

# RF Exposure Exhibit

**EUT Name:** Enlighted, Inc  
**Model No.:** AT-1U-H1  
CFR 47 Part 2.1093

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# 1 RF Exposure

## 1.1 Test Methodology

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this calculation is declared by the manufacturer, and the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

## 1.2 RF Exposure Limit

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

### 1.2.1 RF Exposure Limit

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b). RSS- 102 Section 2.5.2 and IEEE C95.3 are also applicable

FCC Limit:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

| Frequency range (MHz)  | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|--|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposure</b>         |                               |                               |                                     |                          |
| 0.3-3.0  | 614                           | 1.63                          | *100                                | 6                        |
| 3.0-30   | 1842/f                        | 4.89/f                        | *900/f <sup>2</sup>                 | 6                        |
| 30-300   | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300-1,500  |                               |                               | f/300                               | 6                        |
| 1,500-100,000  |                               |                               | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3-1.34   | 614                           | 1.63                          | *100                                | 30                       |
| 1.34-30  | 824/f                         | 2.19/f                        | *180/f <sup>2</sup>                 | 30                       |
| 30-300   | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300-1,500  |                               |                               | f/1500                              | 30                       |
| 1,500-100,000  |                               |                               | 1.0                                 | 30                       |

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

RSS 102 Limit:

**Table 2: RF Field Strength Limits for Devices Used by the General Public  
 (Uncontrolled Environment)**

| Frequency Range (MHz)   | Electric Field (V/m rms)         | Magnetic Field (A/m rms)                        | Power Density (W/m <sup>2</sup> )  | Reference Period (minutes)      |
|---|----------------------------------|---|------------------------------------|---------------------------------|
| 0.003-10 <sup>21</sup>  | 83                               | 90  | -                                  | Instantaneous*                  |
| 0.1-10  | -                                | 0.73/ <i>f</i>                                  | -                                  | 6**                             |
| 1.1-10  | 87/ <i>f</i> <sup>0.5</sup>      | -   | -                                  | 6**                             |
| 10-20   | 27.46                            | 0.0728  | 2                                  | 6                               |
| 20-48   | 58.07/ <i>f</i> <sup>0.25</sup>  | 0.1540/ <i>f</i> <sup>0.25</sup>                | 8.944/ <i>f</i> <sup>0.5</sup>     | 6                               |
| 48-300  | 22.06                            | 0.05852   | 1.291                              | 6                               |
| 300-6000  | 3.142 <i>f</i> <sup>0.3417</sup> | 0.008335 <i>f</i> <sup>0.3417</sup>             | 0.02619 <i>f</i> <sup>0.6834</sup> | 6                               |
| 6000-15000  | 61.4                             | 0.163   | 10                                 | 6                               |
| 15000-150000  | 61.4                             | 0.163   | 10                                 | 616000/ <i>f</i> <sup>1.2</sup> |
| 150000-300000   | 0.158 <i>f</i> <sup>0.5</sup>    | 4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup> | 6.67 x 10 <sup>-5</sup> <i>f</i>   | 616000/ <i>f</i> <sup>1.2</sup> |
| Note: <i>f</i> is frequency in MHz.<br>*Based on nerve stimulation (NS).<br>** Based on specific absorption rate (SAR). |                                  |   |                                    |                                 |

### 1.2.2 EUT Operating Condition

The software provided by Manufacturer enabled the EUT to transmit data at lowest, middle and highest channel individually.

### 1.2.3 Classification

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in user's manual. So, this device is classified as a **Mobile Device**.

### 1.2.4 Test Results

#### 1.2.4.1 Antenna Gain

The transmitting antenna was integrated. The antenna gain was +0.0 dBi or 1.68 (numeric).

1.2.4.2 Output Power into Antenna & RF Exposure value at distance 20cm:

|  |           |     |                                    |
|--|-----------|-----|------------------------------------|
| Corrected (including cal factors) Measurement: | 2.38      | dBm |                                    |
| The Gain of the antenna:                       | 0.00      | dBi |                                    |
| Type of Measurement:                           | Conducted |     | Direct measurement at Antenna Port |
| Impedance:                                     | 50.00     | Ω   |                                    |
| Measuring Distance:                            | 0.00      | m   |                                    |
| Time weighted Duty Cycle:                      | 100.00    | %   |                                    |

The Power Out would be: 0.001729816 Watts  
 or: 1.72982 mW  
 or: 1729.82 μW  
 or: 2.38 dBm

Frequency range from 10 MHz to 40 GHz:  
 Frequency: 2.44 GHz = 2440 MHz

Power output with DC and antenna Gain (EIRP):

|              |          |
|--------------|----------|
| Power (dBm): | 2.38     |
| Power (mW):  | 1.730    |
| Power (W):   | 0.001730 |

R = distance in 20 cm

|                                  |           |                    |
|----------------------------------|-----------|--------------------|
| FCC:                             |           |                    |
| Controlled Exposures - Limit =   | 5         | mW/cm <sup>2</sup> |
| Uncontrolled Exposures - Limit = | 1         | mW/cm <sup>2</sup> |
| Pd =                             | 0.0003441 | mW/cm <sup>2</sup> |
| Controlled Margin to Limit =     | 4.9997    | mW/cm <sup>2</sup> |
| Uncontrolled Margin to Limit =   | 0.9997    | mW/cm <sup>2</sup> |

Note: \* = Plane-wave equivalent power density

|                                 |             |                  |
|---------------------------------|-------------|------------------|
| IC:                             |             |                  |
| Controlled Exposures to Limit = | 31.88534789 | W/m <sup>2</sup> |
| Uncontrolled Exposures Limit =  | 5.408510856 | W/m <sup>2</sup> |
| Pd =                            | 0.003441    | W/m <sup>2</sup> |
| Controlled Margin to Limit =    | 31.8819     | W/m <sup>2</sup> |
| Uncontrolled Margin to Limit =  | 5.4051      | W/m <sup>2</sup> |

ISED exemption limit  $1.31 \times 10^{-2} \cdot f^{0.6834}$   
 For f = 2480 Mhz; ISED = 2.735518 W

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

1.2.5 Sample Calculation

The Friss transmission formula:  $Pd = (Pout \cdot G) / (4 \cdot \pi \cdot R^2)$

Where;

Pd = power density in mW/cm<sup>2</sup>

Pout = output power to antenna in mW

G = gain of antenna in linear scale

$\pi \approx 3.1416$

R = distance between observation point and center of the radiator in cm

Ref. : David K. Cheng, Field and Wave Electromagnetics, Second Edition, Page 640, Eq. (11-133).