Maximum Permissible Exposure Report

1. Product Information

FCC ID:	2AMTQCGC20
Product name	Streaming box
Test Model	HA2810
Additional Model No	HA2811, HA2812, HA2813, HA2810S, HA2811S, HA2812S, HA2813S, HA2810B, HA2811B, HA2812B, HA2813B, HA2810C, HA2811C, HA2812C, HA2813C
Model Declaration	PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Power supply	For AC Adapter: Input: AC 100-240V, 50/60Hz, 0.4A Output: DC 5.0V, 2.0A
Operation frequency	2402MHz-2480MHz 2412MHz-2462MHz 5180MHz-5240MHz 5745MHz-5825MHz
Antenna Type	PCB Antenna
Antenna Gain	2.00dBi(Max)
Hardware version	V2.1
Software version	/
Channel Number	79 channels for Bluetooth V4.2 (BDR/EDR) 40 channels for Bluetooth V4.2 (BT LE) 11 Channels for 20MHz bandwidth (2412~2462MHz) 7 Channels for 40MHz bandwidth (2422~2452MHz) 4 channels for 20MHz bandwidth (5180-5240MHz) 2 channels for 40MHz bandwidth (5190~5230MHz) 1 channels for 80MHz bandwidth (5210MHz) 5 channels for 20MHz bandwidth(5745-5825MHz) 2 channels for 40MHz bandwidth(5755~5795MHz) 1 channels for 80MHz bandwidth(5775MHz)
Channel Spacing	5MHz
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Mobile Devices

2. Evaluation Method

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. Limit

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 1 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 2.1091: Radiofrequency radiation exposure evaluation: Mobile 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

ES-D4 can only use antennas certificated as follows provided by manufacturer;

Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
PCB Antenna	2402MHz-2480MHz 2412MHz-2462MHz 5180MHz-5240MHz 5745MHz-5825MHz	2 dBi	BT/WiFi Antenna

6. Conducted Power

[BT Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	0.623
	39	2441	1.560
	78	2480	0.315
π/4DQPSK	0	2402	0.781
	39	2441	2.033
	78	2480	0.721
8DPSK	0	2402	0.792
	19	2440	2.008
	39	2480	0.705

[BLE Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
BT LE	0	2402	3.572
	19	2440	2.02
	39	2480	0.301

[2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power(dBm)
11B	1	2412	13.24
	6	2437	13.74
	11	2462	13.4
11G	1	2412	13.89
	6	2437	14.52
	11	2462	13.99
11N20SISO	1	2412	13.14
	6	2437	13.8
	11	2462	14.19
11N40SISO	3	2422	12
	6	2437	12.95
	9	2452	13.54

[5.2GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Average Conducted Output Power (dBm)
11A	36	5180	13.56
	40	5200	13.91
	48	5240	14.78
11N20 SISO	36	5180	12.08
	40	5200	13.28
	48	5240	14.86
11N40 SISO	38	5190	12.5
	46	5230	12.45
11AC20 SISO	36	5180	12.18
	40	5200	12.37
	48	5240	13.46
11AC40 SISO	38	5190	12.11
	46	5230	13.5
11AC80 SISO	42	5210	13.19

[5.8WIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Average Conducted Output Power (dBm)
11A	149	5745	13.69
	157	5785	13.1
	165	5825	12.72
11N20 SISO	149	5745	13.87
	157	5785	13.18
	165	5825	12.77
11N40 SISO	151	5755	12.65
	159	5795	12.72
11AC20 SISO	149	5745	12.18
	157	5785	12.37
	165	5825	13.46
11AC40 SISO	151	5755	12.11
	159	5795	13.5
11AC80 SISO	155	5775	13.35

7. Measurement Results

BT

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	0	1.0	0
Tolerance ±(dB)	1.0	1.0	1.0
π/4DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	0	2.0	0
Tolerance ±(dB)	1.0	1.0	1.0
8DPSK (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	0	2.0	0
Tolerance ±(dB)	1.0	1.0	1.0

BLE

BT LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	3.0	2.0	0
Tolerance ±(dB)	1.0	1.0	1.0

2.4GWIFI

11B (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	13.0	13.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0
11G (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	13.0	14.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20SISO (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	13.0	13.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40SISO (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	12.0	12.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0

5.2GWIFI

11A (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	13.0	13.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20 SISO (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	12.0	13.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40 SISO (Average)			
Channel	Channel 38		Channel 46
Target (dBm)	12.0		12.0
Tolerance ±(dB)	1.0		1.0
11AC20 SISO (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	12.0	12.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0
11AC40 SISO (Average)			
Channel	Channe38		Channel 46
Target (dBm)	12.0		13.0
Tolerance ±(dB)	1.0		1.0
11AC80 SISO (Average)			
Channel	Channel 42		
Target (dBm)	13.0		
Tolerance ±(dB)	1.0		

5.8GWIFI

11A (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	13.0	13.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20 SISO (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	13.0	13.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0
11N40 SISO (Average)			
Channel	Channel 151	Channel 159	
Target (dBm)	12.0	12.0	
Tolerance ±(dB)	1.0	1.0	
11AC20 SISO (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	12.0	12.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0
11AC40 SISO (Average)			
Channel	Channe151	Channel 159	
Target (dBm)	12.0	13.0	
Tolerance ±(dB)	1.0	1.0	
11AC80 SISO (Average)			
Channel	Channel 155		
Target (dBm)	13.0		
Tolerance ±(dB)	1.0		

8. Evaluation Results

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 =20cm, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

BT

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
		dBm	mW				
GFSK	2.441	2.0	1.5849	2.0	1.5849	0.0005	1.0000
π/4DQPSK	2.441	3.0	1.9953	2.0	1.5849	0.0006	1.0000
8DPSK	2.441	3.0	1.9953	2.0	1.5849	0.0006	1.0000

BLE

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
		dBm	mW				
BT LE	2.402	4.0	2.5119	2.0	1.5849	0.0008	1.0000

2.4GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
		dBm	mW				
IEEE 802.11b	2.437	14.0	25.1189	2.0	1.5849	0.0079	1.0000
IEEE 802.11g	2.437	15.0	31.6228	2.0	1.5849	0.0100	1.0000
IEEE 802.11n HT20	2.462	15.0	31.6228	2.0	1.5849	0.0100	1.0000
IEEE 802.11n HT40	2.452	14.0	25.1189	2.0	1.5849	0.0079	1.0000

5.2GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
		dBm	mW				
11A	5.240	15.0	31.6228	2.0	1.5849	0.0100	1.0000
11N20 SISO	5.240	15.0	31.6228	2.0	1.5849	0.0100	1.0000
11N40 SISO	5.190	13.0	19.9526	2.0	1.5849	0.0063	1.0000
11AC20 SISO	5.240	14.0	25.1189	2.0	1.5849	0.0079	1.0000
11AC40 SISO	5.240	14.0	25.1189	2.0	1.5849	0.0079	1.0000
11AC80 SISO	5.210	14.0	25.1189	2.0	1.5849	0.0079	1.0000

5.8GWIFI

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
		dBm	mW				
11A	5.745	14.0	25.1189	2.0	1.5849	0.0079	1.0000
11N20 SISO	5.745	14.0	25.1189	2.0	1.5849	0.0079	1.0000
11N40 SISO	5.795	13.0	19.9526	2.0	1.5849	0.0063	1.0000
11AC20 SISO	5.825	14.0	25.1189	2.0	1.5849	0.0079	1.0000
11AC40 SISO	5.795	14.0	25.1189	2.0	1.5849	0.0079	1.0000
11AC80 SISO	5.775	14.0	25.1189	2.0	1.5849	0.0079	1.0000

Remark:
1. Output power including turn-up tolerance;
2. Output power is burst average power;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer;
4. MPE values = $PG/4\pi R^2$

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----------