FCC Part 15C 3M Radiation

Power: AC 120V/60Hz

Humidity: 45 %

No.	Frequency (MHz)	Reading (dB μ V)	Factor (dB/m)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector	P/F	Remark
1 !	34.2760	21.49	13.01	34.50	40.00	-5.50	QP	P	
2 *	38.4808	22.64	13.76	36.40	40.00	-3.60	QP	P	
3 !	44.7433	21.60	13.90	35.50	40.00	-4.50	QP	P	
4	83.8155	13.81	9.29	23.10	40.00	-16.90	QP	P	
5	184.4898	9.73	11.07	20.80	43.50	-22.70	QP	P	
6	869.1300	13.33	26.05	39.38	46.00	-6.62	QP	P	

Note: 1. The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported

2. Measurements were conducted in all three channels (high, middle, low) and three modulation (GFSK, Pi/4 DQPSK, 8DPSK) and the worst case Mode (Highest channel and GFSK) was submitted only.

3. Freq. = Emission frequency in MHz

Measurement (dB μ V/m) = Reading level (dB μ V) + Corr. Factor (dB)

Correction Factor= Antenna Factor + Cable loss – Pre-amplifier

Limit (dB μ V/m) = Limit stated in standard

Margin (dB) = Measurement (dB μ V/m) – Limits (dB μ V/m)

* is meaning the worst frequency has been tested in the test frequency range

Frequency PK Value (MHz)	Read Level PK (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level PK (dBuV/m)	Limit Line PK (dBuV/m)	Over Limit (dB)	Polarization
1370.00	36.38	25.66	4.59	33.39	33.24	74.00	-40.76	Vertical
2355.00	36.74	27.69	5.34	34.05	35.72	74.00	-38.28	Vertical
3415.00	35.87	28.67	6.80	32.85	38.49	74.00	-35.51	Vertical
4150.00	32.31	30.06	8.01	32.01	38.37	74.00	-35.63	Vertical
4695.00	32.68	31.65	8.51	32.03	40.81	74.00	-33.19	Vertical
5645.00	30.20	32.36	9.72	32.35	39.93	74.00	-34.07	Vertical
1430.00	34.83	25.42	4.64	33.47	31.42	74.00	-42.58	Horizontal
2410.00	34.53	27.57	5.40	33.99	33.51	74.00	-40.49	Horizontal
3395.00	36.97	28.60	6.76	32.87	39.46	74.00	-34.54	Horizontal
4115.00	28.75	29.95	7.97	32.05	34.62	74.00	-39.38	Horizontal
4635.00	29.80	31.57	8.46	32.01	37.82	74.00	-36.18	Horizontal
5590.00	27.72	32.22	9.63	32.38	37.19	74.00	-36.81	Horizontal

Note:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (dB μ V/m)- limit (dB μ V/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.
5. Data of measurement shown “*” in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

5.4. Manually Activated Transmitter

5.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.231(a)(1)
Test Method:	ANSI C63.10: 2013
Limit:	According to 15.231(a), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
	<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 to the maximum power setting and enable the EUT transmit continuously. 3. Use the following spectrum analyzer settings. VBW = 1MHz, $VBW \geq RBW$; Span = 0; Sweep Time = 5s; Detector function = peak; 4. Measure and record the results in the test report.
Test setup:	 <p>The diagram illustrates the test setup. A green Spectrum Analyzer is connected to a yellow EUT (Equipment Under Test) via a grey cable. A small white rectangular component, representing a switch, is placed on the cable between the two devices. The Spectrum Analyzer has a screen and two knobs. The EUT is a simple rectangular box with two black feet at the bottom.</p>
Test Mode:	Transmitting Mode
Test results:	PASS

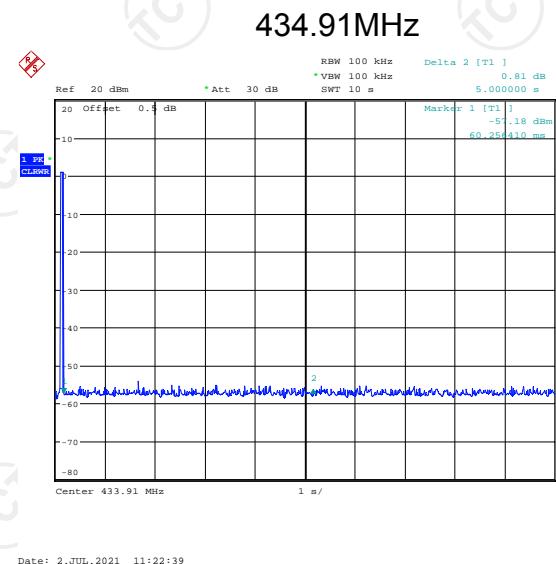
5.4.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2021

5.4.3. Test data

Test Channel (MHz)	Manually Activated Transmitter (s)	Limit (s)	Conclusion
433.91	5.00	5	PASS

Test plots as follows:



5.5. Occupied Bandwidth

5.5.1. Test Specification

5.5.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Sep. 11, 2021

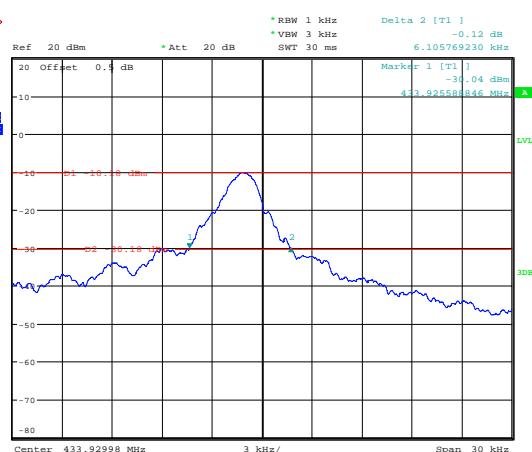
5.5.3. Test data

Test Channel (MHz)	20dB Occupy Bandwidth (kHz)	Limit (kHz)	Conclusion
433.91	6.11	1084.78	PASS

Note: Limit = 433.91MHz *0.25% = 1084.78 kHz

Test plots as follows:

433.91MHz

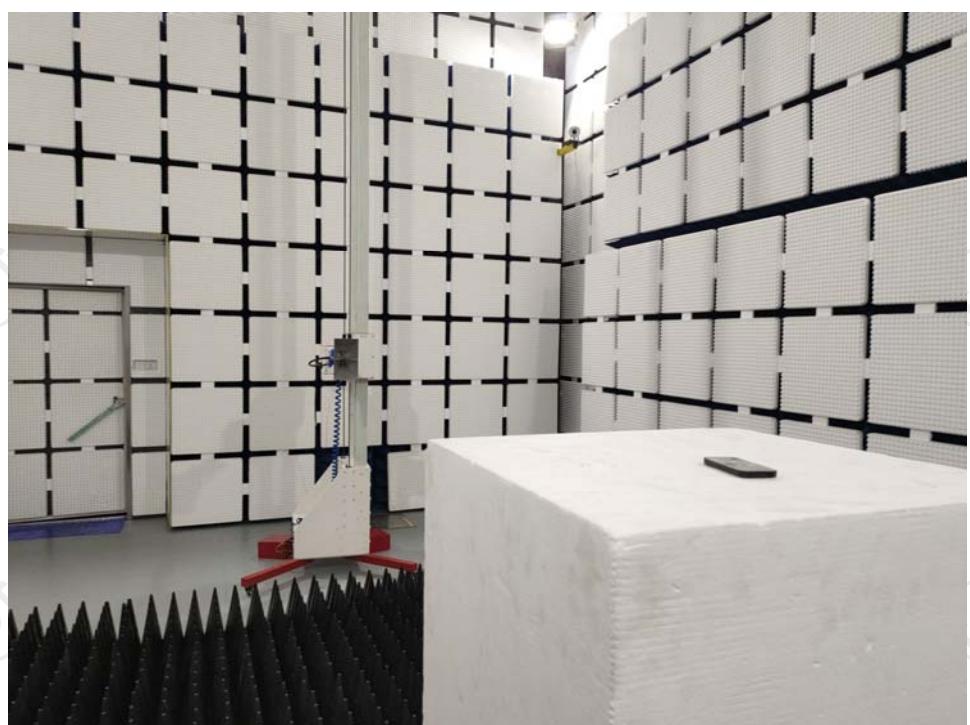
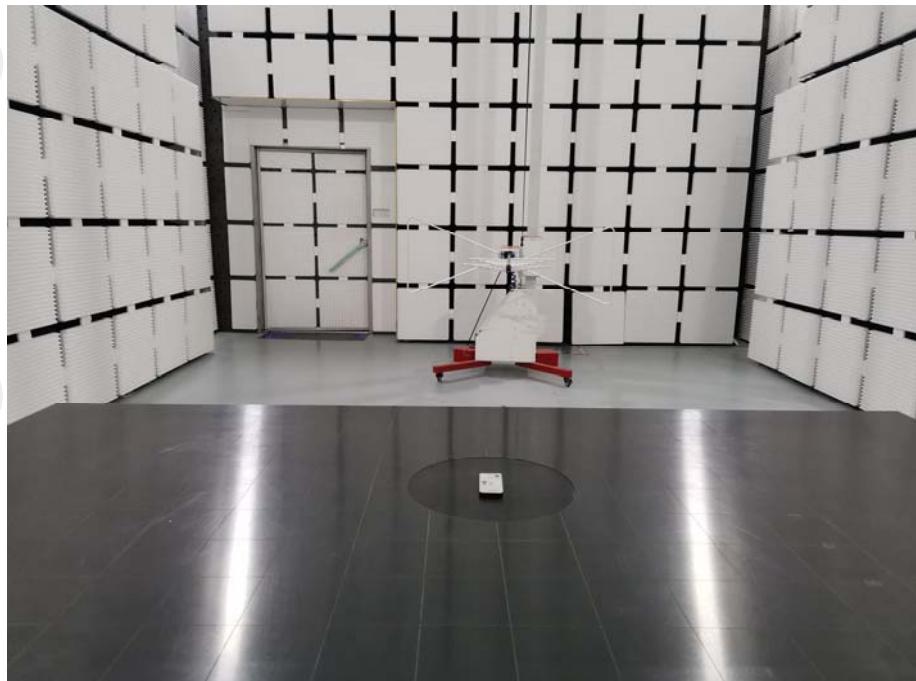


Appendix A: Photographs of Test Setup

Product: Luminoodle UNDER CABINET

Model: RMT-CAB

Radiated Emission

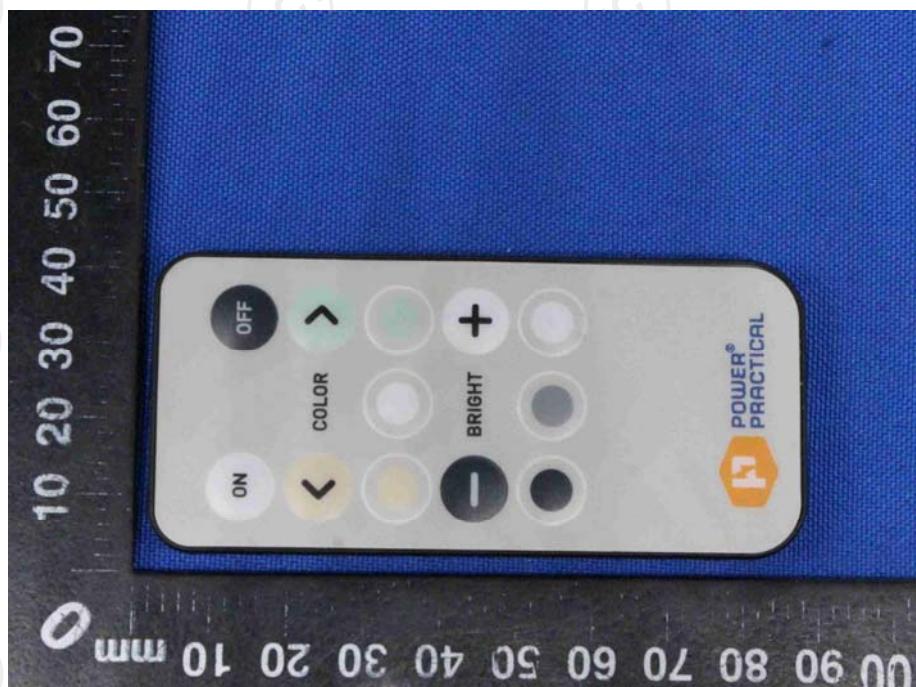


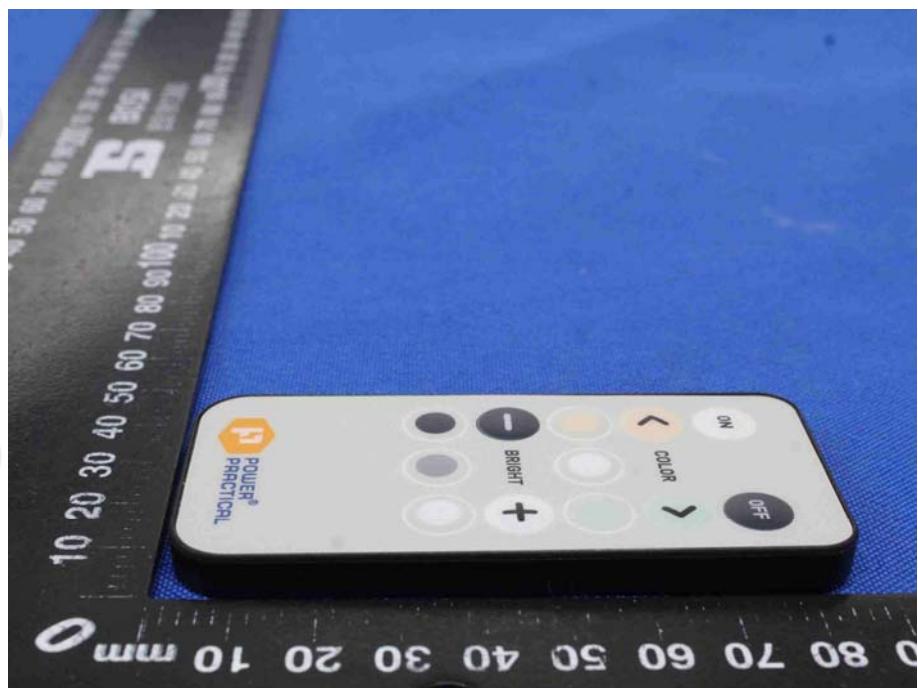
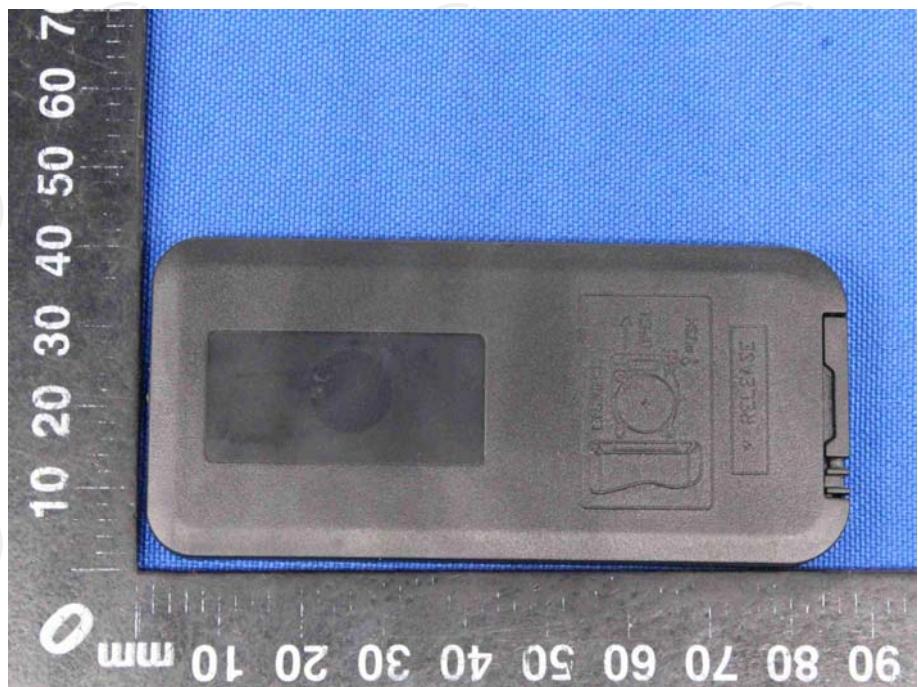
Appendix B: Photographs of EUT

Product: Luminoodle UNDER CABINET

Model: RMT-CAB

External Photos





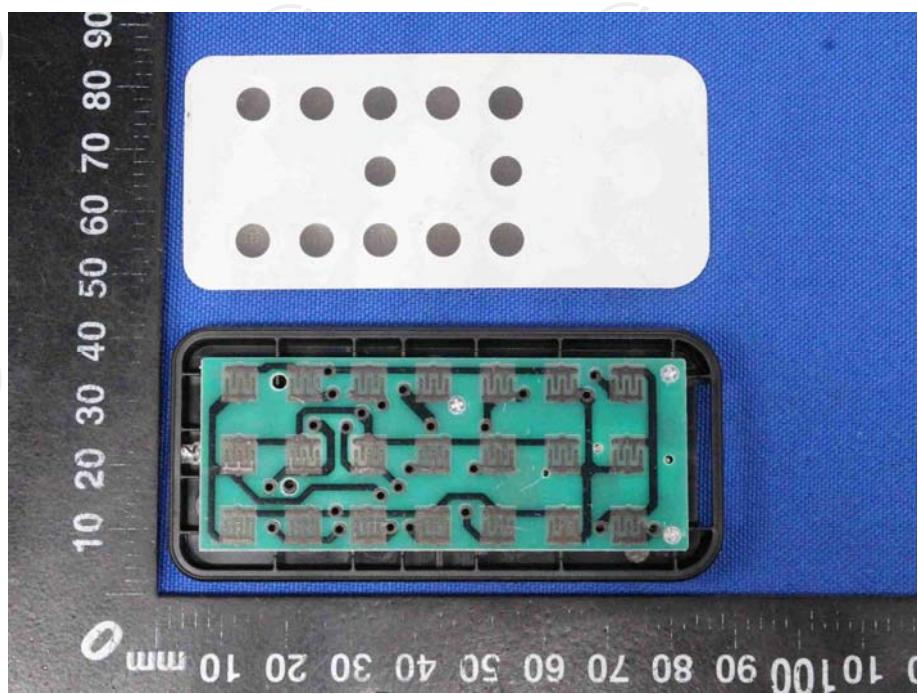


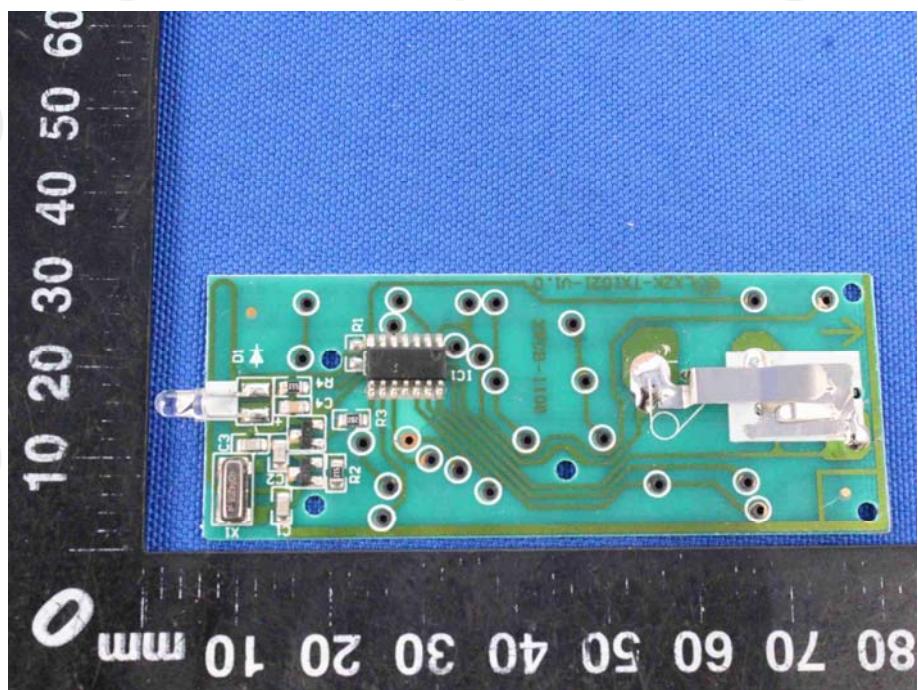
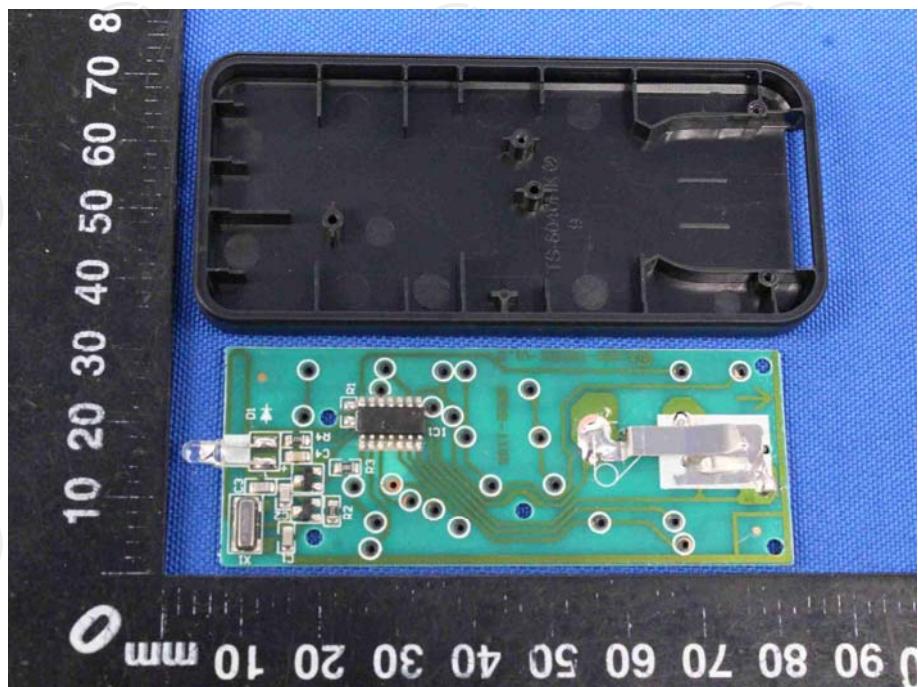


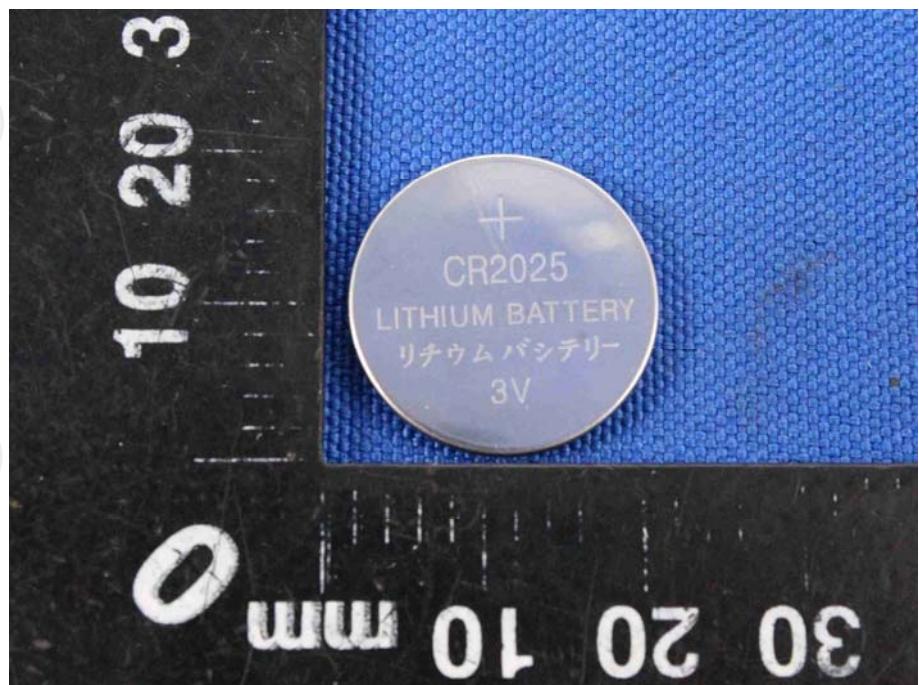
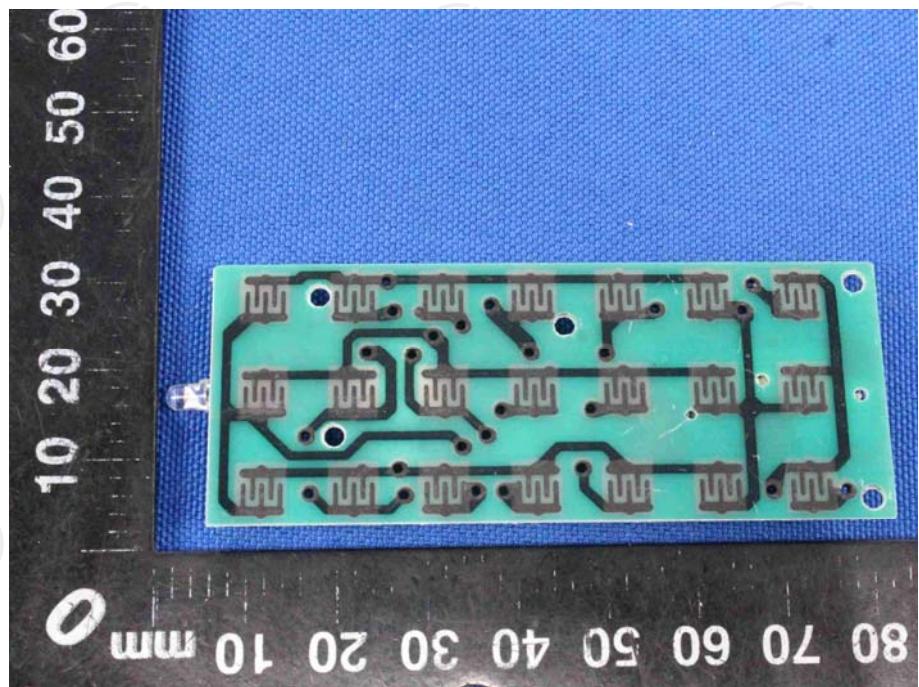
Product: Luminoodle UNDER CABINET

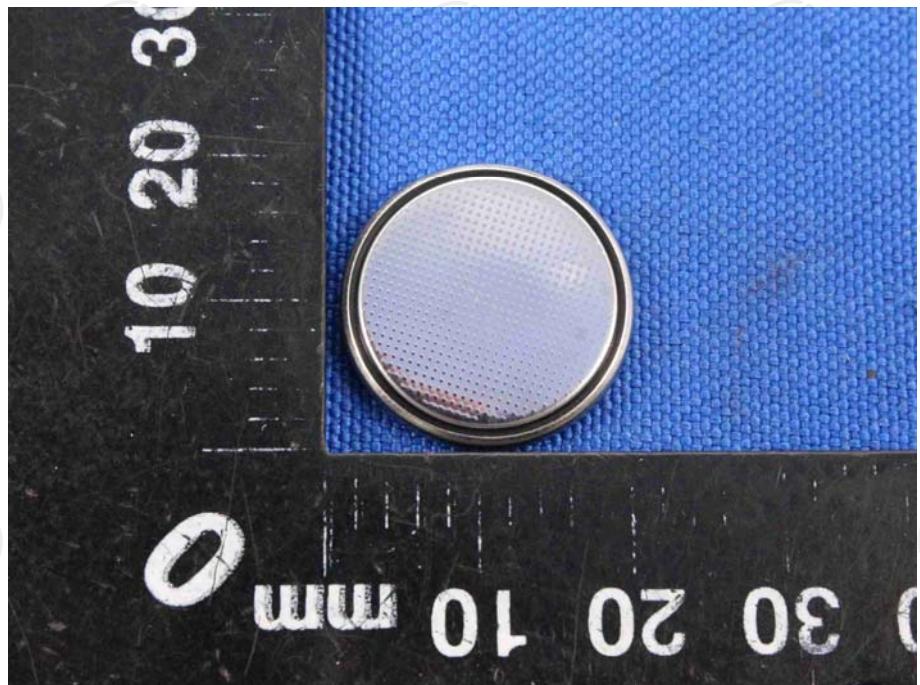
Model: RMT-CAB

Internal Photos









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