

## FCC 47 CFR MPE REPORT

AUDIO PRO AB

WIRELESS MULTIROOM LOUDSPEAKER

Model Number: A38

Additional Model: A28

FCC ID: 2AGNC-A38

|                          |                                                                     |
|--------------------------|---------------------------------------------------------------------|
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|                          |                                                                     |
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|                 |                       |
|-----------------|-----------------------|
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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 <sup>2</sup> ) | Averaging Times   E   <sup>2</sup> ,   H   <sup>2</sup> 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 <sup>2</sup> ) | Averaging Times   E   <sup>2</sup> ,   H   <sup>2</sup> 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            |                                   |                                   | 1.0                                     | 30                                                                     |

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

## 1.2. MPE Calculation Method

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

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<br>(MHz) | Peak output power<br>(dBm) | Peak output power<br>(mW) | Target power<br>(dBm) |
|-----------------------------------|--------------------|----------------------------|---------------------------|-----------------------|
| GFSK                              | 2402               | 4.63                       | 2.90                      | 5±1                   |
|                                   | 2441               | 4.19                       | 2.62                      | 4±1                   |
|                                   | 2480               | 3.96                       | 2.49                      | 4±1                   |
| 8-DPSK                            | 2402               | 1.45                       | 1.40                      | 1±1                   |
|                                   | 2441               | 1.43                       | 1.39                      | 1±1                   |
|                                   | 2480               | 0.74                       | 1.19                      | 1±1                   |
| BLE                               | 2402               | 4.33                       | 2.71                      | 4±1                   |
|                                   | 2440               | 4.03                       | 2.53                      | 4±1                   |
|                                   | 2480               | 3.71                       | 2.35                      | 4±1                   |
| IEEE<br>802.11b                   | 2412               | 17.25                      | 53.09                     | 17±1                  |
|                                   | 2437               | 17.39                      | 54.83                     | 17±1                  |
|                                   | 2462               | 17.42                      | 55.21                     | 17±1                  |
| IEEE<br>802.11g                   | 2412               | 21.49                      | 140.93                    | 21±1                  |
|                                   | 2437               | 21.58                      | 143.88                    | 22±1                  |
|                                   | 2462               | 22.04                      | 159.96                    | 22±1                  |
| IEEE<br>802.11n<br>HT20<br>(2.4G) | 2412               | 23.36                      | 216.77                    | 23±1                  |
|                                   | 2437               | 24.08                      | 255.86                    | 24±1                  |
|                                   | 2462               | 24.13                      | 258.82                    | 24±1                  |
| IEEE<br>802.11a                   | 5180               | 14.408                     | 27.593                    | 14±1                  |
|                                   | 5200               | 14.267                     | 26.712                    | 14±1                  |
|                                   | 5240               | 14.383                     | 27.435                    | 14±1                  |
|                                   | 5745               | 14.373                     | 27.372                    | 14±1                  |
|                                   | 5785               | 14.197                     | 26.285                    | 14±1                  |
|                                   | 5825               | 13.292                     | 21.340                    | 13±1                  |
| IEEE<br>802.11n<br>HT20 (5G)      | 5180               | 14.225                     | 26.455                    | 14±1                  |
|                                   | 5200               | 13.854                     | 24.288                    | 14±1                  |
|                                   | 5240               | 14.180                     | 26.182                    | 14±1                  |
|                                   | 5745               | 14.030                     | 25.293                    | 14±1                  |
|                                   | 5785               | 13.858                     | 24.311                    | 14±1                  |
|                                   | 5825               | 13.066                     | 20.258                    | 13±1                  |

|                              |      |        |        |      |
|------------------------------|------|--------|--------|------|
| IEEE<br>802.11ac<br>VHT20    | 5180 | 14.213 | 26.382 | 14±1 |
|                              | 5200 | 13.853 | 24.283 | 14±1 |
|                              | 5240 | 14.143 | 25.960 | 14±1 |
|                              | 5745 | 13.990 | 25.061 | 14±1 |
|                              | 5785 | 13.990 | 25.061 | 14±1 |
|                              | 5825 | 13.033 | 20.105 | 13±1 |
| IEEE<br>802.11n<br>HT40 (5G) | 5190 | 12.286 | 16.928 | 12±1 |
|                              | 5230 | 12.468 | 17.652 | 12±1 |
|                              | 5755 | 12.647 | 18.395 | 13±1 |
|                              | 5795 | 12.086 | 16.166 | 12±1 |
| IEEE<br>802.11ac<br>VHT40    | 5190 | 12.301 | 16.986 | 12±1 |
|                              | 5230 | 12.479 | 17.697 | 12±1 |
|                              | 5755 | 12.648 | 18.399 | 13±1 |
|                              | 5795 | 12.142 | 16.376 | 12±1 |
| IEEE<br>802.11ac<br>VHT80    | 5210 | 12.130 | 16.331 | 12±1 |
|                              | 5775 | 11.567 | 14.345 | 12±1 |

**Antenna 2**

| Mode                              | Frequency<br>(MHz) | Peak output power<br>(dBm) | Peak output power<br>(mW) | Target power<br>(dBm) |
|-----------------------------------|--------------------|----------------------------|---------------------------|-----------------------|
| IEEE<br>802.11b                   | 2412               | 16.69                      | 46.67                     | 17±1                  |
|                                   | 2437               | 16.72                      | 46.99                     | 17±1                  |
|                                   | 2462               | 17.03                      | 50.47                     | 17±1                  |
| IEEE<br>802.11g                   | 2412               | 21.09                      | 128.53                    | 21±1                  |
|                                   | 2437               | 21.16                      | 130.62                    | 21±1                  |
|                                   | 2462               | 21.37                      | 137.09                    | 21±1                  |
| IEEE<br>802.11n<br>HT20<br>(2.4G) | 2412               | 23.76                      | 237.68                    | 24±1                  |
|                                   | 2437               | 23.53                      | 225.42                    | 24±1                  |
|                                   | 2462               | 23.74                      | 236.59                    | 24±1                  |
| IEEE<br>802.11a                   | 5180               | 13.189                     | 20.840                    | 13±1                  |
|                                   | 5200               | 13.700                     | 23.442                    | 14±1                  |
|                                   | 5240               | 13.903                     | 24.564                    | 14±1                  |
|                                   | 5745               | 12.879                     | 19.404                    | 13±1                  |
|                                   | 5785               | 12.172                     | 16.489                    | 12±1                  |
|                                   | 5825               | 11.504                     | 14.138                    | 12±1                  |

|                              |      |        |        |      |
|------------------------------|------|--------|--------|------|
| IEEE<br>802.11n<br>HT20 (5G) | 5180 | 12.904 | 19.516 | 13±1 |
|                              | 5200 | 13.396 | 21.857 | 13±1 |
|                              | 5240 | 13.649 | 23.169 | 14±1 |
|                              | 5745 | 12.775 | 18.945 | 13±1 |
|                              | 5785 | 11.874 | 15.396 | 12±1 |
|                              | 5825 | 11.179 | 13.119 | 11±1 |
| IEEE<br>802.11ac<br>VHT20    | 5180 | 12.903 | 19.512 | 13±1 |
|                              | 5200 | 13.407 | 21.913 | 13±1 |
|                              | 5240 | 13.632 | 23.078 | 14±1 |
|                              | 5745 | 12.713 | 18.677 | 13±1 |
|                              | 5785 | 12.039 | 15.992 | 12±1 |
|                              | 5825 | 11.265 | 13.381 | 11±1 |
| IEEE<br>802.11n<br>HT40 (5G) | 5190 | 11.521 | 14.194 | 12±1 |
|                              | 5230 | 11.359 | 13.674 | 11±1 |
|                              | 5755 | 11.231 | 13.277 | 11±1 |
|                              | 5795 | 10.338 | 10.809 | 10±1 |
| IEEE<br>802.11ac<br>VHT40    | 5190 | 11.547 | 14.279 | 12±1 |
|                              | 5230 | 11.951 | 15.671 | 12±1 |
|                              | 5755 | 11.416 | 13.855 | 11±1 |
|                              | 5795 | 10.101 | 10.235 | 10±1 |
| IEEE<br>802.11ac<br>VHT80    | 5210 | 11.508 | 14.151 | 12±1 |
|                              | 5775 | 9.883  | 9.734  | 10±1 |

### 3. Calculated Result and Limit

#### Bluetooth

| Antenna | Channel | MAX<br>Target<br>power<br>(dBm) | Antenna gain |          | Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Limited of<br>Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Test<br>Result |
|---------|---------|---------------------------------|--------------|----------|--------------------------------------------------|----------------------------------------------------------------|----------------|
|         |         |                                 | (dBi)        | (Linear) |                                                  |                                                                |                |
| 1       | 2402    | 6                               | 2            | 1.585    | 0.00126                                          | 1                                                              | Complies       |

#### WLAN 2.4G SISO

| Antenna | Channel | MAX<br>Target<br>power<br>(dBm) | Antenna gain |          | Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Limited of<br>Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Test<br>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<br>case           | Channel | Target<br>power<br>(dBm)<br>Antenna 1 | Target<br>power<br>(dBm)<br>Antenna 2 | Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> )<br>Antenna 1 | Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> )<br>Antenna 2 | Total<br>Ratio | Limit<br>Ratio | Test<br>Result |
|-------------------------|---------|---------------------------------------|---------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|----------------|----------------|----------------|
| IEEE<br>802.11n<br>HT20 | 2462    | 25                                    | 25                                    | 0.09971                                                       | 0.09971                                                       | 0.19942        | 1              | Complies       |

**WLAN 5G SISO**

| Antenna | Channel | MAX<br>Target<br>power<br>(dBm) | Antenna gain |          | Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Limited of<br>Power<br>Density<br>(S)<br>(mW/cm <sup>2</sup> ) | Test<br>Result |
|---------|---------|---------------------------------|--------------|----------|--------------------------------------------------|----------------------------------------------------------------|----------------|
|         |         |                                 | (dBi)        | (Linear) |                                                  |                                                                |                |
| 1       | 5180    | 15                              | 2            | 1.585    | 0.00997                                          | 1                                                              | Complies       |
| 2       | 5240    | 15                              | 2            | 1.585    | 0.00997                                          | 1                                                              | Complies       |

**WLAN 5G MIMO**

| Worst<br>case           | Channel | Target<br>power<br>(dBm) | Target<br>power<br>(dBm) | Power<br>Density<br>(S)            | Power<br>Density<br>(S)            | Total<br>Ratio | Limit<br>Ratio | Test<br>Result |
|-------------------------|---------|--------------------------|--------------------------|------------------------------------|------------------------------------|----------------|----------------|----------------|
|                         |         | Antenna<br>1             | Antenna<br>2             | (mW/cm <sup>2</sup> )<br>Antenna 1 | (mW/cm <sup>2</sup> )<br>Antenna 2 |                |                |                |
| IEEE<br>802.11n<br>HT20 | 5240    | 15                       | 15                       | 0.00997                            | 0.00997                            | 0.01994        | 1              | Complies       |

**Bluetooth+ WLAN**

| MAX<br>Power Density<br>(S)<br>(mW/cm <sup>2</sup> )<br>Bluetooth | MAX<br>Power Density<br>(S)<br>(mW/cm <sup>2</sup> )<br>WiFi | Total Ratio | Limit Ratio | Test Result |
|-------------------------------------------------------------------|--------------------------------------------------------------|-------------|-------------|-------------|
| 0.00126                                                           | 0.19942                                                      | 0.20068     | 1           | Complies    |

**Note: 1. only the worst case was recorded.**

**2. 2.4G wifi & 5G wifi can't transmit simultaneously.**

**End of Test Report**