# INDUSTRY CANADA RSS 102 ISSUE 5

# RF EXPOSURE REPORT

**For**

**Rolling Bot**

**Model: LG-RB200**

**Trade Name: LG**

*Issued to*

**LG Electronics MobileComm USA, Inc.**
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*Issued by*

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Testing Laboratory
1309

## Revision History

| Rev. | | Issue Date | | Revisions | Effect Page | Revised By |
|---|---|---|---|---|---|---|
| 00 | | June 2, 2016 | | Initial Issue | ALL | Becca Chen |

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# 1. LIMIT

According to RSS-102 Issue 5, 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 levels in excess of the Commission's guidelines.

# 2. EUT SPECIFICATION

| | |
|---|---|
| **Product** | Rolling Bot |
| **Model Number** | LG-RB200 |
| **Model Discrepancy** | N/A |
| **Trade Name** | LG |
| **Frequency band (Operating)** | ☒ Bluetooth 4.0: 2402 ~ 2480 MHz<br>802.11b/g/n HT 20: 2.412GHz ~ 2.462GHz<br>802.11n HT 40: 2.422GHz ~ 2.452GHz<br>802.11a/n HT 20: 5.180GHz ~ 5.320GHz / 5.500 ~ 5.825GHz<br>802.11n HT 40: 5.190GHz ~ 5.310GHz / 5.510 ~ 5.795GHz<br>802.11ac VHT 80: 5.210GHz ~ 5.290GHz / 5.530 ~ 5.775GHz<br>☐ Others |
| **Device category** | ☐ Portable (<20cm separation)<br>☒ Mobile (>20cm separation)<br>☐ Others |
| **Exposure classification** | ☐ Occupational/Controlled exposure (S = 0.6455 $f^2$ W/m$^2$)<br>☒ General Population/Uncontrolled exposure (S=0.02619 $f^{0.6834}$ W/m$^2$)<br>Note: $f$ is frequency in MHz |
| **Antenna Specification** | **BT**<br>MAG LAYERS / FPA-5220-2G4C2-A1-AH<br>FPC Antenna / Gain: 0.34dBi<br>**2.4G**<br>MAG LAYERS / FPA-5321-25GC2-A1-AH<br>FPC Antenna / Gain: 1.72dBi<br>**5G**<br>MAG LAYERS / FPA-5321-25GC2-A1-AH<br>FPC Antenna / Gain: 4.45dBi<br>BT: Antenna Gain : 0.34 dBi (Numeric gain: 1.08) Worst<br>2.4GHz: Antenna Gain : 1.72 dBi (Numeric gain: 1.49) Worst<br>5GHz: Antenna Gain : 4.45 dBi (Numeric gain: 2.79) Worst |
| **Maximum Average output power** | Bluetooth 4.0 Mode : -2.30 dBm (0.00 W)<br>IEEE 802.11b Mode: 16.21 dBm (0.04 W)<br>IEEE 802.11g Mode: 13.50 dBm (0.02 W)<br>IEEE 802.11n HT 20 Mode: 12.49 dBm (0.02 W)<br>IEEE 802.11n HT 40 Mode: 12.44 dBm (0.02 W)<br>IEEE 802.11a Mode: 12.33 dBm (0.02 W)<br>IEEE 802.11n HT 20 Mode: 12.33 dBm (0.02 W)<br>IEEE 802.11n HT 40 Mode: 10.42 dBm (0.01 W)<br>IEEE 802.11ac VHT 80 Mode: 7.78 dBm (0.01 W) |

| | |
|---|---|
| **Maximum Tune up Power** | Bluetooth 4.0 Mode : -1.00 dBm (0.00 W)<br>IEEE 802.11b Mode: 17.00 dBm (0.05 W)<br>IEEE 802.11g Mode: 14.00 dBm (0.03 W)<br>IEEE 802.11n HT 20 Mode: 13.00 dBm (0.02 W)<br>IEEE 802.11n HT 40 Mode: 13.00 dBm (0.02 W)<br>IEEE 802.11a Mode: 13.00 dBm (0.02 W)<br>IEEE 802.11n HT 20 Mode: 13.00 dBm (0.02 W)<br>IEEE 802.11n HT 40 Mode: 11.00 dBm (0.01 W)<br>IEEE 802.11ac VHT 80 Mode: 9.00 dBm (0.01 W) |
| **Evaluation applied** | ☒ MPE Evaluation*<br>☐ SAR Evaluation<br>☐ N/A |

# 3. TEST RESULTS

## No non-compliance noted.

### Calculation

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{377}$

*Where E = Field strength in Volts / meter*
*P = Power in Watts*
*G = Numeric antenna gain*
*d = Distance in meters*
*S = Power density in milliwatts / square centimeter*

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

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

Yields

$$S = \frac{30 \times P \times G}{377 \times (d)^2} = 0.0796 \times \frac{P \times G}{d^2}$$ ***Equation 1***

*Where d = Distance in m*
*P = Power in W*
*G = Numeric antenna gain*
*S = Power density in W / $m^2$*

# 4. MAXIMUM PERMISSIBLE EXPOSURE

Substituting the MPE safe distance using d = 0.2 m into Equation 1:

$$S = 1.99 \times P \times G$$

*Where P = Power in W*

*G = Numeric antenna gain*

*S = Power density in W / $m^2$*

**Bluetooth 4.0 mode:**

| Ch. | Frq.(MHz) | P (W) | Gain (num.) | D (m) | Power density in W / $m^2$ | Limit (W/m2) |
|---|---|---|---|---|---|---|
| 0 | 2402 | 0 | 1.08 | 0.2 | 0.0000 | 5.35 |

**IEEE 802.11b mode:**

| Ch. | Frq.(MHz) | P (W) | Gain (num.) | D (m) | Power density in W / $m^2$ | Limit (W/m2) |
|---|---|---|---|---|---|---|
| 1 | 2412 | 0.05 | 1.49 | 0.2 | 0.1483 | 5.37 |

**IEEE 802.11g mode:**

| Ch. | Frq.(MHz) | P (W) | Gain (num.) | D (m) | Power density in W / $m^2$ | Limit (W/m2) |
|---|---|---|---|---|---|---|
| 6 | 2437 | 0.03 | 1.49 | 0.2 | 0.0890 | 5.40 |

**IEEE 802.11n HT 20 mode:**

| Ch. | Frq.(MHz) | P (W) | Gain (num.) | D (m) | Power density in W / $m^2$ | Limit (W/m2) |
|---|---|---|---|---|---|---|
| 6 | 2437 | 0.02 | 1.49 | 0.2 | 0.0593 | 5.40 |

**IEEE 802.11n HT 40 mode:**

| Ch. | Frq.(MHz) | P (W) | Gain (num.) | D (m) | Power density in W / $m^2$ | Limit (W/m2) |
|---|---|---|---|---|---|---|
| 3 | 2422 | 0.02 | 1.49 | 0.2 | 0.0593 | 5.38 |

**IEEE 802.11a mode:**

| Ch. | Frq.(MHz) | P (W) | Gain (num.) | D (m) | Power density in W / $m^2$ | Limit (W/m2) |
|---|---|---|---|---|---|---|
| 44 | 5220 | 0.02 | 2.79 | 0.2 | 0.1110 | 9.09 |

**IEEE 802.11n HT 20 mode:**

| Ch. | Frq.(MHz) | P (W) | Gain (num.) | D (m) | Power density in W / $m^2$ | Limit (W/m2) |
|---|---|---|---|---|---|---|
| 2.79 | 2.79 | 0.02 | 2.79 | 0.2 | 0.1110 | 0.05 |

**IEEE 802.11n HT 40 mode:**

| Ch. | Frq.(MHz) | P (W) | Gain (num.) | D (m) | Power density in W / $m^2$ | Limit (W/m2) |
|---|---|---|---|---|---|---|
| 151 | 5755 | 0.01 | 2.79 | 0.2 | 0.0555 | 9.72 |

**IEEE 802.11ac VHT 80 mode:**

| Ch. | Frq.(MHz) | P (W) | Gain (num.) | D (m) | Power density in W / $m^2$ | Limit (W/m2) |
|---|---|---|---|---|---|---|
| 155 | 5775 | 0.01 | 2.79 | 0.2 | 0.0555 | 9.74 |