



RADIO FREQUENCY EXPOSURE

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.

EUT Specification

EUT	Dual-lines VDSL2/ADSL2+ Wireless-AC 3G/4G LTE VPN Firewall Router
Model	BiPAC 8920AX
Data Applies To	BiPAC 8920AXL ; BiPAC 8921AXL ; BiPAC 8900AX ; BiPAC 8900AXL ; BEC 8920X ; BEC 8920AC ; BEC 8920ACS ; BEC 8900X ; BEC 8900AC
Frequency band (Operating)	☒ 802.11b/g/gn HT20: 2412 MHz ~ 2462 MHz 802.11gn HT40: 2422 MHz ~ 2452 MHz 802.11a, 802.11ac VHT20 : 5180 MHz ~ 5240 MHz / 5745 MHz ~ 5825 MHz 802.11ac VHT40 : 5190 MHz ~ 5230 MHz / 5755 MHz ~ 5795 MHz 802.11ac VHT80 : 5210 MHz / 5775 MHz ☐ Others
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others
Exposure classification	☐ Occupational/Controlled exposure ($S = 5\text{mW}/\text{cm}^2$) ☒ General Population/Uncontrolled exposure ($S=1\text{mW}/\text{cm}^2$)
Antenna Specification	Dipole Antenna × 2 , 2.4GHz: Antenna 0(Chain 0), Antenna Gain: 3.50 dBi (Numeric gain: 2.24) 2.4GHz: Antenna 1(Chain 1), Antenna Gain: 3.50 dBi (Numeric gain: 2.24) Dipole Antenna × 3 , 5GHz: Antenna 0(Chain 0), Antenna Gain: 5.00 dBi (Numeric gain: 3.16) 5GHz: Antenna 1(Chain 1), Antenna Gain: 5.70 dBi (Numeric gain: 3.72) 5GHz: Antenna 2(Chain 2), Antenna Gain: 5.70 dBi (Numeric gain: 3.72)



Maximum output power	2.4G	
	IEEE 802.11b Mode:	18.71 dBm (74.302 mW)
	IEEE 802.11g Mode:	28.57 dBm (719.449 mW)
	IEEE 802.11gn HT 20 Mode:	29.31 dBm (853.100 mW)
	IEEE 802.11gn HT 40 Mode:	26.13 dBm (410.204 mW)
	5G UNII Band 1	
	IEEE 802.11a Mode:	18.98 dBm (79.068 mW)
	IEEE 802.11ac VHT20 Mode:	14.56 dBm (28.576 mW)
	IEEE 802.11ac VHT40 Mode:	19.43 dBm (87.700 mW)
	IEEE 802.11ac VHT80 Mode:	16.51 dBm (44.771 mW)
	5G UNII Band 3	
	IEEE 802.11a Mode:	20.04 dBm (100.925 mW)
	IEEE 802.11ac VHT20 Mode:	21.42 dBm (138.676 mW)
	IEEE 802.11ac VHT40 Mode:	19.34 dBm (85.901 mW)
	IEEE 802.11ac VHT80 Mode:	16.00 dBm (39.811 mW)
Evaluation applied	☒ MPE Evaluation*	
	☐ SAR Evaluation	
	☐ N/A	



Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	2015/06/08	Initial Issue	ALL	Michelle Chiu



TEST RESULTS

No non-compliance noted.

Calculation

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

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:

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

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

$$S = \frac{30 \times (P/1000) \times G}{3770 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \textbf{Equation 1}$$

Where d = Distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power density in mW / cm²

**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

2.4G**IEEE 802.11b mode:**

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
2412 ~ 2462	74.302	2.24	20	0.0331	1

IEEE 802.11g mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
2412 ~ 2462	719.449	2.24	20	0.3207	1

IEEE 802.11gn HT20 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
2412 ~ 2462	853.100	2.24	20	0.3803	1

IEEE 802.11gn HT40 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
2422 ~ 2452	410.204	2.24	20	0.1829	1

**5G UNII Band 1****IEEE 802.11a mode:**

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
5180 ~ 5240	79.068	3.72	20	0.0585	1

IEEE 802.11ac VHT20 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
5180 ~ 5240	28.576	3.72	20	0.0212	1

IEEE 802.11ac VHT40 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
5190 ~ 5230	87.700	3.72	20	0.0649	1

IEEE 802.11ac VHT80 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
5210	44.771	3.72	20	0.0331	1

5G UNII Band 3**IEEE 802.11a mode:**

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
5475 ~ 5825	100.925	3.72	20	0.0747	1

IEEE 802.11ac VHT20 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
5475 ~ 5825	138.68	3.72	20	0.1027	1

IEEE 802.11ac VHT40 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
5755 ~ 5795	85.901	3.72	20	0.0636	1

IEEE 802.11ac VHT80 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
5775	39.811	3.72	20	0.0295	1



Simultaneously MPE

Simultaneously MPE = $MPE1/Limit1 + MPE2/Limit2$

2.4G + 5G

Simultaneously MPE = $0.3803 + 0.1027 = 0.483 \text{ mW/cm}^2$