



# 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>	15'' Notebook Computer
<b>Frequency band (Operating)</b>	<input checked="" type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input type="checkbox"/> WLAN: 5.745GHz ~ 5.825GHz <input type="checkbox"/> Others: <u>Bluetooth: 2.402GHz ~ 2.480GHz</u>
<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>Antenna diversity</b>	<input checked="" type="checkbox"/> Single antenna <input type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input type="checkbox"/> Tx/Rx diversity
<b>Max. output power</b>	IEEE 802.11b mode: 19.91 dBm (97.94mW) IEEE 802.11g mode: 23.47 dBm (222.33mW) IEEE 802.11n HT 20 MHz Channel mode: 23.22 dBm (209.89mW) IEEE 802.11n HT 40 MHz mode: 23.1 dBm (204.17mW)
<b>Antenna gain (Max)</b>	3.71 dBi (Numeric gain: 2.34)
<b>Evaluation applied</b>	<input type="checkbox"/> MPE Evaluation <input checked="" type="checkbox"/> SAR Evaluation* <input type="checkbox"/> N/A
<b>Remark:</b>	
1. The maximum output power is <u>23.47 dBm (222.33mW) at 2412MHz</u> (with <u>2.34numeric antenna gain.</u> ) 2. DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.	

## TEST RESULTS

No non-compliance noted.

## MPE EVALUATION

Not applicable



<b>EUT</b>	15'' Notebook Computer
<b>Frequency band (Operating)</b>	<input type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input checked="" type="checkbox"/> WLAN: 5.725GHz ~ 5.850GHz <input type="checkbox"/> Others: <u>Bluetooth: 2.402GHz ~ 2.480GHz</u>
<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/cm2) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure (S=1mW/cm2)
<b>Antenna diversity</b>	<input checked="" type="checkbox"/> Single antenna <input type="checkbox"/> Multiple antennas <ul style="list-style-type: none"> <li><input type="checkbox"/> Tx diversity</li> <li><input type="checkbox"/> Rx diversity</li> <li><input type="checkbox"/> Tx/Rx diversity</li> </ul>
<b>Max. output power</b>	IEEE 802.11a mode: 22.33 dBm(171.00mW) IEEE 802.11n HT 20 MHz Channel mode: 22.03 dBm(159.58mW) IEEE 802.11n HT 40 MHz mode: 22.25 dBm(167.88mW)
<b>Antenna gain (Max)</b>	1.09 dBi (Numeric gain: 1.28)
<b>Evaluation applied</b>	<input type="checkbox"/> MPE Evaluation <input checked="" type="checkbox"/> SAR Evaluation* <input type="checkbox"/> N/A

**Remark:**

1. The maximum output power is 22.33 dBm(171.00mW) at 5745MHz (with 1.28numeric antenna gain.)
2. DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.

**TEST RESULTS**

No non-compliance noted.

**MPE EVALUATION**

Not applicable



### 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:

$$P (mW) = P (W) / 1000 \text{ and}$$

$$d (cm) = d(m) / 100$$

Yields

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

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:

Yields

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

Where  $P =$  Power in mW

$G =$  Numeric antenna gain

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



**IEEE 802.11b mode:**

EUT output power = 97.94mW

Numeric Antenna gain = 2.34

→ Power density = 0.0456 mW / cm<sup>2</sup>

**IEEE 802.11g mode:**

EUT output power = 222.33 mW

Numeric Antenna gain = 2.34

→ Power density = 0.1035 mW / cm<sup>2</sup>

**IEEE 802.11n HT 20 MHz mode:**

EUT output power = 209.89 mW

Numeric Antenna gain = 2.34

→ Power density = 0.0977mW / cm<sup>2</sup>

**IEEE 802.11n HT 40 MHz mode:**

EUT output power = 204.17mW

Numeric Antenna gain = 2.34

→ Power density = 0.0951 mW / cm<sup>2</sup>

**IEEE 802.11a mode:**

EUT output power = 171.00mW

Numeric Antenna gain = 1.28

→ Power density = 0.0436 mW / cm<sup>2</sup>

**IEEE 802.11n HT 20 MHz Channel mode:**

EUT output power = 159.5mW

Numeric Antenna gain = 1.28

→ Power density = 0.040 mW / cm<sup>2</sup>

**IEEE 802.11n HT 40 MHz mode:**

EUT output power = 167.8mW

Numeric Antenna gain = 1.28

→ Power density = 0.0428 mW / cm<sup>2</sup>

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