Test Report

Verified code: 865840

Report No.: E20220126665001-4

Customer:	Lumi United Technology Co., Ltd
Address:	B1, Chongwen Park, Nanshan iPark, Liuxian Avenue, Taoyuan Residential District, Nanshan District, Shenzhen, China
Sample Name:	Hub M1S Gen 2
Sample Model:	HM1S-G02
Receive Sample Date:	Feb.09,2022
Test Date:	Feb.15,2022 ~ Mar.03,2022
Reference Document:	CFR 47, FCC Part 2.1091Radiofrequency radiation exposure evaluation: mobile devices. KDB 447498 D01 General RF Exposure Guidance v06
Test Result:	Pass

Prepared by: Yang Zhaoyun Reviewed by: Jiang Tao Approved by: Xiao Liang

GUANGZHOU GRG METROLOGY & TEST CO., LTD

Issued Date: 2022-03-17

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Statement

1. The report is invalid without "special seal for inspection and testing"; some copies are invalid; The report is invalid if it is altered or missing; The report is invalid without the signature of the person who prepared, reviewed and approved it.

2. The sample information is provided by the client and responsible for its authenticity; The content of the report is only valid for the samples sent this time.

3. When there are reports in both Chinese and English, the Chinese version will prevail when the language problems are inconsistent.

4. If there is any objection concerning the report, please inform us within 15 days from the date of receiving the report.

5. Without the agreement of the laboratory, the client is not authorized to use the test results for unapproved propaganda.

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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 DESCRIPTIONOF EQUIPMENTUNDER TEST

Equipment:	Hub M1S Gen 2
Model No.:	HM1S-G02
Adding Model:	/
Trade Name:	Aqara
FCC ID:	2AKIT-HM1S-G02
Power Supply:	AC120V/60Hz
Adapter Specification:	/
Frequency Band:	Zigbee:2405MHz-2475MHz 2.4G Wi-Fi:2412MHz-2462MHz for 802.11b/g/n HT20
Transmit Power:	Zigbee:8.86 dBm 2.4G Wi-Fi: 18.67dBm for 802.11b mode 24.14dBm for 802.11g mode 23.33dBm for 802.11n HT20 mode
Modulation type:	Zigbee:OQPSK 2.4G Wi-Fi: DSSS for 802.11b mode; OFDM for 802.11g/nmode
Antenna Specification:	Zigbee: Internal antenna with 1dBi gain (Max) 2.4G Wi-Fi:Internal antenna with 1.5dBi gain (Max)
Temperature Range:	-10℃~ +40℃
Hardware Version:	T0
Software Version:	V1.0.1_0001
Sample No:	E20220126665001-0002
Note:	/

2. LABORATORYAND ACCREDITATIONS

2.1. LABORATORY

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

Add.:	No.1301 Guanguang Road Xinlan Community, Guanlan Street, Longhua District Shenzhen, 518110, People's Republic of China.
P.C.:	518000
Tel :	0755-61180008
Fax:	0755-61180008

2.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

USA	A2LA(Certificate #2861.01)
China	CNAS(L0446)

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	ISED (Company Number: 24897，CAB identifier:CN0069)
USA	FCC (Registration Number: 759402，Designation Number:CN1198)

Copies of granted accreditation certificates are available for downloading from our web site, http://www.grgtest.com

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3. EVALUATION METHOD

Exposure category: General population/uncontrolled environment
EUT Type: Production Unit
Device Type: Mobile Device

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.
In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.
In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

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4. LIMITS FOR GENERAL POPULATION/UNCONTROLLEDEXPOSURE

(B)Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength(H) (A/m)	Power Density (S) (Mw/cm^2)	Averaging Time$[E]^2$, $[H]^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-100,000	/	/	1.0	30

Note: f=frequency in MHz; *Plane-wave equivalent power density

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5. CALCULATION METHOD

Predication of MPE limit at a given distance
Equation from page 18 of OET Bulletin 65, Edition 97-01
$S=PG/4\pi R^2$
Where: S=power density
P=power input to antenna
G=power gain of the antenna in the direction of interest relative to anisotropic radiator
R=distance to the center of radiation of the antenna
From the EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the maximum gain of the used as following information, the RF power density can be obtained.

Frequency Band	Antenna type	Maximum antenna gain
Zigbee	Internal antenna	1dBi
2.4G Wi-Fi	Internal antenna	1.5dBi

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6. ESTIMATION RESULT

6.1. CONDUCTED POWER RESULTS

Zigbee

Antenna	Mode	Frequency(MHz)	Peak Conducted Output Power (dBm)
Antenna 1	Zigbee	2405	8.70
		2440	8.75
		2475	8.86

2.4G Wi-Fi

Antenna	Mode	Frequency(MHz)	Peak Conducted Output Power (dBm)
Antenna 2	IEEE 802.11b	2412	18.05
		2437	18.53
		2462	18.67
	IEEE 802.11g	2412	23.76
		2437	24.12
		2462	24.14
	IEEE 802.11n HT20	2412	22.87
		2437	22.98
		2462	23.33

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6.2. MANUFACTURING TOLERANCE

Frequency (MHz)	Zigbee
	2475
Target (dBm)	9.0
Tolerance ±(dB)	1.0

Frequency (MHz)	2.4G Wi-Fi		
	IEEE 802.11b	IEEE 802.11g	IEEE 802.11n HT20
	2462	2462	2462
Target (dBm)	19.0	24.0	23.0
Tolerance ±(dB)	1.0	1.0	1.0

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6.3. MEASUREMENT RESULTS

6.3.1. STANDALONE MPE

Zigbee

Antenna 1

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	(dBm)	(mW)				
Zigbee	10.0	10.0000	1	1.2589	0.0025	1.0000

2.4GWi-Fi

Antenna 2

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	(dBm)	(mW)				
IEEE 802.11b	20.0	100.0000	1.5	1.4125	0.0281	1.0000
IEEE 802.11g	25.0	316.2278	1.5	1.4125	0.0889	1.0000
IEEE 802.11n HT20	24.0	251.1886	1.5	1.4125	0.0706	1.0000

Remark: 1. Maximum peak conducted output power including tune-up tolerance;
2. MPE use distance is 20cm from manufacturer declaration of user manual.

Maximum Simultaneous transmission MPE Ratio

Maximum MPE ratio (mW/cm^2) Zigbee	Maximum MPE ratio (mW/cm^2) 2.4G Wi-Fi	∑ MPE ratios (mW/cm^2)	Limit (mW/cm^2)	Results
0.0025	0.0889	0.0914	1.000	Pass

Note: The estimation distance is 20cm

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7. CONCLUSION

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

---------- End of Report ----------