FCC 47 CFR MPE REPORT

AUDIO PRO AB

WIRELESS MULTIROOM LOUDSPEAKER

Model Number: ADDON C5MkII

FCC ID: 2AGNC-C5MKII

Applicant:	AUDIO PRO AB
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Maximum Permissible Exposure

1. Applicable Standards

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

1.1. Limits for Maximum Permissible Exposure (MPE)

(a) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Times $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-10000			5	6

(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 Times $\|E\|^2$, $\|H\|^2$ 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
1500-10000			1.o	30

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

1.2. MPE Calculation Method

$$E\ (V/m) = \frac{\sqrt{30 \times P \times G}}{d} \qquad \text{Power Density: } Pd\ (W/m^2) = \frac{E^2}{377}$$

E = Electric Field (V/m)

P = Peak RF output Power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

2. Conducted Power Result

Antenna 1

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)
GFSK	2402	5.30	3.39	5±1
	2441	5.50	3.55	5±1
	2480	6.12	4.09	6±1
8-DPSK	2402	1.97	1.57	2±1
	2441	2.41	1.74	2±1
	2480	2.79	1.90	3±1
BLE	2402	4.70	2.95	5±1
	2440	4.62	2.90	5±1
	2480	4.51	2.82	5±1
IEEE 802.11b	2412	17.15	51.88	17±1
	2437	17.38	54.70	17±1
	2462	17.32	53.95	17±1
IEEE 802.11g	2412	21.54	142.56	22±1
	2437	21.73	148.94	22±1
	2462	22.00	158.49	22±1
IEEE 802.11n HT20 (2.4G)	2412	23.77	238.23	24±1
	2437	23.95	248.31	24±1
	2462	24.31	269.77	24±1
IEEE 802.11a	5180	15.506	35.530	16±1
	5200	15.718	37.308	16±1
	5240	16.438	44.035	16±1
	5745	15.484	35.351	15±1
	5785	14.806	30.241	15±1
	5825	14.384	27.441	13±1
IEEE 802.11n HT20 (5G)	5180	12.622	18.289	13±1
	5200	10.748	11.880	11±1
	5240	11.384	13.753	11±1
	5745	12.211	16.638	12±1
	5785	11.630	14.555	12±1
	5825	11.060	12.764	11±1

IEEE 802.11ac VHT20	5180	12.509	17.820	13±1
	5200	12.901	19.503	13±1
	5240	13.437	22.065	13±1
	5745	12.160	16.444	12±1
	5785	11.507	14.148	12±1
	5825	10.972	12.508	11±1
IEEE 802.11n HT40 (5G)	5190	12.133	16.342	12±1
	5230	13.220	20.989	13±1
	5755	12.148	16.398	12±1
	5795	11.241	13.308	11±1
IEEE 802.11ac VHT40	5190	12.153	16.417	12±1
	5230	13.184	20.816	13±1
	5755	12.124	16.308	12±1
	5795	11.134	12.984	11±1
IEEE 802.11ac VHT80	5210	12.377	17.286	12±1
	5775	10.826	12.095	11±1

Antenna 2

Mode	Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Target power (dBm)
IEEE 802.11b	2412	17.82	60.53	18±1
	2437	17.77	59.84	18±1
	2462	17.76	59.70	18±1
IEEE 802.11g	2412	22.06	160.69	22±1
	2437	22.32	170.61	22±1
	2462	22.04	159.96	22±1
IEEE 802.11n HT20 (2.4G)	2412	23.25	211.35	23±1
	2437	23.62	230.14	24±1
	2462	23.65	231.74	24±1
IEEE 802.11a	5180	16.175	41.448	16±1
	5200	15.921	39.093	16±1
	5240	16.357	43.222	16±1
	5745	16.398	43.631	16±1
	5785	15.862	38.566	16±1
	5825	15.451	35.083	15±1

IEEE 802.11n HT20 (5G)	5180	13.170	20.749	13±1
	5200	12.796	19.037	13±1
	5240	13.148	20.644	13±1
	5745	13.147	20.640	13±1
	5785	12.693	18.591	13±1
	5825	12.300	16.982	11±1
IEEE 802.11ac VHT20	5180	13.265	21.208	13±1
	5200	13.649	23.169	14±1
	5240	14.311	26.984	14±1
	5745	13.204	20.912	13±1
	5785	12.575	18.093	13±1
	5825	12.036	15.981	12±1
IEEE 802.11n HT40 (5G)	5190	12.596	18.180	13±1
	5230	12.980	19.861	13±1
	5755	13.151	20.659	13±1
	5795	12.492	17.750	12±1
IEEE 802.11ac VHT40	5190	12.571	18.076	13±1
	5230	12.998	19.943	13±1
	5755	13.159	20.697	13±1
	5795	12.406	17.402	12±1
IEEE 802.11ac VHT80	5210	12.764	18.897	13±1
	5775	12.018	15.915	12±1

3. Calculated Result and Limit

Bluetooth

Antenna	Channel	MAX Target power (dBm)	Antenna gain		Power Density (S) (mW/cm^2)	Limited of Power Density (S) (mW/cm^2)	Test Result
			(dBi)	(Linear)			
1	2480	7	2	1.585	0.00158	1	Complies

WLAN 2.4G SISO

Antenna	Channel	MAX Target power (dBm)	Antenna gain		Power Density (S) (mW/cm^2)	Limited of Power Density (S) (mW/cm^2)	Test Result
			(dBi)	(Linear)			
1	2462	25	2	1.585	0.09971	1	Complies
2	2462	25	2	1.585	0.09971	1	Complies

WLAN 2.4G MIMO

Worst case	Channel	Target power (dBm) Antenna 1	Target power (dBm) Antenna 2	Power Density (S) (mW/cm^2) Antenna 1	Power Density (S) (mW/cm^2) Antenna 2	Total Ratio	Limit Ratio	Test Result
IEEE 802.11n HT20	2462	25	25	0.09971	0.09971	0.19942	1	Complies

WLAN 5G SISO

Antenna	Channel	MAX Target power (dBm)	Antenna gain		Power Density (S) (mW/cm^2)	Limited of Power Density (S) (mW/cm^2)	Test Result
			(dBi)	(Linear)			
1	5240	17	2	1.585	0.0158	1	Complies
2	5240	17	2	1.585	0.0158	1	Complies

WLAN 5G MIMO

Worst case	Channel	Target power (dBm) Antenna 1	Target power (dBm) Antenna 2	Power Density (S) (mW/cm^2) Antenna 1	Power Density (S) (mW/cm^2) Antenna 2	Total Ratio	Limit Ratio	Test Result
IEEE 802.11ac VHT20	5240	14	15	0.00792	0.00997	0.01789	1	Complies

Bluetooth+ WLAN

MAX Power Density (S) (mW/cm^2) Bluetooth	MAX Power Density (S) (mW/cm^2) WiFi	Total Ratio	Limit Ratio	Test Result
0.00158	0.19942	0.20100	1	Complies

Note: 1. only the worst case was recorded.

2. 2.4G wifi & 5G wifi can't transmit simutaneously.

End of Test Report