

**RF EXPOSURE EVALUATION METHOD**

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

**EUT Specification**

|                                   |  |
|-----------------------------------|--|
| <b>EUT</b>                        | Inventor II (3D printer)   |
| <b>Frequency band (Operating)</b> | <input checked="" type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz<br><input type="checkbox"/> WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz<br><input type="checkbox"/> WLAN: 5.745GHz ~ 5825GHz<br><input type="checkbox"/> Others  |
| <b>Device category</b>            | <input type="checkbox"/> Portable (<20cm separation)<br><input checked="" type="checkbox"/> Mobile (>20cm separation)<br><input type="checkbox"/> Others   |
| <b>Exposure classification</b>    | <input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm <sup>2</sup> )<br><input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm <sup>2</sup> )                                  |
| <b>Antenna diversity</b>          | <input checked="" type="checkbox"/> Single antenna<br><input type="checkbox"/> Multiple antennas<br><input type="checkbox"/> Tx diversity<br><input type="checkbox"/> Rx diversity<br><input type="checkbox"/> Tx/Rx diversity |
| <b>Max. output power</b>          | 16.76dBm (0.0474W)   |
| <b>Antenna gain (Max)</b>         | 0 dBi  |
| <b>Evaluation applied</b>         | <input checked="" type="checkbox"/> MPE Evaluation<br><input type="checkbox"/> SAR Evaluation  |

**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> ) | Average Time |
|---|------------------------------|------------------------------|------------------------------------|--------------|
| (A) Limits for Occupational/Control Exposures         |                              |                              |                                    |              |
| 300-1500  | --                           | --                           | F/300                              | 6            |
| 1500-100000   | --                           | --                           | 5                                  | 6            |
| (B) Limits for General Population/Uncontrol Exposures |                              |                              |                                    |              |
| 300-1500  | --                           | --                           | F/1500                             | 6            |
| 1500-100000   | --                           | --                           | 1                                  | 30           |

**transmission formula:  $P_d = (P_{out} * G) / (4 * \pi * R^2)$**

Where

$P_d$  = Power density in mW/cm<sup>2</sup>

$P_{out}$  = output power to antenna in Mw

$G$  = gain of antenna in linear scale

$\pi$  = 3.1416

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

$P_d$  the limit of MPE, 1mW/cm<sup>2</sup>. If we know the maximum gain of the antenna and

total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

### SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and $\leq 50$ mm

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table.

| MHz  | 5  | 10 | 15  | 20  | 25  | mm                                      |
|------|----|----|-----|-----|-----|---|
| 150  | 39 | 77 | 116 | 155 | 194 | SAR Test<br>Exclusion<br>Threshold (mW) |
| 300  | 27 | 55 | 82  | 110 | 137 |   |
| 450  | 22 | 45 | 67  | 89  | 112 |   |
| 835  | 16 | 33 | 49  | 66  | 82  |   |
| 900  | 16 | 32 | 47  | 63  | 79  |   |
| 1500 | 12 | 24 | 37  | 49  | 61  |   |
| 1900 | 11 | 22 | 33  | 44  | 54  |   |
| 2450 | 10 | 19 | 29  | 38  | 48  |   |
| 3600 | 8  | 16 | 24  | 32  | 40  |   |
| 5200 | 7  | 13 | 20  | 26  | 33  |   |
| 5400 | 6  | 13 | 19  | 26  | 32  |   |
| 5800 | 6  | 12 | 19  | 25  | 31  |   |

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where}$$
  
 $f(\text{GHz})$  is the RF channel transmit frequency in GHz

Power and distance are rounded to the nearest mW and mm before calculation

The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm is applied to determine SAR test exclusion.

**Measurement Result**

| Operating Mode | Frequency | Measured Power | Tune up tolerance | Max. Tune up Power | Antenna Gain | Power density at 20cm | Power density Limits |
|----------------|-----------|----------------|-------------------|--------------------|--------------|-----------------------|----------------------|
|                | (MHz)     | (dBm)          | (dBm)             | (dBm)              | (dBi)        | (mW/ cm2 )            | (mW/ cm2 )           |
| 802.11b        | 2412      | 15.51          | 16±1              | 17.00              | 0.0          | 0.0100                | 1                    |
|                | 2437      | 16.19          | 16±1              | 17.00              | 0.0          | 0.0100                | 1                    |
|                | 2462      | 16.68          | 16±1              | 17.00              | 0.0          | 0.0100                | 1                    |
| 802.11g        | 2412      | 16.59          | 16±1              | 17.00              | 0.0          | 0.0100                | 1                    |
|                | 2437      | 16.34          | 16±1              | 17.00              | 0.0          | 0.0100                | 1                    |
|                | 2462      | 16.76          | 16±1              | 17.00              | 0.0          | 0.0100                | 1                    |
| 802.11n (HT20) | 2412      | 14.15          | 14±1              | 15.00              | 0.0          | 0.0063                | 1                    |
|                | 2437      | 14.33          | 14±1              | 15.00              | 0.0          | 0.0063                | 1                    |
|                | 2462      | 14.19          | 14±1              | 15.00              | 0.0          | 0.0063                | 1                    |