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

3G/4G LTE Embedded VDSL2/ADSL2+ Wireless-N VPN Firewall Router

Model: BiPAC 8920NZ

Data Applies To: BiPAC 8920NZL, BEC 8920NZ, BEC 8920NZL, BiPAC 8900NZ, BiPAC 8900NZL, BEC 8900NZ, BEC 8900NZL

Trade Name: Billion ; BEC

Issued for

Billion Electric Co., Ltd.

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Issued by

**Compliance Certification Services Inc.
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TAF

Testing Laboratory
0240

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	03/31/2017	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	3G/4G LTE Embedded VDSL2/ADSL2+ Wireless-N VPN Firewall Router
Model Number	BiPAC 8920NZ
Data Applies To	BiPAC 8920NZL, BEC 8920NZ, BEC 8920NZL, BiPAC 8900NZ, BiPAC 8900NZL, BEC 8900NZ, BEC 8900NZL
Identify Number	T161219S08
Received Date	December 19, 2016
Frequency band (Operating)	IEEE 802.11b/g/gn HT20 Mode: 2412MHz ~ 2462MHz IEEE 802.11gn HT40 Mode: 2422MHz ~ 2452MHz LTE Mode: 1710.7 MHz ~ 1754.2 MHz
Device category	Mobile (>20cm separation)
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm^2) ☒ General Population/Uncontrolled exposure (S=1mW/cm^2)
Antenna Specification	WiFi 2.4GHz: PCB Antenna, Gain: × 2 Ant. 0 (Chain 0), Antenna Gain: 4.8 dBi Ant. 1 (Chain 1), Antenna Gain: 3.6 dBi LTE Antenna: Antenna Gain: 2.26 dBi
Maximum average output power	IEEE 802.11b Mode (Diversity): Chain 0 : 16.34 dBm Chain 1 : 16.68 dBm IEEE 802.11g Mode (Diversity): Chain 0 : 17.62 dBm Chain 1 : 19.77 dBm IEEE 802.11gn HT20 MCS0 Mode: 20.20 dBm IEEE 802.11gn HT40 MCS0 Mode: 15.62 dBm LTE Mode: 23.1 dBm
Evaluation applied	MPE Evaluation*

The difference of the series model

Model Number	BiPAC 8920NZ	BiPAC 8920NZL	BiPAC 8900NZ	BiPAC 8900NZL
Trand Name	Billion	Billion	Billion	Billion
External Feature	Wide-band Antenna	Wide-band Antenna	Wide-band Antenna	Wide-band Antenna
External color	Upper/Lower Casing: Gray/ Silver	Upper/Lower Casing: Gray/ Silver	Upper/Lower Casing: Gray/ Silver	Upper/Lower Casing: Gray/ Silver
Housing Drawing	D3-R w/ Vertical Stand	D3-R w/ Vertical Stand	D3-R w/ Vertical Stand	D3-R w/ Vertical Stand
VDSL / ADSL	O	O	O	O
Dual-Sim slot	O	O	X	X
VPN	O	X	O	X
Power Adapter	DC 15V/ 1.6A	DC 15V/ 1.6A	DC 15V/ 1.6A	DC 15V/ 1.6A
Note: "O" means all the same, and "X" means the difference				

Model Number	BEC 8920NZ	BEC 8920NZL	BEC 8900NZ	BEC 8900NZL
Trand Name	BEC	BEC	BEC	BEC
External Feature	Wide-band Antenna	Wide-band Antenna	Wide-band Antenna	Wide-band Antenna
External color	Upper/Lower Casing: Gray/ Silver	Upper/Lower Casing: Gray/ Silver	Upper/Lower Casing: Gray/ Silver	Upper/Lower Casing: Gray/ Silver
Housing Drawing	D3-R w/ Vertical Stand	D3-R w/ Vertical Stand	D3-R w/ Vertical Stand	D3-R w/ Vertical Stand
VDSL / ADSL	O	O	O	O
Dual-Sim slot	O	O	X	X
VPN	O	X	O	X
Power Adapter	DC 15V/ 1.6A	DC 15V/ 1.6A	DC 15V/ 1.6A	DC 15V/ 1.6A
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-8920NZ filing.
3. The model BiPAC 8920NZ was considered the main model for testing.

4. Test Results

No non-compliance noted.

Calculation

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

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 (mW) = P (W) / 1000 and

d (cm) = d(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

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 / cm^2

Mode	Frequency (MHz)	Power (dBm)	Ant. Gain (dBi)	Distance (cm)	Power density (mW/cm^2)	Limit (mW/cm^2)
IEEE 802.11b	2412	16.68	3.6	20	0.0212	1
IEEE 802.11g	2437	19.77	3.6	20	0.0432	1
IEEE 802.11gn HT20 MCS0	2437	20.20	4.8	20	0.0629	1
IEEE 802.11gn HT40 MCS0	2452	15.62	4.8	20	0.0219	1
LTE Band 4	1720	23.1	2.26	20	0.0683	1.1467

Simultaneously MPE

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

WiFi 2.4GHz + LTE Mode

Simultaneously MPE = (0.0629 / 1) + (0.0683 / 1.1467) = **0.1225 mW/cm^2**