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Report Template Version: V05
Report Template Revision Date: 2021-11-03

Test Report

Report No.:	CQASZ20230701191E-01
Applicant:	ShenZhen GeelMi Technology Co., Ltd.
Address of Applicant:	B703, Building 1, Zhuanguang Innovation Technology Park, Nanshan District, Shenzhen, China

Equipment Under Test (EUT):

EUT Name:	Wireless LED Target System
Model No.:	WLTS101
Test Model No.:	WLTS101
Brand Name:	GEELMI
FCC ID:	2BB35-WLTS101T
Standards:	47 CFR Part 15, Subpart C
Date of Receipt:	2023-07-04
Date of Test:	2023-07-04 to 2023-07-13
Date of Issue:	2023-08-02
Test Result:	**PASS***

***In the configuration tested, the EUT complied with the standards specified above**

Tested By: Lewis Zhou

(Lewis Zhou)

Reviewed By: Timo Lei

(Timo Lei)

Approved By:

(Jack Ai)

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CQA, this report can't be reproduced except in full.

1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20230701191E-01	Rev.01	Initial report	2023-08-02

2 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203	ANSI C63.10 (2013)	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10 (2013)	N/A
Field Strength of the Fundamental Signal	47 CFR Part 15, Subpart C Section 15.249 (a)	ANSI C63.10 (2013)	PASS
Spurious Emissions	47 CFR Part 15, Subpart C Section 15.249 (a)/15.209	ANSI C63.10 (2013)	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15, Subpart C Section 15.249(a)/15.205	ANSI C63.10 (2013)	PASS
20dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.215 (c)	ANSI C63.10 (2013)	PASS

Note:

Since the EUT is powered by battery, this AC power line conducted emission test should be not applicable

3 Contents

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4 General Information

4.1 Client Information

Applicant:	ShenZhen GeelMi Technology Co., Ltd.
Address of Applicant:	B703, Building 1, Zhuanguang Innovation Technology Park, Nanshan District, Shenzhen, China
Manufacturer:	ShenZhen GeelMi Technology Co., Ltd.
Address of Manufacturer:	B703, Building 1, Zhuanguang Innovation Technology Park, Nanshan District, Shenzhen, China
Factory:	ShenZhen GeelMi Technology Co., Ltd.
Address of Factory:	B703, Building 1, Zhuanguang Innovation Technology Park, Nanshan District, Shenzhen, China

4.2 General Description of EUT

EUT Name:	Wireless LED Target System
Model No.:	WLTS101
Test Model No.:	WLTS101
Trade Mark:	GEELMI
Software Version:	Version:1.04
Hardware Version:	Version:1.05
Frequency Range:	2420MHz
Modulation Type:	GFSK
Number of Channels:	1
Sample Type:	☐ Mobile ☒ Portable
Test Software of EUT:	EUT key
Antenna Type:	Spring antenna
Antenna Gain:	3.02dBi
Power Supply:	Dry dell:3*AA DC1.5V battery

Operation Frequency each of channel					
Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2420MHz	/	/	/	/

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Middle channel(CH1)	2420MHz

4.3 Test Environment and Mode

Operating Environment:	
Radiated Emissions:	
Temperature:	27 °C
Humidity:	59 % RH
Atmospheric Pressure:	1009mbar
Temperature:	26 °C
Humidity:	59 % RH
Atmospheric Pressure:	1009mbar
Radio conducted item test (RF Conducted test room):	
Temperature:	25.3 °C
Humidity:	55 % RH
Atmospheric Pressure:	1009mbar
Test mode:	
Transmitting mode:	Use test software (RF test) to set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT.

4.4 Description of Support Units

The EUT has been tested with associated equipment below.

1）Support equipment

Description	Manufacturer	Model No.	Certification	Supplied by
/	/	/	/	/

2) Cable

Cable No.	Description	Manufacturer	Cable Type/Length	Supplied by
/	/	/	/	/

4.5 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate.

The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities.

The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the **Shenzhen Huaxia Testing Technology Co., Ltd.** quality system acc. to DIN EN ISO/IEC 17025.

Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for **CQA** laboratory is reported:

Test	Range	Uncertainty	Notes
Radiated Emission	Below 1GHz	5.12dB	(1)
Radiated Emission	Above 1GHz	4.60dB	(1)
Conducted Disturbance	0.15~30MHz	3.34dB	(1)

(1)This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

4.6 Test Location

All tests were performed at:

Shenzhen Huaxia Testing Technology Co., Ltd.

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

4.7 Test Facility

- **A2LA (Certificate No. 4742.01)**
Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4742.01.
- **FCC Registration No.: 522263**
Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.:522263

4.8 Deviation from Standards

None.

4.9 Abnormalities from Standard Conditions

None.

4.10 Other Information Requested by the Customer

None.

4.11 Equipment List

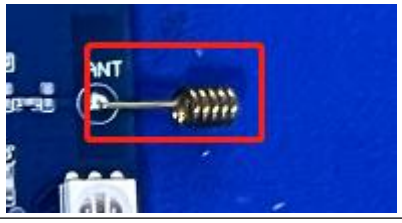
Test Equipment	Manufacturer	Model No.	Instrument No.	Calibration Date	Calibration Due Date
EMI Test Receiver	R&S	ESR7	CQA-005	2022/9/9	2023/9/8
Spectrum analyzer	R&S	FSU26	CQA-038	2022/9/9	2023/9/8
Preamplifier	MITEQ	AFS4-00010300-18-10P-4	CQA-035	2022/9/9	2023/9/8
Preamplifier	MITEQ	AMF-6D-02001800-29-20P	CQA-036	2022/9/9	2023/9/8
Loop antenna	Schwarzbeck	FMZB1516	CQA-087	2021/9/16	2024/9/15
Bilog Antenna	R&S	HL562	CQA-011	2021/9/16	2024/9/15
Horn Antenna	R&S	HF906	CQA-012	2021/9/16	2024/9/15
Horn Antenna	Schwarzbeck	BBHA 9170	CQA-088	2021/9/16	2024/9/15
Coaxial Cable (Above 1GHz)	CQA	N/A	C019	2022/9/9	2023/9/8
Coaxial Cable (Below 1GHz)	CQA	N/A	C020	2022/9/9	2023/9/8
Antenna Connector	CQA	RFC-01	CQA-080	2022/9/9	2023/9/8
RF cable(9KHz~40GHz)	CQA	RF-01	CQA-079	2022/9/9	2023/9/8
Power divider	MIDWEST	PWD-2533-02-SMA-79	CQA-067	2022/9/9	2023/9/8
EMI Test Receiver	R&S	ESPI3	CQA-013	2022/9/9	2023/9/8
LISN	R&S	ENV216	CQA-003	2022/9/9	2023/9/8
Coaxial cable	CQA	N/A	CQA-C009	2022/9/9	2023/9/8

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.

5 Test results and Measurement Data

5.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203
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.	
EUT Antenna:	
The antenna is Spring antenna. The best case gain of the antenna is 3.02dBi.	

5.2 Radiated Emission

Test Requirement:	47 CFR Part 15C Section 15.249 and 15.209 and 15.205
Test Method:	ANSI C63.10: 2013
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30KHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30KHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30KHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30KHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30KHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100 kHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

Note: For fundamental frequency, RBW=5MHz, VBW=5MHz, Peak detector is for PK value, RMS detector is for Average value.

Limit:
(Spurious Emissions and band edge)

Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3

Note: 1) 15.35(b), 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. This peak limit applies to the total peak emission level radiated by the device.

2) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

Limit:
(Field strength of the fundamental signal)

Frequency	Limit (dBuV/m @3m)	Remark
2400MHz-2483.5MHz	94.0	Average Value
	114.0	Peak Value

Test Setup:	

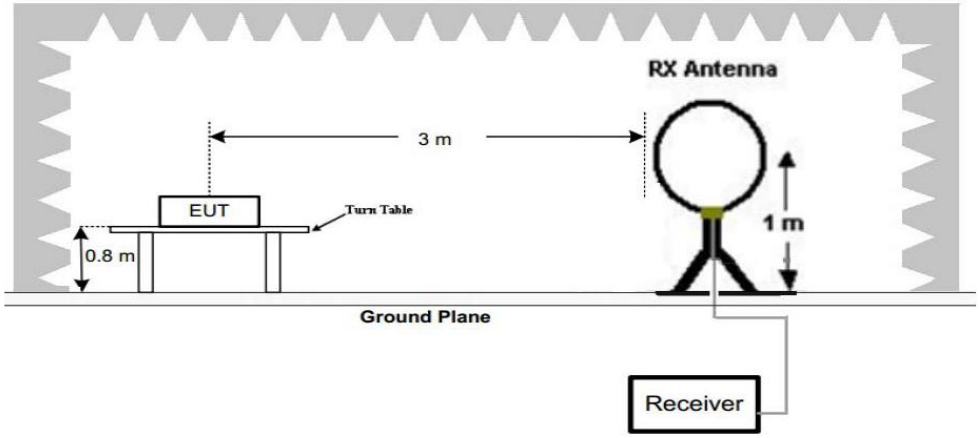


Figure 1. Below 30MHz

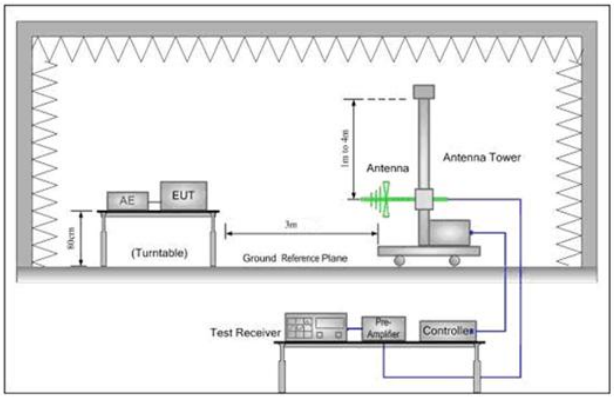


Figure 2. 30MHz to 1GHz

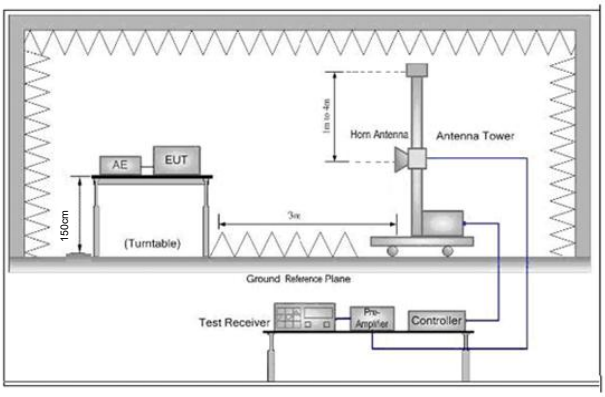


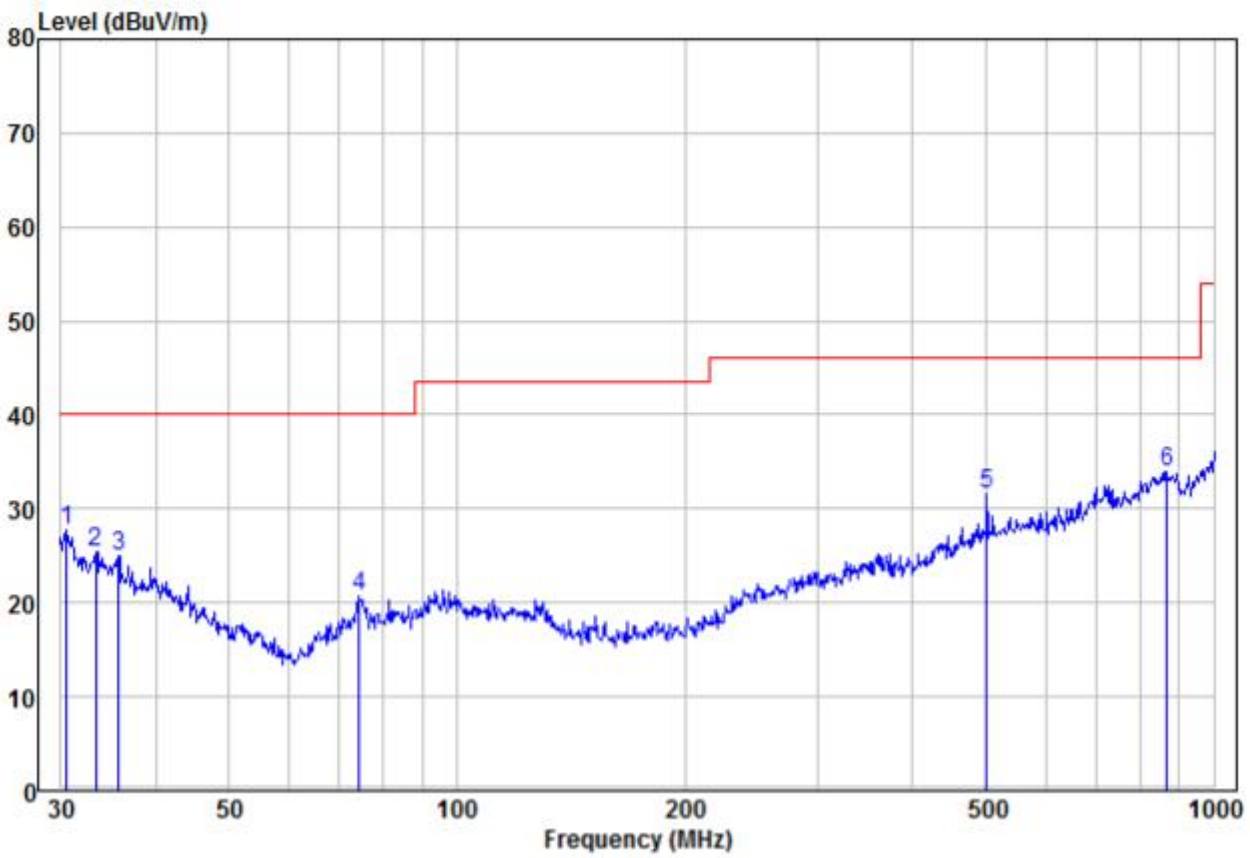
Figure 3. Above 1 GHz

Test Procedure:	a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. Note: For the radiated emission test above 1GHz: 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. 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. 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. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table

	was turned from 0 degrees to 360 degrees to find the maximum reading. e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 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. g. Test the EUT in the lowest channel,the middle channel,the Highest channel h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode,And found the X axis positioning which it is worse case. i. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting mode, Charge + Transmitting mode.
Final Test Mode:	Pretest the EUT at Transmitting mode and Charge + Transmitting mode, found the Charge + Transmitting mode which it is worse case. For below 1GHz part, through pre-scan, the worst case is the lowest channel. Only the worst case is recorded in the report.
Test Results:	Pass

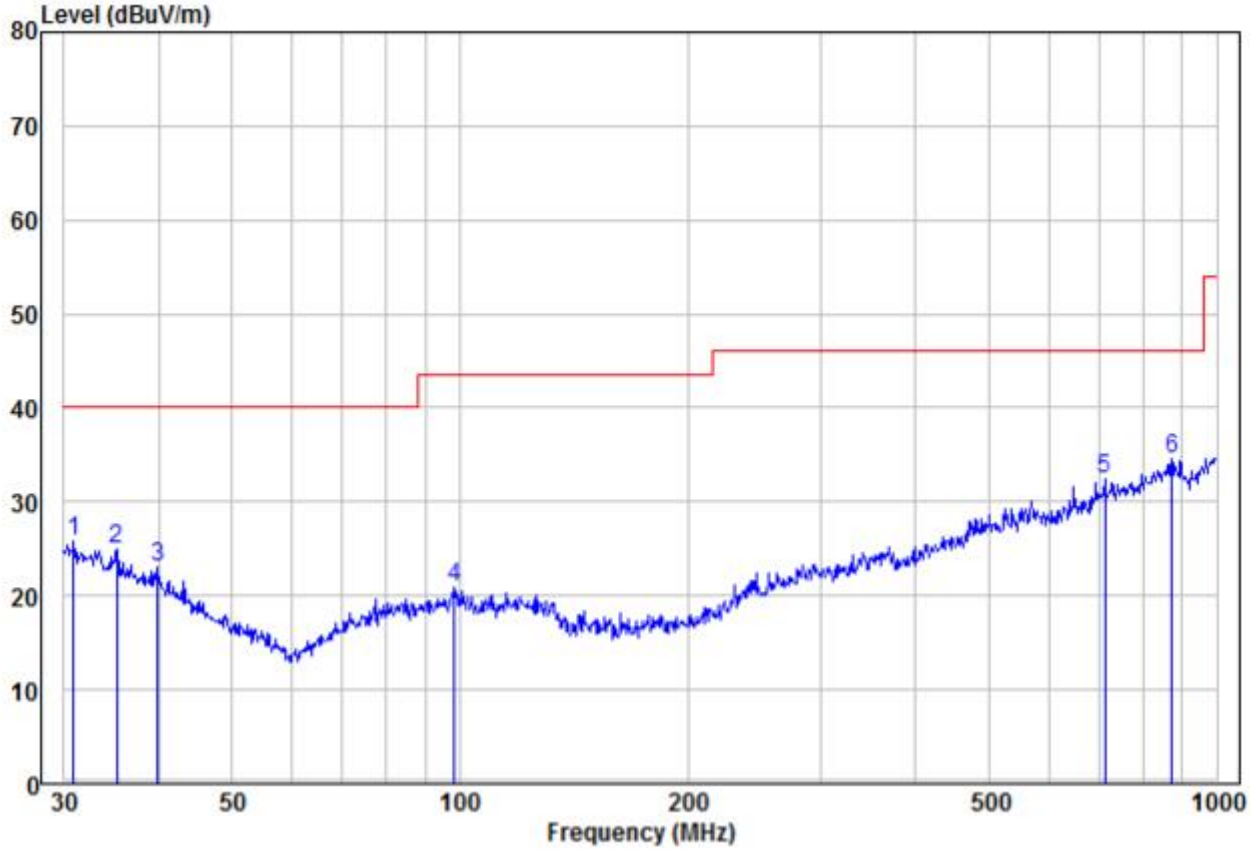
Measurement Data

30MHz~1GHz		
Test mode:	Transmitting	Vertical



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	30.53	11.95	15.77	27.72	40.00	-12.28	Peak	VERTICAL
2	33.33	10.40	15.04	25.44	40.00	-14.56	Peak	VERTICAL
3	35.75	10.62	14.33	24.95	40.00	-15.05	Peak	VERTICAL
4	74.40	11.81	8.87	20.68	40.00	-19.32	Peak	VERTICAL
5	501.18	13.22	18.29	31.51	46.00	-14.49	Peak	VERTICAL
6 pp	869.13	10.00	23.97	33.97	46.00	-12.03	Peak	VERTICAL

Test mode:	Transmitting	Horizontal



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	30.85	10.22	15.69	25.91	40.00	-14.09	Peak	HORIZONTAL
2	35.25	10.43	14.51	24.94	40.00	-15.06	Peak	HORIZONTAL
3	39.85	10.15	12.85	23.00	40.00	-17.00	Peak	HORIZONTAL
4	98.49	10.31	10.56	20.87	43.50	-22.63	Peak	HORIZONTAL
5	711.67	11.34	21.17	32.51	46.00	-13.49	Peak	HORIZONTAL
6 pp	872.18	10.55	23.96	34.51	46.00	-11.49	Peak	HORIZONTAL

Above 1GHz			
Test mode:	Transmitting	Test channel:	1

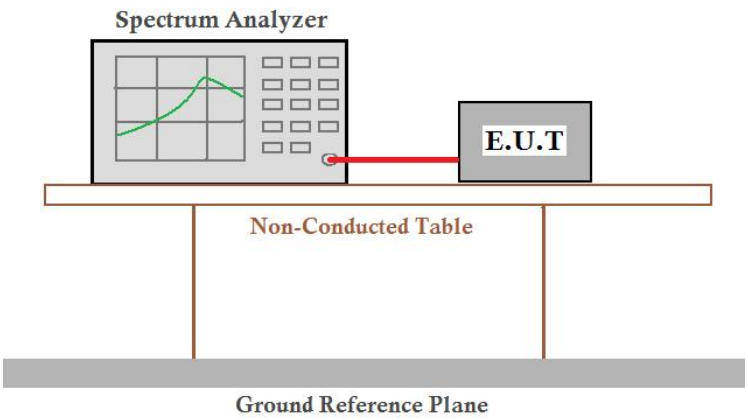
Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Over (dB)	Detector Type	Ant. Pol. H/V
2390	60.68	-9.2	51.48	74	-22.52	Peak	H
2390	44.16	-9.2	34.96	54	-19.04	AVG	H
2400	44.18	-9.39	34.79	74	-39.21	Peak	H
2400	45.49	-9.39	36.10	54	-17.90	AVG	H
2420	100.83	-9.33	91.50	114	-22.50	peak	H
2420	95.74	-9.33	86.41	94	-7.59	AVG	H
2390	60.20	-9.2	51.00	74	-23.00	peak	V
2390	46.56	-9.2	37.36	54	-16.64	AVG	V
2400	59.80	-9.39	50.41	74	-23.59	peak	V
2400	45.68	-9.39	36.29	54	-17.71	AVG	V
2420	95.74	**-9.33**	86.41	114	-27.59	peak	V
2420	92.31	-9.33	82.98	94	-11.02	AVG	V
2483.5	61.97	-9.29	52.68	74	-21.32	Peak	H
2483.5	44.02	-9.29	34.73	54	-19.27	AVG	H
2483.5	59.89	-9.29	50.60	74	-23.40	peak	V
2483.5	44.90	-9.29	35.61	54	-18.39	AVG	V
4840	55.29	-4.28	51.01	74	-22.99	peak	H
4840	42.64	-4.28	38.36	54	-15.64	AVG	H
7260	52.25	1.13	53.38	74	-20.62	peak	H
7260	36.88	1.13	38.01	54	-15.99	AVG	H
4840	57.53	-4.28	53.25	74	-20.75	peak	V
4840	41.55	-4.28	37.27	54	-16.73	AVG	V
7260	51.59	1.13	52.72	74	-21.28	peak	V
7260	38.07	1.13	39.20	54	-14.80	AVG	V

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

2) Scan from 9kHz to 25GHz,The disturbance above 10GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported .

5.3 20dB Bandwidth

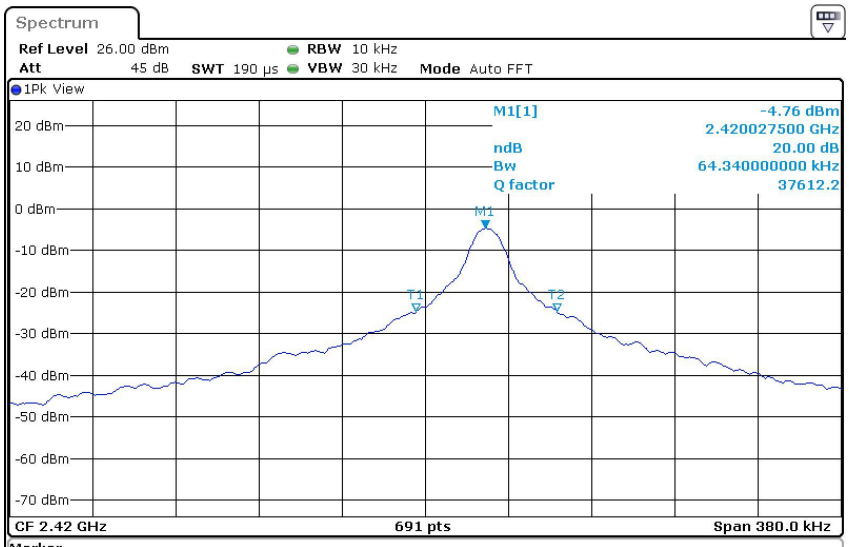
Test Requirement:	47 CFR Part 15C Section 15.215
Test Method:	ANSI C63.10:2013
Test Setup:	
Test Mode:	Transmitting with GFSK modulation.
Limit:	N/A
Test Results:	Pass

Measurement Data

Test channel	20dB bandwidth (KHz)	Results
Middle	64.34	Pass

Test plot as follows:

Test channel:	Middle



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4200275 GHz	-4.76 dBm	ndB down	64.34 kHz
T1		1	2.4199956 GHz	-24.74 dBm	ndB	20.00 dB
T2		1	2.42005994 GHz	-24.71 dBm	Q factor	37612

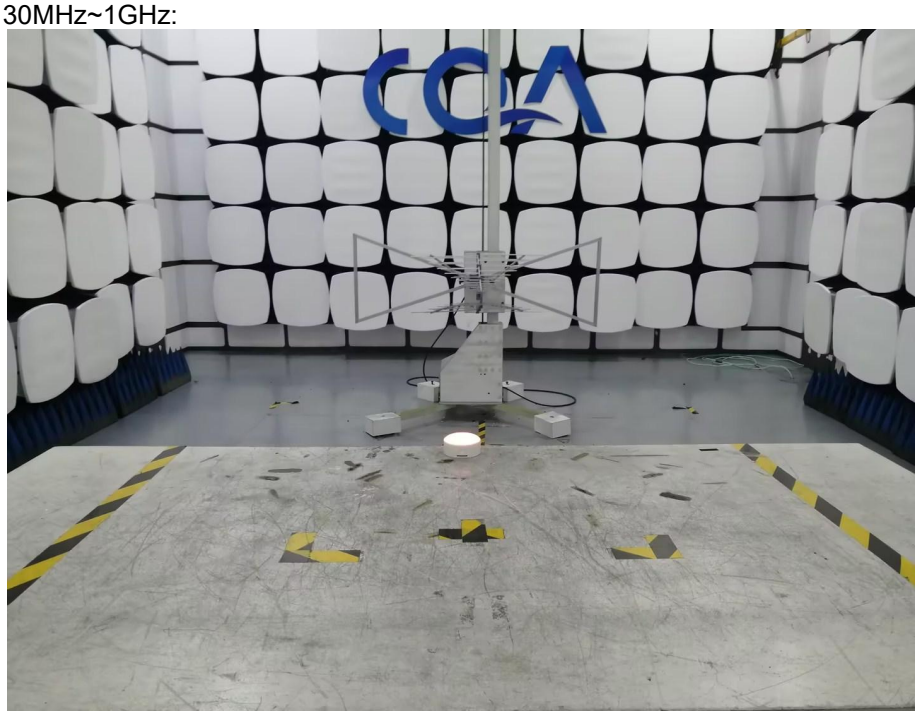
Date: 7.JUL.2023 18:29:04

6 Photographs

6.1 Radiated Emission Test Setup

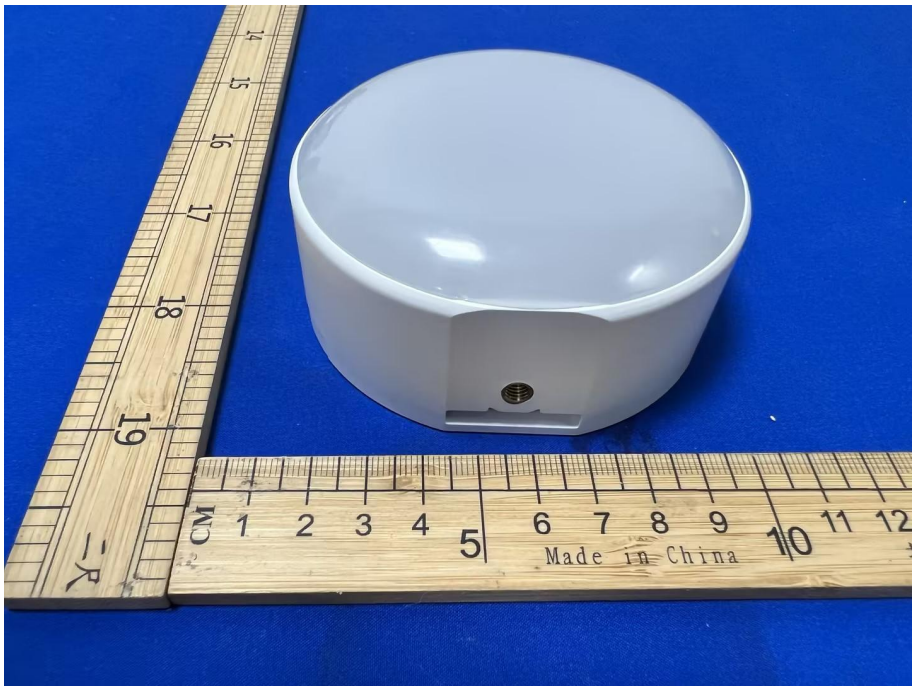
9kHz~30MHz

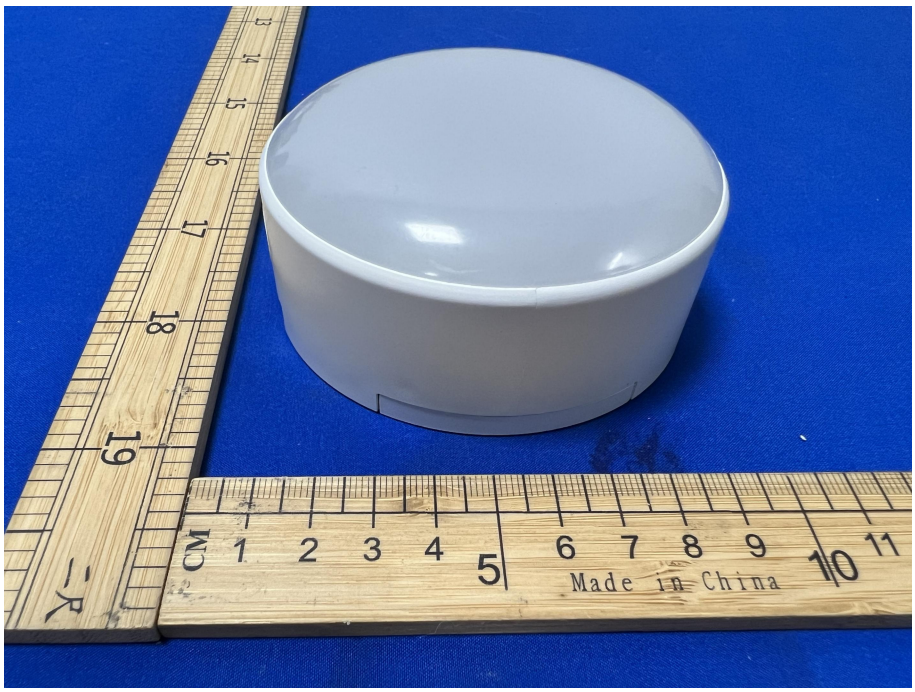
30MHz~1GHz:



Above 1GHz:

6.2 EUT Constructional Details


CM
Made in China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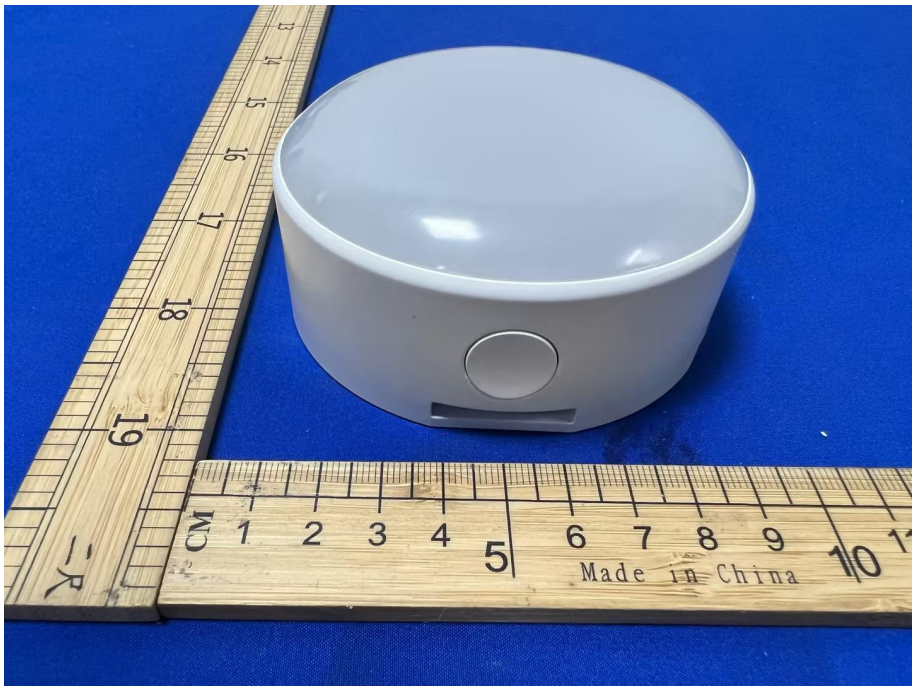
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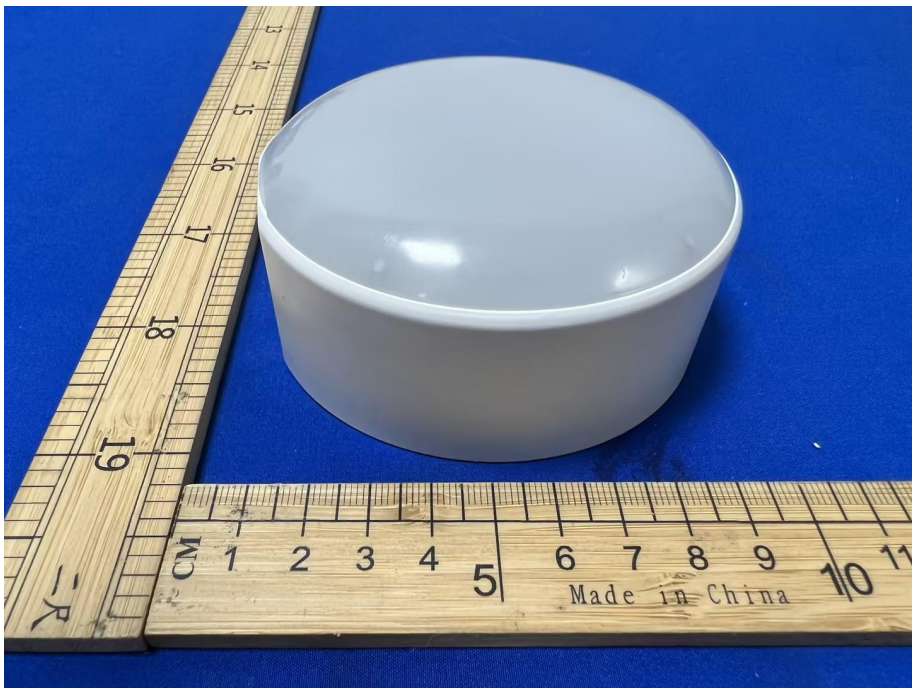
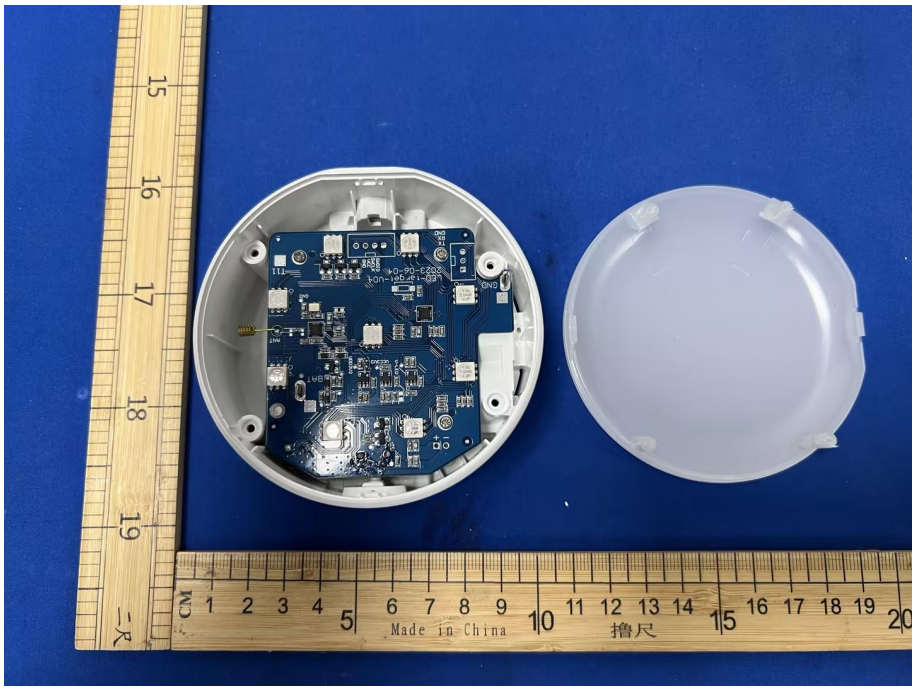

CM
Made in China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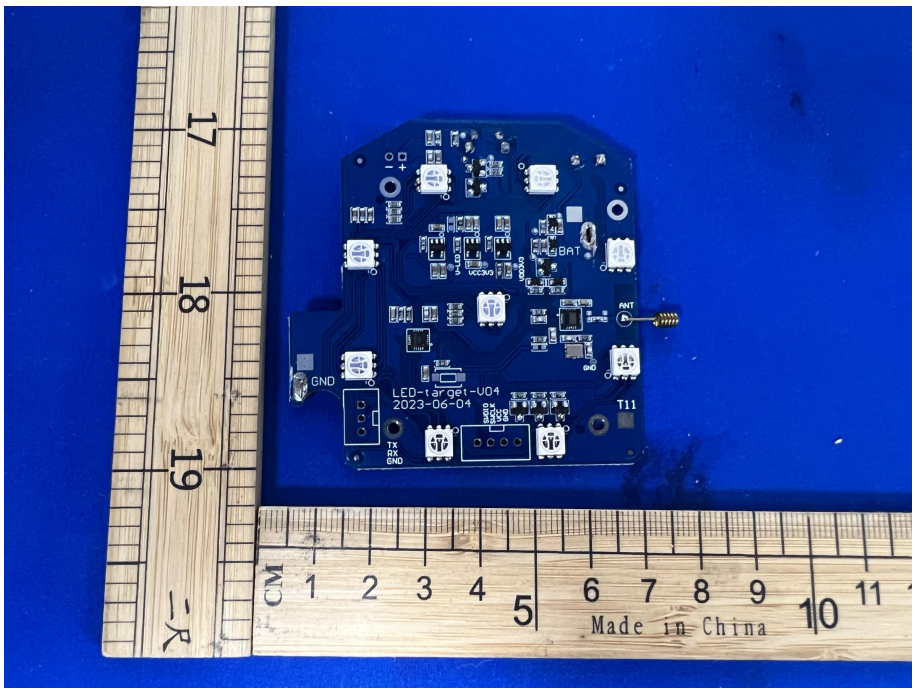
LED-target-V04
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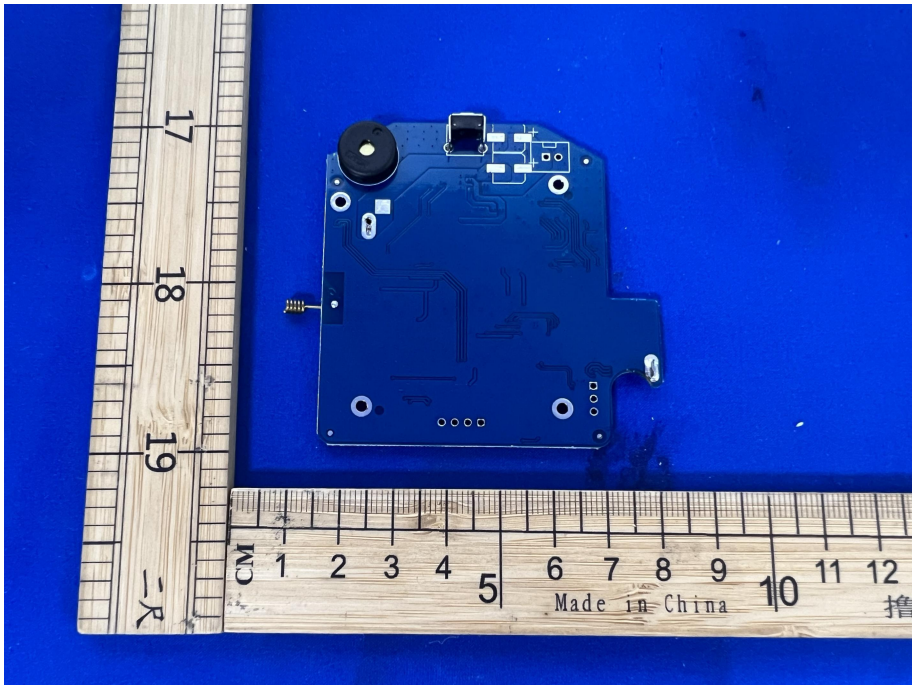

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