

IEEE C95.1

KDB 447498 D01 v06

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

Smart Energy Wireless Router

Model: Billion SG600R2

**Data Applies To: Please refer to section 2
(altogether 9 series models)**

Trade Name: Billion, BEC

Issued for

Billion Electric Co., Ltd.

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Issued by

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	12/13/2016	Initial Issue	All Page	Dola Hsieh

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1. TEST REPORT CERTIFICATION

We hereby certify that:

The equipment has been tested by Compliance Certification Services Inc., and found compliance with the requirement of the applicable standards. The test record, data evaluation and Equipment under Test (EUT) configurations represented herein are true and accurate accounts of the measurement of the sample’s RF characteristics under the conditions specified in this report.

APPLICABLE STANDARD	
Standard	Test Result
IEEE C95.1 KDB 447498 D01 v06 47 C.F.R. Part 1, Subpart I, Section 1.1310 47 C.F.R. Part 2, Subpart J, Section 2.1091	No non-compliance noted

Approved by:



Sb. Lu
Sr. Engineer

Prepared by:



Dola Hsieh
Report coordinator

2. 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.

3. EUT Specification

Product Name	Smart Energy Wireless Router
Model Number	Billion SG600R2
Data Applies To	Please refer to section 2 (altogether 9 series models)
Identify Number	T161020S01
Received Date	October 20, 2016
Frequency band (Operating)	802.11b/g/gn HT20 Mode: 2412MHz ~ 2462MHz 802.11gn HT40 Mode: 2422MHz ~ 2452MHz Zigbee Mode: 2405MHz ~ 2480MHz
Device category	Mobile (>20cm separation)
Exposure classification	<input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm ²) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm ²)
Antenna Specification	WiFi Dipole Antennax 1, Antenna Gain: 1.8 dBi Zigbee External Dipole Antennax 1, Antenna Gain: 1.8 dBi Internal PCB Antennax 1, Antenna Gain: 2.73 dBi
Maximum average output power	IEEE 802.11b Mode: 18.05 dBm IEEE 802.11g Mode: 17.12 dBm IEEE 802.11gn HT20 MCS0 Mode: 17.14 dBm IEEE 802.11gn HT40 MCS0 Mode: 17.26 dBm Zigbee Mode: 5.45 dBm
Evaluation applied	MPE Evaluation*

The difference of the series model

Model Number	Difference		
	Brand	Color	Housing
Billion SG600R2	Billion	White	D2
Billion SG600 R2NXL-Std		White	D2
Billion SG600 R2NX-Std		Blue	D2
Billion SG600 R2NXL-SDK		White	D2
Billion SG600 R2NX-SDK		Blue	D2
BEC SG600R2	BEC	White	D2 / B2
BEC SG600 R2NXL-Std		White	D2 / B2
BEC SG600 R2NX-Std		Blue	D2 / B2
BEC SG600 R2NXL-SDK		White	D2 / B2
BEC SG600 R2NX-SDK		Blue	D2 / B2

Note: "O" means all the same, and "X" means the difference

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-SG600R2 filing.
3. The model Billion SG600R2 was considered the main model for testing.

4. 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 $E = \text{Field strength in Volts / meter}$

$P = \text{Power in Watts}$

$G = \text{Numeric antenna gain}$

$d = \text{Distance in meters}$

$S = \text{Power density in milliwatts / square centimeter}$

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

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

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 $d = \text{Distance in cm}$

$P = \text{Power in mW}$

$G = \text{Numeric antenna gain}$

$S = \text{Power density in mW / cm}^2$

5. 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)
IEEE 802.11b	2462	18.05	1.8	20	0.0192	1
IEEE 802.11g	2437	17.12	1.8	20	0.0155	1
IEEE 802.11gn HT20 MCS0	2437	17.14	1.8	20	0.0156	1
IEEE 802.11gn HT40 MCS0	2437	17.26	1.8	20	0.016	1
Zigbee	2445	5.45	2.73	20	0.0013	1

Simultaneously MPE

Simultaneously MPE = MPE 1 / Limit 1 + MPE 2 / Limit 2 +

WiFi 2.4GHz + Zigbee Mode

Simultaneously MPE = (0.0192 / 1) + (0.0013 / 1) = **0.0205 mW/cm²**