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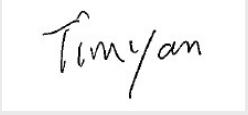
TEST REPORT
Radio Spectrum Matters (RF)

Identification of item tested	Filter Reading Matte Box System
Trademark	Light Widow LLC
Model and /or type reference	FRS-Light V1
FCC ID	2A8WP-FRSLV1
Contains FCC ID	YCP-STM32WB5M001
Features	Charging input: 5 Vdc Li-ion Battery: 3.7 Vdc
Applicant´s name / address	Light Widow LLC 31 Chaparral Circle, Glenwood Springs, Colorado, 81601, USA
Test method requested, standard	KDB 447498 D01V06 FCC Part 1.1310
Verdict Summary	COMPLIANCE
Tested by (name & signature)	Jazz Liang 
Approved by (name & signature)	Tim Yan 
Date of issue	2022-10-16
Report template No	TRF_EMC 2017-06- FCC_Exposure

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GENERAL CONDITIONS

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.
5. This report will not be used for social proof function in China market.

UNCERTAINTY

For all measurements where guidance for the calculation of the instrumentation uncertainty of a measurement is specified in EN 55016-4-2 (CISPR 16-4-2), EN/IEC 61000-4 series or a product standard, the measurement instrumentation uncertainty has been calculated and applied in accordance with these standards.

Uncertainties have been calculated according to the DEKRA internal document. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

Ambient temperature	15 °C – 35 °C
Relative Humidity air	30% - 60%
Atmospheric pressure	86 kPa – 106 kPa

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

POSSIBLE TEST CASE VERDICTS

Test case does not apply to test object	N/A
Test object does meet requirement	P (Pass) / PASS
Test object does not meet requirement	F (Fail) / FAIL
Not tested	N/T

DEFINITION OF SYMBOLS USED IN THIS TEST REPORT

☒ Indicates that the listed condition, standard or equipment is applicable for this report/test/EUT.				
☐ Indicates that the listed condition, standard or equipment is not applicable for this report/test/EUT.				
Decimal separator used in this report	☒	Comma (,)	☐	Point (.)

ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

EUT	:	Equipment Under Test
QP	:	Quasi-Peak
CAV	:	CISPR Average
AV	:	Average
CDN	:	Coupling Decoupling Network
SAC	:	Semi-Anechoic Chamber
OATS	:	Open Area Test Site
BW	:	Bandwidth
AM	:	Amplitude Modulation
PM	:	Pulse Modulation
HCP	:	Horizontal Coupling Plane
VCP	:	Vertical Coupling Plane
U_N	:	Nominal voltage
*T*x	:	Transmitter
*R*x	:	Receiver
N/A	:	Not Applicable
N/M	:	Not Measured

DOCUMENT HISTORY

Report nr.	Date	Description

REMARKS AND COMMENTS

The equipment under test (EUT) does meet the essential requirements of the stated standard(s)/test(s).

1 GENERAL INFORMATION

1.1 General Description of the Item(s)

Description of the item .....:	Filter Reading Matte Box System
Trademark.....:	Light Widow LLC
Model / Type number.....:	FRS-Light V1
FCC ID .....:	2A8WP-FRSLV1
Hardware .....:	FRSLEB010C
Software.....:	N/A
Firmware .....:	3.2.5
Contains FCC ID.....:	YCP-STM32WB5M001
Ratings.....:	Charging input: 5 Vdc Li-ion Battery: 3.7 Vdc
Manufacturer.....:	Same as applicant
Factory.....:	Same as applicant

			Reference poles				
Rated power supply .....:	Voltage and Frequency		L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 5V					
	☒	Battery: 3.7V					
Mounting position.....:	☐	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☒	Hand-held equipment					
	☐	Other:					

Declared by manufacturer, the NFC module is the transceiver which need be provocative.
the characteristics of NFC module:

Operating Frequency	13.56 MHz	
Operating Temperature Range	-40 – 85 °C	
Modulation	ASK	
Antenna Assembly	Type	Integral
	Gain	2 dBi

The characteristic of wireless chip(BLE mode)

Contains FCC ID.....:	YCP-STM32WB5M001
Operating frequency range(s).....:	2402 MHz – 2480 MHz
Type of Modulation .....:	GFSK
Maximum e.i.r.p .....:	5.9 dBm
Antenna type.....:	Integral Antenna
Operating Temperature Range.....:	-40 – 85 ℃
BT version.....:	N/A
Antenna gain.....:	2.0 dBi
Adaptivity/ Non-adaptivity .....:	Adaptivity

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	14	2430	28	2458
1	2404	15	2432	29	2460
2	2406	16	2434	30	2462
3	2408	17	2436	31	2464
4	2410	18	2438	32	2466
5	2412	19	2440	33	2468
6	2414	20	2442	34	2470
7	2416	21	2444	35	2472
8	2418	22	2446	36	2474
9	2420	23	2448	37	2476
10	2422	24	2450	38	2478
11	2424	25	2452	39	2480
12	2426	26	2454	-	-
13	2428	27	2456	-	-

Intended use of the Equipment Under Test (EUT)
The apparatus as supplied for the test is Filter Reading Matte Box System, which intended for residential use, the product contains electronic control circuitry but without earth connection.

Copy of marking plate:
No provide.

1.2 Test data

Test Location	DEKRA Testing and Certification (Shanghai) Ltd. Guangzhou Branch Block 5, No.3, Qiyun Road, Huangpu District, Guangzhou, Guangdong, China FCC Designation Number: CN1324;
Date of receipt of test item	2022-08-24
Date (s) of performance of tests	2022-08-24 to 2022-09-20
Test sample	Normal sample: FRS-Light V1 (S/N:C1)

1.3 The environment(s) in which the EUT is intended to be used

The equipment under test (EUT) is intended to be used in the following environment(s):

☒	Residential (domestic) environment.
☐	Commercial and light-industrial environment.
☐	Industrial environment.

2 DESCRIPTION OF TEST SETUP

2.1 Operating mode(s) used for tests

During the tests the following operating mode(s) has(have) been used.

Operating mode	Operating mode description	Used for methos	
		Conducted	Radiated
1	NFC transmitting mode	☐	☒
2		☐	☐
3		☐	☐
Supplemental information: ---			

2.2 Support / Auxiliary equipment / unit / software for the EUT

The EUT has been tested with the following auxiliary equipment / unit / software:

Auxiliary equipment / unit / software	Type / Version	Manufacturer	Supplied by
Mobile phone	Galaxy A02s	SAMSUNG	Client
Adaptor	-	-	DEKRA
Supplemental information: ---			

2.3 Measurement procedure

The EUT was controlled by Mobile phone which provided by manufacturer which connected to Mobile phone through the Bluetooth. After connected, run the Apps “LW Cert” supplied by manufacturer to control the EUT work in required test NFC transmitting mode.

3 RF EXPOSURE EVALUATION

3.1 Limits

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)
LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm2)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f^2	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f^2	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	F/1500	30
1500-100,000	--	--	1	30

F= Frequency in MHz
* = Plane-wave equivalent power density

Friis Formula
Friis transmission formula: Pd = (Pout*G)/(4*pi*r^2)

Where
Pd = power density in mW/cm2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
Pi = 3.1416
R = distance between observation point and center of the radiator in cm

Pd is the limit of MPE, 1 mW/cm2. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

3.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

The temperature and related humidity: 18℃and 78％ RH.

3.3 Test Result

Test Mode	Measured Conducted Power		Antenna Gain (dBi)	Measured e.i.r.p (mW)		$S_{(mW/cm^2)}$= $PG/4\pi R^2$	Limit (mW/cm^2)
	(dBm)	(mW)		(dBm)	(mW)		
BLE	3.90	2.45	2	5.90	3.89	0.0008	1.0
Zigbee	4.86	3.13	2	6.86	4.85	0.001	1.0

Note:

"RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons."

Test Mode	E-field strength	E-field strength	Electric Field Strength limit
NFC	45.5 dBuV/m@3m	0.0424 V/m@0.2m*	60.77 V/m

Note: Limit for 13.56MHz is 60.77 V/m

*: E-field (dBuV/m @0.20m) = E-field (dBuV/m @3m) + 40log(3/0.20)=92.54 dBuV/m @0.2m

E-field (V/m)= 10^[E-field (dBuV/m) /20] ×10^{-6}=0.0424 V/m@0.2m*

NFC 13.56MHz and BT/Zigbee modules can transmit simultaneously and BT/Zigbee function can not transit simultaneously, so the maximum rate of MPE is

The result: 0.0424/60.77+0.001/1 =0.0006974+0.001 = 0.0016974 <1.0.

Note: The formula of calculate the simultaneously transmission is

$$\sum_{i=1}^{a}\frac{P_i}{P_{\mathrm{th},i}}+\sum_{j=1}^{b}\frac{ERP_j}{ERP_{\mathrm{th},j}}+\sum_{k=1}^{c}\frac{Evaluated_k}{Exposure\ Limit_k}\leq 1 \qquad (C.1)$$

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