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47 C.F.R. Part 1, Subpart I, Section 1.1310

47 C.F.R. Part 2, Subpart J, Section 2.1091

RF EXPOSURE REPORT

For

ZigBee Module

Model: MD1000

Trade Name: Billion

Issued for

Billion Electric Co., Ltd.

**8F., No.192, Sec. 2, Zhongxing Rd., Xindian Dist., New Taipei City 231,
Taiwan (R.O.C.)**

Issued by

Compliance Certification Services Inc.

Hsinchu Lab.

**NO. 989-1, Wenshan Rd., Shangshan Village,
Qionglin Township, Hsinchu County 30741, Taiwan (R.O.C.)**

<http://www.ccsrf.com>

service@ccsrf.com

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Revision History

| Rev. | Issue Date | Revisions | Effect Page | Revised By |
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1. Limit

According to §15.247(i), 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. See § 1.1307(b)(1) of this chapter.

2. EUT Specification

| | |
|-------------------------------------|---|
| Product Name | ZigBee Module |
| Model Number | MD1000 |
| Identify Number | T160809S01 |
| Received Date | August 09, 2016 |
| Frequency band (Operating) | 2405MHz ~ 2480MHz |
| Device category | Mobile (>20cm separation) |
| Exposure classification | <input type="checkbox"/> Occupational/Controlled exposure ($S = 5\text{mW}/\text{cm}^2$) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure ($S=1\text{mW}/\text{cm}^2$) |
| Antenna Specification | Internal : PCB Antenna × 1, Antenna Gain : 2.73dBi External : Dipole Antenna × 1, Antenna Gain : 1.8dBi |
| Maximum average output power | Zigbee Mode: 7.66 dBm |
| Evaluation applied | MPE Evaluation* |

Remark:

1. For more details, please refer to the User's manual of the EUT.
2. This submittal(s) (test report) is intended for FCC ID: QI3BIL-MD1000 filing.

3. Test Results

No non-compliance noted.

Calculation

$$\text{Given } E = \frac{\sqrt{30 \times P \times G}}{d} \quad \& \quad S = \frac{E^2}{3770}$$

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:

$$S = \frac{30 \times P \times G}{3770 d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P / 1000) \times G}{377 \times (d / 100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \textbf{Equation 1}$$

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

4. Maximum Permissible Exposure

Substituting the MPE safe distance using $d = 20$ cm into Equation 1:

$$S = 0.000199 \times P \times G$$

Where

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

| Mode | Frequency (MHz) | Power (dBm) | Ant. Gain (dBi) | Distance (cm) | Power density (mW/cm ²) | Limit (mW/cm ²) |
|--------|-----------------|-------------|-----------------|---------------|-------------------------------------|-----------------------------|
| Zigbee | 2405 | 7.66 | 2.73 | 20 | 0.0022 | 1 |