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	802.11n Wireless ADSL2+ 4-port Gateway
Frequency band (Operating)	☒ WLAN: 2.412GHz ~ 2.462GHz ☐ WLAN: 5.725GHz ~ 5.850GHz ☐ Bluetooth: 2.402GHz ~ 2.480 GHz
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation)
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm^2) ☒ General Population/Uncontrolled exposure (S=1mW/cm^2)
Antenna diversity	☐ Single antenna ☒ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☒ Tx/Rx diversity
Max. output power	802.11b: 21.85 dBm (153.11 mW) 802.11g: 21.04dBm (127.06 mW) 802.11n (20MHz): Chain0:21.37dBm (137.09 mW) Chain1:21.62 dBm (145.21 mW) 802.11n (40MHz): Chain0:21.17 dBm (130.92 mW) Chain1:22.27 dBm (168.66 mW)
Antenna gain (Max)	Chain0:5.00 dBi (Numeric gain:3.162) Chain1:5.00 dBi(Numeric gain: 3.162)
Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ N/A
Remark: *1. The maximum output power is 22.27 dBm (168.66 mW) at 2422 MHz (withnumeric 3.162 antenna gain.)* *2. DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.* *3. For mobile or fixed location transmitters, no SAR consideration applied. The maximum power density is 1.0 mW/cm^2 even if the calculation indicates that the power density would be larger.*	

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:

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

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and
d (cm) = d(m) / 100

Yields

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

Where *d = Distance in cm*
P = Power in mW
G = Numeric antenna gain
S = Power density in mW / cm^2

Maximum Permissible Exposure

Modulation Mode	Frequency band (MHz)	Max. Conducted output power(dBm)	Antenna gain (dBi)	Distance (cm)	Power density (mW/cm2)	Limit (mW/cm2)
802.11b	2412-2462	21.85	5.00	20	0.096	1
802.11g	2412-2462	21.04	5.00	20	0.080	1
802.11n(20MHz)(Chain0)	2412-2462	21.37	5.00	20	0.086	1
802.11n(20MHz)(Chain1)	2412-2462	21.62	5.00	20	0.091	1
802.11 n(20MHz) (Chain0+Chain1)	2412-2462	/	/	20	0.177	1
802.11n(40MHz)(Chain0)	2422-2452	21.17	5.00	20	0.082	1
802.11n(40MHz)(Chain1)	2422-2452	22.27	5.00	20	0.106	1
802.11 n(40MHz) (Chain0+Chain1)	2422-2452	/	/	20	0.188	1

NOTE:

Total(Chain0+Chain1) , the formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1

CPD = Calculation power density

LPD = Limit of power density