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	Wireless N VDSL2 4-port Bonding Combo WAN Gateway with HPNA
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: 26.84 dBm (483.05 mW) 802.11g: 26.71 dBm (468.81 mW) 802.11n (20MHz): Chain0:26.21 dBm (417.83 mW) Chain1:24.32 dBm (270.40 mW) 802.11n (40MHz): Chain0:18.04 dBm (63.68 mW) Chain1:17.20 dBm (52.48 mW)
Antenna gain (Max)	Antenna 1（chain 0） Dipole 3.0dBi(Numeric gain:1.995) Antenna 2（chain 1） PIFA 3.0dBi(Numeric gain: 1.995)
Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ N/A

Remark:

1. *The maximum output power is 26.84dBm (483.05 mW) at 2412 MHz (withnumeric 1.995 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	26.84	3.00	20	0.192	1
802.11g	2412-2462	26.71	3.00	20	0.186	1
802.11n(20MHz)(Chain0)	2412-2462	26.21	3.00	20	0.166	1
802.11n(20MHz)(Chain1)	2412-2462	24.32	3.00	20	0.107	1
802.11 n(20MHz) (Chain0+Chain1)	2412-2462	/	/	20	0.273	1
802.11n(40MHz)(Chain0)	2422-2452	18.04	3.00	20	0.025	1
802.11n(40MHz)(Chain1)	2422-2452	17.20	3.00	20	0.001	1
802.11 n(40MHz) (Chain0+Chain1)	2422-2452	/	/	20	0.026	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