

Test Report

Verified code: 668228

Report No.: E20221124437601-6-G1

Customer: Lumi United Technology Co., Ltd

Address: B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District, Nanshan District, Shenzhen, China

Sample Name: Presence Sensor FP2

Sample Model: PS-S02E

Receive Sample Date: Nov.28,2022

Test Date: Nov.29,2022 ~ Feb.06,2023

Reference Document: CFR 47, FCC Part 2.1091 Radiofrequency radiation exposure evaluation: Mobile devices.

Test Result: Pass

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GUANGZHOU GRG METROLOGY & TEST CO., LTD

Issued Date: 2023-02-27

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REPORT ISSUED HISTORY

Report Version	Report No.	Description	Compile Date
1.0	E20221124437601-6	Original Issue	2023-02-07
2.0	E20221124437601-6-G1	Update	2023-02-27

Note:

- 1). The maximum output power of radar were refer to the report CR221157696-00 which issued on 02-04-2023 by China Certification ICT Co., Ltd (Dongguan).
- 2). This report E20221124437601-6-G1 is the modification of report E20221124437601-6. On the basis of the original report, update the home page customer and address, and update the FCC ID in section 1.3, and the original report E20221124437601-6 is invalid.

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1. GENERAL DESCRIPTION OF EUT

1.1 APPLICANT

Name: Lumi United Technology Co., Ltd
Address: B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District, Nanshan District, Shenzhen, China

1.2 MANUFACTURER

Name: Lumi United Technology Co., Ltd
Address: B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District, Nanshan District, Shenzhen, China

1.3 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Equipment: Presence Sensor FP2
Model No.: PS-S02E
Adding Model: PS-S02D
Models Difference: That EUT (Presence Sensor FP2) Model Numbers PS-S02E and PS-S02D have the same technical construction including circuit diagram, PCB LAYOUT, hardware version and software version identical, except sales area, packaging, and accessories are different.
Trade Name: Aqara
FCC ID: 2AKIT-PS-S02
Rating: DC 5V/1A
Frequency Band: 2402MHz-2480MHz for Bluetooth LE with 1M;
2412MHz-2472MHz for 2.4G WIFI 802.11b/g/n HT20;
2422MHz-2452MHz for 2.4G WIFI 802.11n HT40
60000MHz-64000MHz for Radar
Maximum Transmit Power: BLE for 1Mbps:6.21dBm, 2.4GHz WIFI:21.24dBm, Radar: -10.83dBm
Modulation Type: GFSK for LE 1Mbps
DSSS for IEEE 802.11b mode;
OFDM for IEEE 802.11g/n mode
FMCW for Radar
Antenna Specification: BLE&2.4GHz WIFI: FPC antenna with 1dBi gain (Max)
Radar: Internal Integrated antenna with 5dBi gain (Max)
Temperature Range: -10°C ~ +40°C
Hardware Version: X2
Software Version: 1.0.0_0004.0004
Sample No: E20221124437601-0007, E20221124437601-0008
Note: /

2. LABORATORY

The tests & measurements refer to this report were performed by Shenzhen EMC Laboratory of Guangzhou GRG Metrology & Test Co.,Ltd.

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3. LIMITS FOR GENERAL POPULATION/UNCONTROLLED EXPOSURE

According to the KDB 447498 D04 Interim General RF Exposure Guidance v01, General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table 4.1 to support an exemption from further evaluation from 300 kHz through 100 GHz.

TABLE 4.1—THRESHOLDS FOR SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	–	1.34	159 m	–	35.6 m	1,920 R ²
1.34	–	30	35.6 m	–	1.6 m	3,450 R ² /f ²
30	–	300	1.6 m	–	159 mm	3.83 R ²
300	–	1,500	159 mm	–	31.8 mm	0.0128 R ² f
1,500	–	100,000	31.8 mm	–	0.5 mm	19.2 R ²
Subscripts L and H are low and high; λ is wavelength. From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.						

For mobile devices that are not exempt per Table 4.1 at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in §1.1310 is necessary if the ERP of the device is greater than $ERP_{20\text{cm}}$ in Formula (4.1).

$$P_{\text{th}} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (4.1)$$

In accordance with KDB447498D04 Either SAR-based or MPE-based exemption may be considered for test exemption for fixed, mobile, or portable device exposure conditions; therefore, the contributions from each exemption in conjunction with the measured SAR (Evaluated_k term) shall be used to determine exemption for simultaneous transmission according to Formula

$$\text{MPE Ratio} = \sum_{j=1}^b \frac{ERP_j}{ERP_{\text{th},j}} < 1$$

ERP_j : the available maximum time-averaged power or the ERP, whichever is greater, of fixed, mobile, or portable RF source j .

$ERP_{\text{th},j}$: exemption threshold ERP for fixed, mobile, or portable RF source j , at a distance of at least $\lambda/2\pi$, according to the applicable § 1.1307(b)(3)(i)(C) Table 1 formula at the location in question.

the sum of the ratios of the applicable terms for SAR-based, MPE-based and measured SAR or MPE shall be less than 1, to determine simultaneous transmission exposure compliance

4. CALCULATION METHOD

Predication of MPE limit at a given distance

$EIRP(dBm) = \text{Maximum Tune-up Output power (dBm)} + \text{Maximum antenna gain (dBi)}$

$ERP(dBm) = EIRP(dBm) - 2.15$

R= minimum distance to the center of radiation of the antenna

From the EUT RF output power, the minimum mobile separation distance, $d=20\text{cm}$, as well as the maximum gain of the used as following information, the RF power ERP can be obtained.

Table 1 Antenna Specification

Frequency Band	Antenna type	Internal Identification	Maximum antenna gain
2.4G wifi	FPC antenna	Antenna 1	1.00dBi
BLE	FPC antenna	Antenna 1	1.00dBi
Radar	Internal Integrated antenna	Antenna 2	5dBi

Table 2 Transmit Power

Frequency Band	Maximum Output Power (dBm)	Tune-up Output power Range (dBm)
2.4G wifi	21.24	21.00 ± 1.00
BLE	6.21	6.00 ± 1.00
Radar	-10.83	-11.00 ± 1.00

5. ESTIMATION RESULT

5.1 MEASUREMENT RESULTS

STANDALONE MPE

Mode	Frequency (MHz)	Maximum Tune-up Output power (dBm)	Antenna Gain (dBi)	Maximum Tune-up EIRP (dBm)	Maximum Tune-up ERP (dBm)	Maximum Tune-up ERP (W)	Threshold ERP (W)
2.4G wifi	2412- 2462	22.00	1.00	23.00	20.85	0.1216	0.7680
BLE	2402- 2480	7.00	1.00	8.00	5.85	0.0038	0.7680
Radar	60000-64000	-10.00	5.00	-5.00	-7.15	0.0002	0.7680

Remark:

1. RF Exposure use distance is 20cm from manufacturer declaration of user manual.
- 2 $ERP = EIRP - 2.15$
3. Threshold $ERP(W) = 19.2R^2(W) = 19.2 * 0.2 * 0.2(W) = 0.7680(W)$.

Maximum Simultaneous transmission MPE Ratio for WLAN and Radar

Maximum MPE ratio 2.4G wifi	Maximum MPE ratio Radar	Σ MPE ratios	Limit	Results
0.15830	0.00026	0.15856	1.00000	Pass

Note:

1. The BLE and WiFi do not support simultaneous transmission, the BLE and radar do not support simultaneous transmission, the wifi and radar support simultaneous.
2. ERP_j : the available maximum time-averaged power or the ERP, whichever is greater, of fixed, mobile, or portable RF source j.
3. $ERP_{th,j}$: exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least $\lambda/2\pi$, according to the applicable § 1.1307(b)(3)(i)(C) Table 1 formula at the location in question.
4. Maximum MPE Ratio (2.4G wifi) = Maximum Tune-up ERP/ Threshold ERP = $0.1216W/0.768W = 0.1583$;
Maximum MPE Ratio (Radar) = Maximum Tune-up ERP/ Threshold ERP = $0.0002W/0.768W = 0.00026$;
 Σ MPE ratios = Maximum MPE Ratio (2.4G wifi) + Maximum MPE Ratio (Radar) = $0.15830 + 0.00026 = 0.15856$

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6. CONCLUSION

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

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