

## FCC RF Exposure

EUT Description: Robot Vacuum cleaner

Model No.: A1,C1,A2,C2

FCC ID: 2BBQR-A1

Equipment type: fixed equipment

### 1. Limits

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)

#### Limits for Maximum Permissible Exposure (MPE)

| Frequency range<br>(MHz)                                | Electric field<br>strength<br>(V/m) | Magnetic field strength<br>(A/m) | Power density<br>(mW/cm <sup>2</sup> ) | Averaging time<br>(minutes) |
|---|-------------------------------------|----------------------------------|--|-----------------------------|
| (A) Limits for Occupational/Controlled Exposures        |                                     |                                  |  |                             |
| 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                           |
| 300–1500  |                                     |                                  | f/300                                  | 6                           |
| 1500–100,000  |                                     |                                  | 5                                      | 6                           |
| (B) Limits for General Population/Uncontrolled Exposure |                                     |                                  |  |                             |
| 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                          |
| 300–1500  |                                     |                                  | f/1500                                 | 30                          |
| 1500–100,000  |                                     |                                  | 1.0                                    | 30                          |

F = frequency in MHz

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,

$\pi = 3.14$ ;

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

$P_d$  is the limit of MPE, 1 mW/cm<sup>2</sup>. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

### 2. Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

### 3. Test Result of RF Exposure Evaluation

#### WIFI

|                | Output power<br>(dBm/ mW) | Antenna<br>Gain(dBi) | Power Density<br>at R=20cm<br>(mW/cm <sup>2</sup> ) | Limit<br>(mW/cm <sup>2</sup> ) | Result |
|----------------|---------------------------|----------------------|---|--------------------------------|--------|
| 802.11b        | 3.69/2.3388               | 2.54                 | 0.00084   | 1.0                            | Pass   |
| 802.11g        | 4.29/2.6853               | 2.54                 | 0.00096   | 1.0                            | Pass   |
| 802.11n(20MHz) | 3.91/2.4604               | 2.54                 | 0.00088   | 1.0                            | Pass   |
| 802.11n(40MHz) | 3.58/2.2803               | 2.54                 | 0.00081   | 1.0                            | Pass   |

BT:

$$EIRP = E_{Meas} + 20 \log(d_{meas}) - 104.7$$

EIRP is the equivalent isotropically radiated power,

E<sub>Meas</sub> in dBm is the field strength of the emission at the measurement distance, in dB u V/m

d<sub>meas</sub> is the measurement distance, in m

| Field<br>strength(dBuV/m) | EIRP(dBm) | Max<br>tune-up(mW) | Antenna<br>Gain(dBi) | Power<br>Density<br>at R=20cm<br>(mW/cm <sup>2</sup> ) | Limit<br>(mW/cm <sup>2</sup> ) | Result |
|---------------------------|-----------|--------------------|----------------------|--|--------------------------------|--------|
| 89.61                     | -5.5476   | 0.2788             | 2.54                 | 0.00010  | 1.0                            | Pass   |
| 88.53                     | -6.6276   | 0.2174             | 2.54                 | 0.00008  | 1.0                            | Pass   |
| 90.66                     | -4.4976   | 0.3550             | 2.54                 | 0.00013  | 1.0                            | Pass   |

Conclusion: No SAR is required