

FCC RF Exposure Evaluation

1. Product Information

FCC ID	:	2AMTQHA88XX
Product name	:	Legends Ultimate Home Arcade
Model number	:	HA8800S,HA8800B,HA8800C,HA8800D,HA8801,HA8801S,HA8801B,HA8801C,HA8801D,HA8802,HA8802S,HA8802B,HA8802C,HA8803,HA8803S,HA8803B,HA8803C,HA8804,HA8804S,HA8804B,HA8804C,HA8805,HA8805S,HA8805B,HA8805C,HA8810,HA8810S,HA8810B,HA8810C,HA8810D,HA8811,HA8811S,HA8811B,HA8811C,HA8812,HA8812S,HA8812B,HA8812C,HA8813,HA8813S,HA8813B,HA8813C,HA8814,HA8814S,HA8814B,HA8814C,HA8815,HA8815S,HA8815B,HA8815C,HA8820,HA8820S,HA8820B,HA8820C,HA2800,HA2800S,HA2800B,HA2800C,HA2800D,HA2801,HA2801S,HA2801B,HA2801C,HA2801D
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, so no additional models were tested
Test Model	:	HA8800
Power supply	:	Input: AC100-240V, 50/60Hz 2A Output: DC12V/5A
Bluetooth	:	2402-2480MHz
Channel Number	:	79 channels for Bluetooth V4.1 (BDR/EDR) 40 channels for Bluetooth V4.1 (BT LE)
Channel Spacing	:	1MHz for Bluetooth V4.1 (BDR/EDR) 2MHz for Bluetooth V4.1 (BT LE)
Modulation Type	:	GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth V4.1 (BDR/EDR) GFSK for Bluetooth V4.1 (BT LE)
Bluetooth Version	:	4.1
WIFI(2.4G Band)	:	2412-2462MHz
Channel Spacing	:	5MHz
Channel Number	:	11 channels for 20MHz bandwidth(2412~2462MHz) 7 channels for 40MHz bandwidth(2422~2452MHz)
Modulation Type	:	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK); IEEE 802.11g/n: OFDM(64QAM, 16QAM, QPSK, BPSK)
WIFI(5.2G Band)	:	5180-5240MHz
Channel Number	:	4 channels for 20MHz bandwidth(5180-5240MHz) 2 channels for 40MHz bandwidth(5190~5230MHz) 1 channels for 80MHz bandwidth(5210MHz)
Modulation Type	:	IEEE 802.11a/n/ac: OFDM(64QAM, 16QAM, QPSK, BPSK)
WIFI(5.8G Band)	:	5745-5825MHz
Channel Number	:	5 channels for 20MHz bandwidth(5745-5825MHz) 2 channels for 40MHz bandwidth(5755~5795MHz) 1 channels for 80MHz bandwidth(5775MHz)
Modulation Type	:	IEEE 802.11a/n/ac: OFDM(64QAM, 16QAM, QPSK, BPSK)
Antenna Type	:	PCB antenna
Antenna Gain	:	2.0dBi (maximum)
Hardware version	:	HA8800-V2.2
Software version	:	HA8800_Wifi_V2.0
Exposure category	:	General population/uncontrolled environment
EUT Type	:	Production Unit
Device Type	:	Mobile Device

2. Evaluation method and Limit

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 modelled 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.

3. Refer Evaluation Method

3.1 Refer Evaluation Method

[ANSI C95.1-1999](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

[FCC KDB publication 447498 D01 General RF Exposure Guidance v06](#): Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

[FCC CFR 47 part1 1.1310](#): Radiofrequency radiation exposure limits.

[FCC CFR 47 part2 2.1093](#): Radiofrequency radiation exposure evaluation: portable devices

3.2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
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

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 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	/	/	1.0	30

F=frequency in MHz

*=Plane-wave equivalent power density

4. MPE 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 an isotropic radiator

R=distance to the center of radiation of the antenna

5. Antenna Information

ZJ-MWIR-RGB can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Note
Antenna	PCB Antenna	2000 MHz – 2500 MHz 5000 MHz – 6000 MHz	2dBi	WLAN Antenna

6. Conducted Power Results

<BT Classics>

Mode	Channel	Frequency(MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	-2.310
	39	2441	-3.230
	78	2480	-2.680
$\pi/4$ DQPSK	0	2402	-3.130
	39	2441	-4.050
	78	2480	-3.410
8DPSK	0	2402	-3.160
	39	2441	-4.080
	78	2480	-3.440

<BT LE>

Mode	Channel	Frequency(MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	-5.55
	19	2440	-4.72
	39	2480	-5.97

<2.4GWLAN>

Mode	Channel	Frequency(MHz)	Average Conducted Output Power (dBm)
IEEE 802.11b	1	2412	19.71
	6	2437	18.63
	11	2462	17.7
IEEE 802.11g	1	2412	19.16
	6	2437	18.36
	11	2462	17.79
IEEE 802.11n HT20	1	2412	19.51
	6	2437	18.56
	11	2462	17.96
IEEE 802.11n HT40	3	2422	20.06
	6	2437	19.02
	9	2452	18.83

<5.2GWLAN>

Mode	Channel	Frequency(MHz)	Average Conducted Output Power (dBm)
IEEE 802.11a	36	5745	14.38
	40	5785	13.94
	48	5825	14.34
IEEE 802.11nHT20	36	5745	14.31
	40	5785	13.98
	48	5825	14.39
IEEE 802.11nHT40	38	5755	14.21
	46	5795	14.23
IEEE 802.11ac VHT20	36	5745	14.3
	40	5785	14.18
	48	5825	14.45
IEEE 802.11ac VHT40	38	5755	14.09
	46	5795	14.27
IEEE 802.11ac VHT80	42	5210	14.42

<5.8GWLAN>

Mode	Channel	Frequency(MHz)	Average Conducted Output Power (dBm)
IEEE 802.11a	149	5745	14.64
	157	5785	14.82
	165	5825	15.2
IEEE 802.11nHT20	149	5745	14.64
	157	5785	14.81
	165	5825	15.25
IEEE 802.11nHT40	151	5755	14.33
	159	5795	14.77
IEEE 802.11ac VHT20	149	5745	14.65
	157	5785	14.81
	165	5825	15.19
IEEE 802.11ac VHT40	151	5755	14.42
	159	5795	14.68
IEEE 802.11ac VHT80	155	5775	15.01

7. Manufacturing Tolerance

<BT Classics>

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	-2.0	-3.0	-3.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
π /4DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	-3.0	-4.0	-3.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
8DPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	-3.0	-4.0	-3.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

<BT LE>

GFSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	-5.0	-5.0	-6.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

<2.4GWLAN>

IEEE 802.11b (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	20	19	18
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	19	18	18
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n20 (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	20	19	18
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n40 (Average)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	20	19	19
Tolerance $\pm$ (dB)	1.0	1.0	1.0

<5.2GWLAN>

IEEE 802.11a (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	15	14	14
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	14	14	14
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11 HTn40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	14	14	/
Tolerance $\pm$ (dB)	1.0	1.0	/
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	14	14	14
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ac VHT40 (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	14	14	/
Tolerance $\pm$ (dB)	1.0	1.0	/
IEEE 802.11ac VHT80 (Average)			
Channel	Channel 42	/	/
Target (dBm)	14	/	/
Tolerance $\pm$ (dB)	1.0	/	/

<5.8GWLAN>

IEEE 802.11a (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	15	15	15
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	15	15	15
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 151	Channel 159	/
Target (dBm)	15	15	/
Tolerance $\pm$ (dB)	1.0	1.0	/
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	15	15	15
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ac VHT40 (Average)			
Channel	Channel 151	Channel 159	/
Target (dBm)	15	15	/
Tolerance $\pm$ (dB)	1.0	1.0	/
IEEE 802.11ac VHT80 (Average)			
Channel	Channel 155	/	/
Target (dBm)	15	/	/
Tolerance $\pm$ (dB)	1.0	/	/

8. Evaluation Results

8.1 Standalone MPE

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r=20\text{cm}$, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

[Antenna]BT

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
GFSK	-1.00	0.7943	2.0	1.5849	100%	0.0003	1.0000
$\pi/4$ DQPSK	-2.00	0.6310	2.0	1.5849	100%	0.0002	1.0000
8DPSK	-2.00	0.6310	2.0	1.5849	100%	0.0002	1.0000

[Antenna]BLE

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
GFSK	-4.00	0.3981	2.0	1.5849	100%	0.0001	1.0000

[Antenna]2.4G

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11b	21.00	125.8925	2.0	1.5849	100%	0.0397	1.0000
IEEE 802.11g	20.00	100.0000	2.0	1.5849	100%	0.0315	1.0000
IEEE 802.11n HT20	21.00	125.8925	2.0	1.5849	100%	0.0397	1.0000
IEEE 802.11n HT20	21.00	125.8925	2.0	1.5849	100%	0.0397	1.0000

[Antenna]5.2G

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11a	16.00	39.8107	2.0	1.5849	100%	0.0126	1.0000
IEEE 802.11 n HT20	15.00	31.6228	2.0	1.5849	100%	0.0100	1.0000
IEEE 802.11n HT40	15.00	31.6228	2.0	1.5849	100%	0.0100	1.0000
IEEE 802.11ac20	15.00	31.6228	2.0	1.5849	100%	0.0100	1.0000
IEEE 802.11ac 40	15.00	31.6228	2.0	1.5849	100%	0.0100	1.0000
IEEE 802.11ac80	15.00	31.6228	2.0	1.5849	100%	0.0100	1.0000

[Antenna]5.8G

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11a	15.00	31.6228	2.0	1.5849	100%	0.0100	1.0000
IEEE 802.11 n HT20	15.00	31.6228	2.0	1.5849	100%	0.0100	1.0000
IEEE 802.11n HT40	15.00	31.6228	2.0	1.5849	100%	0.0100	1.0000
IEEE 802.11ac 20	15.00	31.6228	2.0	1.5849	100%	0.0100	1.0000
IEEE 802.11ac 40	15.00	31.6228	2.0	1.5849	100%	0.0100	1.0000
IEEE 802.11ac80	15.00	31.6228	2.0	1.5849	100%	0.0100	1.0000

Remark:

1. Output power including tune-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;

8.2 Simultaneous Transmission MPE

The sample support only one BT&WLAN modular and WLAN and BT share same antenna, the Bluetooth, 2.4GWLAN and 5GWLAN cannot no transmit at the same time, so no need consider simultaneous transmission.

9.Conclusion

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

.....THE END OF REPORT.....