RADIO FREQUENCY EXPOSURE

LIMIT

According to §15.247(i) and §15.407(f), 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) of this chapter.

EUT Specification

EUT	NP2000
Frequency band (Operating)	☒ WLAN: 2.412GHz ~ 2.462GHz ☒ WLAN: 5.15GHz ~ 5.25GHz ☒ WLAN: 5.25GHz ~ 5.35GHz ☒ WLAN: 5.47GHz ~ 5.725GHz ☒ WLAN: 5.725GHz ~ 5.85GHz ☒ Bluetooth: 2.402GHz ~ 2.480GHz ☐ Others
Device category	☐ Portable (<20cm separation) ☒ Mobile (>20cm separation) ☐ Others
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	WLAN: 2.412-2.462GHz IEEE 802.11b mode: 10.48dBm IEEE 802.11g mode: 14.89 dBm IEEE 802.11n HT20 mode: 17.15 dBm IEEE 802.11n HT40 mode: 17.58 dBm 5G：5150~5725MHz IEEE802.11a mode: 14.79dBm IEEE802.11an HT20 mode: 17.23dBm IEEE802.11an HT40 mode: 17.80dBm IEEE802.11ac VHT20 mode: 14.68dBm IEEE802.11ac VHT40 mode: 15.35dBm IEEE802.11ac VHT80 mode: 14.35dBm 5G：5725~5850MHz IEEE 802.11a: 13.20 dBm IEEE 802.11n HT20 MHz Channel Mode: 16.02 dBm IEEE 802.11n HT40 MHz Channel Mode: 16.65 dBm IEEE 802.11ac VHT20 MHz Channel Mode: 13.21 dBm IEEE 802.11ac VHT40 MHz Channel Mode: 13.77 dBm IEEE 802.11ac VHT 80 MHz Channel Mode: 12.92 dBm Bluetooth：9.16 dBm
Antenna gain (Max)	Antenna1 Gain: 3.0 dBi Antenna2 Gain: 3.0 dBi
Evaluation applied	☒ MPE Evaluation* ☐ SAR Evaluation ☐ N/A
Remark:	

1. *The maximum output power is 17.80dBm (60.256mW) at 5190MHz (with 1.995 numeric 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/cm2 even if the calculation indicates that the power density would be larger.*
4. *All two antennas are completely uncorrelated with each other*.

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

Substituting the MPE safe distance using d = 20 cm into Equation 1:

Yields

$$S = 0.000199 \times P \times G$$

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

For WLAN:

Modulation Mode	Frequency band (MHz)	Max. tune up power(dBm)	Antenna gain (dBi)	Distance (cm)	Power density (mW/cm2)	Limit (mW/cm2)
IEEE802.11b	2412-2462	10.5	3.0	20	0.0045	1
IEEE802.11g		15.0	3.0	20	0.0126	1
IEEE802.11 n(20MHz)		18.5	3.0	20	0.0281	1
IEEE802.11 n(40MHz)		18.5	3.0	20	0.0281	1
IEEE802.11a mode	5150~5725	15.0	3.0	20	0.0126	1
IEEE802.11an HT20 mode		18.0	3.0	20	0.0251	1
IEEE802.11an HT40 mode		18.0	3.0	20	0.0251	1
IEEE802.11ac VHT20 mode		15.0	3.0	20	0.0126	1
IEEE802.11ac VHT40 mode		15.5	3.0	20	0.0141	1
IEEE802.11ac VHT80 mode		15.0	3.0	20	0.0126	1
IEEE802.11a mode	5725~5850	14.0	3.0	20	0.0100	1
IEEE802.11an HT20 mode		17.0	3.0	20	0.0199	1
IEEE802.11an HT40 mode		17.0	3.0	20	0.0199	1
IEEE802.11ac VHT20 mode		14.0	3.0	20	0.0100	1
IEEE802.11ac VHT40 mode		14.5	3.0	20	0.0112	1
IEEE802.11ac VHT80 mode		14.0	3.0	20	0.0100	1

For Bluetooth:

Modulation Mode	Frequency band (MHz)	Max. tune up power(dBm)	Antenna gain (dBi)	Distance (cm)	Power density (mW/cm2)	Limit (mW/cm2)
1Mbps	2402-2480	9.5	3.0	20	0.0035	1
3Mbps		9.5	3.0	20	0.0035	1
BLE4.0		7.5	3.0	20	0.0022	1

Note:

All of the Bluetooth& WLAN can transmit simultaneously, the formula of calculated the MPE is:
CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1
CPD = Calculation power density
LPD = Limit of power density
Bluetooth+ WLAN 2.4G=0.0035+0.0281=0.0316mW/cm^2

(For mobile or fixed location transmitters, the maximum power density is 1.0 mW/cm^2 even if the calculation indicates that the power density would be larger.)

EUT with two transmit antennas, each with the same directional gain 3dBi, being driven by two transmitter outputs of equal power. Directional gain is to be computed as follows:

All transmit signals are completely uncorrelated with each other, So directional gain=3dBi.