



# APPENDIX I 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

<b>EUT</b>	4G/LTE VoIP Wireless-N VPN Broadband Router
<b>Model</b>	BiPAC 6300VNOZ
<b>Data Applies To</b>	BiPAC 6300VNPZ ; BEC 6300VNL ; BiPAC 6300NZ ; BiPAC 6300NZL ; BEC 6300NL
<b>Frequency band (Operating)</b>	<input checked="" type="checkbox"/> LTE Band 12: 701.5MHz ~ 713.5MHz (Channel Bandwidth 5MHz) <input checked="" type="checkbox"/> LTE Band 12: 704.0MHz ~ 711.0MHz (Channel Bandwidth 10MHz) <input checked="" type="checkbox"/> WLAN: 2412MHz ~ 2462MHz <input type="checkbox"/> Others
<b>Device category</b>	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others
<b>Exposure classification</b>	<input type="checkbox"/> Occupational/Controlled exposure (S = 5mW/cm <sup>2</sup> ) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm <sup>2</sup> )
<b>Average output power</b>	LTE Band 12 : Channel Bandwidth 5MHz : QPSK : 24.26 dBm(266.686mW) 16QAM : 23.86 dBm(243.220mW) Channel Bandwidth 10MHz : QPSK : 23.10 dBm(204.174mW) 16QAM : 24.18 dBm(261.818mW) WLAN : IEEE 802.11b : 20.45dBm (110.9mW) IEEE 802.11g : 25.61dBm (363.9mW) IEEE 802.11n HT20 : 23.76dBm (237.4mW) IEEE 802.11n HT40 : 25.46dBm (351.6mW)
<b>Evaluation applied</b>	<input checked="" type="checkbox"/> MPE Evaluation* <input type="checkbox"/> SAR Evaluation <input type="checkbox"/> N/A

**Remark :** 1. For more details, please refer to the User's manual of the EUT.  
2. The models BiPAC 6300VNOZ was considered the main model for testing.



### Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	2014/07/04	Initial Issue	ALL	Gloria Chang
01	2014/07/14	Revised	ALL	Gloria Chang



Table 1: LTE Band 12 Channel Bandwidth 5MHz QPSK

Ch.	Frequency (MHz)	P (mW)		Gain (num.)	D (cm)	Power density in mW/cm <sup>2</sup>		Limit (mW/cm <sup>2</sup> )
		Measured	Tune-up limit			Measured	Reported	
23155	713.5	286.418	371.535	1.48	20	0.0844	0.1094	0.5

Table 2: LTE Band 12 Channel Bandwidth 5MHz 16QAM

Ch.	Frequency (MHz)	P (mW)		Gain (num.)	D (cm)	Power density in mW/cm <sup>2</sup>		Limit (mW/cm <sup>2</sup> )
		Measured	Tune-up limit			Measured	Reported	
23155	713.5	243.220	371.535	1.48	20	0.0716	0.1094	0.5

Table 3: LTE Band 12 Channel Bandwidth 10MHz QPSK

Ch.	Frequency (MHz)	P (mW)		Gain (num.)	D (cm)	Power density in mW/cm <sup>2</sup>		Limit (mW/cm <sup>2</sup> )
		Measured	Tune-up limit			Measured	Reported	
23130	711.0	204.174	371.535	1.48	20	0.0601	0.1094	0.5

Table 4: LTE Band 12 Channel Bandwidth 10MHz QPSK

Ch.	Frequency (MHz)	P (mW)		Gain (num.)	D (cm)	Power density in mW/cm <sup>2</sup>		Limit (mW/cm <sup>2</sup> )
		Measured	Tune-up limit			Measured	Reported	
23155	711.0	261.818	371.535	1.48	20	0.0771	0.1094	0.5

Table 5: WLAN

Frequency (MHz)	Maximum Conducted Power		Gain (num.)	D (cm)	Power density in mW/cm <sup>2</sup>	Limit (mW/cm <sup>2</sup> )
	dBm	mW				
2437	25.61	363.9	1.72	20	0.124663	1



## **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

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

Where  $d$  = Distance in cm

$P$  = Power in mW

$G$  = Numeric antenna gain

$S$  = Power density in mW / cm<sup>2</sup>



**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<sup>2</sup>

**Test Result**

**Table 1 : LTE Band 12 (701.5MHz ~ 713.5MHz) + WLAN**

Frequency (MHz)	WLAN (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )	WLAN / MPE Limit	LTE Band 12 (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )	LTE Band 12 / MPE Limit	(LTE + WLAN fraction)	Limit
713.5	0.0124663	1.000	0.0124663	0.0844	0.5	0.1688	0.1813	1.000
2437								

**Table 2 : LTE Band 12 (704.0MHz ~ 711.0MHz) + WLAN**

Frequency (MHz)	WLAN (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )	WLAN / MPE Limit	LTE Band 12 (mW/cm <sup>2</sup> )	FCC MPE Limit (mW/cm <sup>2</sup> )	LTE Band 12 / MPE Limit	(LTE + WLAN fraction)	Limit
711.0	0.0124663	1.000	0.0124663	0.0771	0.5	0.1542	0.1667	1.000
2437								