

RF TEST REPORT

Test item : Bike Safety Tail Light
Model No. : R-100A
Order No. : DEMC1406-02229
Date of receipt : 2014-06-09
Test duration : 2014-06-26~ 2014-08-04
Date of issue : 2014-09-02
Use of report : FCC Original Grant

Applicant : WOOJEON&HANDAN Co., Ltd.
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Test specification : FCC Part 15.249 Subpart C
Test environment : See appended test report
Test result : ☒ Pass ☐ Fail

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

Tested by:



Engineer
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Test Report Version

Test Report No.	Date	Description
DRTFCC1409-1136	Sep. 02, 2014	Initial issue

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1. Equipment information

1.1 Equipment description

FCC Equipment Class	Part 15 Low Power Communication Device Transmitter
FCC ID	2AC4W-R-100A
Equipment type	Bike Safety Tail Light
Equipment model name	R-100A
Equipment add model name	N/A
Equipment serial no.	Identical prototype
Frequency band	2433 MHz
Channel information	1 channels
Power	DC 3.0 V
Antenna type	Integral Antenna(Max. peak gain: 2.12 dBi)

1.2 Ancillary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

2. Information about test items

2.1 Test mode

This device was tested in maximum duty mode at maximum power.

Test Case 1	2-FSK
Test Case 2	-
Test Case 3	-

2.2 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

2.3 Tested frequency

	TX Frequency (MHz)	RX Frequency (MHz)
Lowest Channel	2433	2433
Middle Channel	-	-
Highest Channel	-	-

2.4 Tested environment

Temperature	: 24.4 °C
Relative humidity content	: 52 % R.H.
Details of power supply	: DC 3.0 V

2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. Test Report

3.1 Summary of tests

FCC Part RSS-210 & GEN	Parameter	Limit (Using in 2400 ~ 2483.5MHz)	Test Condition	Status Note 1
15.249 (a)	Field Strength Limits	Refer to the FCC 15.249(a)	Radiated	C
15.205, 209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	< FCC 15.209 limits	Radiated	C
15.207	AC Conducted Emissions	< FCC 15.207 limits	Line Conducted	N/A Note.2
Note 1: C=Comply NC=Not Comply NT=Not Tested NA=Not Applicable Note 2: This test is not applicable. Because the power of this device is supplied from batteries. Note 3: The sample was tested according to the following specification: ANSI C-63.10 2009				

3.2 Transmitter requirements

3.2.1 AC Conducted Emissions

Test Requirements and limit, §15.207& RSS-Gen [7.2.4]

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs for the actual connections.

Test Procedure

1. The EUT is placed on a wooden table 80 cm above the reference groundplane.
2. The EUT is connected via LISN to the test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

Test Result: N/A

3.2.2 Radiated Emission

Test Requirements and limit, §15.205, §15.209& RSS-210[A8.5], RSS-Gen [7.2.2]

▪ **Fundamental / Harmonics emission: FCC Part 15.249(a)**

Frequency (MHz)	Limit @ 3m	
	Fundamental (mV/m)	Harmonics (uV/m)
2400 ~ 2483.5	50	500

▪ **FCC Part 15.209(a) and (b)**

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 ~ 0.490	2400/F(KHz)	300
0.490 ~ 1.705	24000/F(KHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

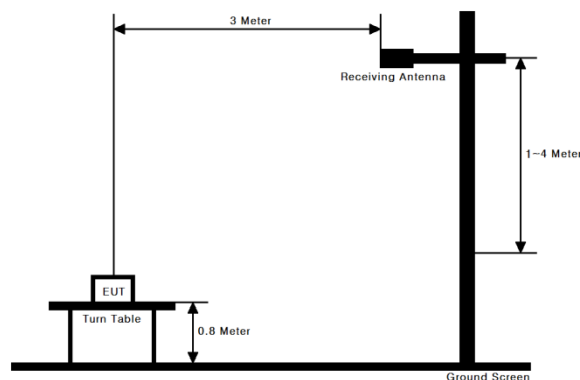
** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	12.29 ~ 12.293	149.9 ~ 150.05	1645.5 ~ 1646.5	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.51975 ~ 12.52025	156.52475 ~	1660 ~ 1710	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.57675 ~ 12.57725	156.52525	1718.8 ~ 1722.2	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	13.36 ~ 13.41	156.7 ~ 156.9	2200 ~ 2300	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	16.42 ~ 16.423	162.0125 ~ 167.17	2310 ~ 2390	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.69475 ~ 16.69525	167.72 ~ 173.2	2483.5 ~ 2500	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.80425 ~ 16.80475	240 ~ 285	2655 ~ 2900	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	25.5 ~ 25.67	322 ~ 335.4	3260 ~ 3267	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	37.5 ~ 38.25	399.90 ~ 410	3332 ~ 3339		
8.291 ~ 8.294	73 ~ 74.6	608 ~ 614	3345.8 ~ 3358		
8.362 ~ 8.366	74.8 ~ 75.2	960 ~ 1240	3600 ~ 4400		
8.37625 ~ 8.38675	108 ~ 121.94	1300 ~ 1427			
8.41425 ~ 8.41475	123 ~ 138	1435 ~ 1626.5			

▪ **FCC Part 15.205(b):** The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

Test Configuration



Note: See test photographs for the actual connections.

Test Procedures for Radiated Spurious Emissions

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. For measurements above 1GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed.
4. The antenna is a broadband antenna, and its 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.
5. 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 table was turned from 0 degrees to 360 degrees to find the maximum reading.
6. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
7. 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.

NOTE 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.

NOTE 2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz for Peak detection and frequency above 1GHz.

NOTE 3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 1kHz for Average detection (AV) at frequency above 1GHz.

9 KHz ~ 25GHz Radiated Spurious Emissions**▪ 2433 MHz**

	Freq. (MHz)	ANT Pol	The worst case EUT Position	Detector Mode	Reading (dBuV)	T.F (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
F	2432.988	V	Y axis	PK	85.69	0.08	85.77	114.00	28.23
F	2432.994	V	Y axis	AV	85.54	0.08	85.62	94.00	8.38
BE	2386.200	V	Y axis	PK	47.87	-0.07	47.80	74.00	26.20
BE	2386.080	V	Y axis	AV	34.98	-0.07	34.91	54.00	19.09
S	2399.910	V	Y axis	PK	47.75	-0.04	47.71	74.00	26.29
S	2399.940	V	Y axis	AV	35.12	-0.04	35.08	54.00	18.92
BE	2483.769	V	Y axis	PK	47.83	0.57	48.40	74.00	25.60
BE	2483.581	V	Y axis	AV	34.93	0.57	35.50	54.00	18.50
S	4865.910	V	Y axis	PK	49.58	6.77	56.35	74.00	17.65
S	4866.086	V	Y axis	AV	45.93	6.77	52.70	54.00	1.30

Note.

1. No other spurious and harmonic emissions were detected greater than listed emissions on above table.
And above listed data is the worst case data.
2. Sample Calculation.

$$\text{Margin} = \text{Limit} - \text{Result} \quad / \quad \text{Result} = \text{Reading} + \text{T.F} / \quad \text{T.F} = \text{AF} + \text{CL} - \text{AG}$$

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain

3.2.3 Antenna Requirements

Test Procedure

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

Test Result: **Comply**

The antenna is permanently attached by soldering. (Refer to Internal Photo file.)

- Minimum Standard:

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 shall be considered sufficient to comply with the provisions.

APPENDIX I

TEST EQUIPMENT FOR TESTS

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment.

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent	N9020A	13/09/24	14/09/24	MY50200834
Digital Multimeter	H.P	34401A	14/02/27	15/02/27	3146A13475
Signal Generator	Rohde Schwarz	SMR20	14/05/12	15/05/12	101251
Vector Signal Generator	Rohde Schwarz	SMJ100A	14/01/07	15/01/07	100148
Thermo hygrometer	BODYCOM	BJ5478	14/05/13	15/05/13	120612-2
DC Power Supply	SM techno	SDP30-5D	14/02/10	15/02/10	305DLJ204
High-pass filter	Wainwright	WHNX3.0	14/01/07	15/01/07	12
BILOG ANTENNA	SCHAFFNER	CBL6112B	12/11/06	14/11/06	2737
LOOP Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
Double-Ridged Guide Antenna	ETS	3117	14/05/12	16/05/12	00140394
HORN ANT	A.H.Systems	SAS-574	13/03/20	15/03/20	154
EMI TEST RECEIVER	R&S	ESU	14/01/08	15/01/08	100014
Amplifier (22dB)	H.P	8447E	14/01/07	15/01/07	2945A02865
Amplifier (30dB)	Agilent	8449B	14/02/27	15/02/27	3008A00370