

# RF EXPOSURE

## 1. Regulation

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.

Limits for Maximum Permissible Exposure: RF exposure is calculated.

Frequency Range	Electric Field Strength [V/m]	Magnetic Field Strength [A/m]	Power Density [mW/cm <sup>2</sup> ]	Averaging Time [minute]
Limits for General Population / Uncontrolled Exposure				
0.3 ~ 1.34	614	1.63	*(100)	30
1.34 ~ 30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30 ~ 300	27.5	0.073	0.2	30
300 ~ 1 500	/	/	f/1 500	30
1 500 ~ 15 000	/	/	1	30

f=frequency in MHz, \*= plane-wave equivalent power density

## MPE (Maximum Permissible Exposure) Prediction

Predication of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2 \quad (\Rightarrow R = \sqrt{PG/4\pi S})$$

S = power density [mW/cm<sup>2</sup>]

P = Power input to antenna [mW]

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna [cm]

## 2. RF Exposure Compliance Issue

The information should be included in the user's manual:

This appliance and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter. A minimum separation distance of 20 cm must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

## MPE Calculations : WLAN2.4GHz(802.11n\_HT20 2412 MHz)

- Frequency Range : 2412 MHz ~ 2462 MHz
- Measured RF Maximum Output Power(Avg.) : 15.77 dBm
- Target Power & Tolerance 16.00 dBm &  $\pm$  1.00 dB  
( Maximum : 17.00 dBm & Minimum : 15.00 dBm )
- Maximum Peak Antenna Gain : 5.48 dBi
- Maximum Output Power for the Calculation : 17.00 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the  
The MPE Calculations for this exposure is shown below.

<p>- EIRP = P + G</p> <p>= <u>17.00</u> dBm + <u>5.48</u> dBi</p> <p>= <u>22.48</u> dBm</p> <p>= <u>177.01</u> mW</p>	<p>- NOTE</p> <p>P : Max tuneup Power (dBm)</p> <p>G : Maximum Peak Antenna Gain (dBi)</p>
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### Power Density at the specific separation

<p>- S = EIRP / (4 X R<sup>2</sup>π)</p> <p>= <u>177.01</u> / ( 4 X 20<sup>2</sup> X π )</p> <p>= <u>0.035 215</u> mW/cm<sup>2</sup></p>	<p>- NOTE</p> <p>S : Maximum Power Density (mW/cm<sup>2</sup>)</p> <p>EIRP : Equivalent Isotropic Radiated Power (mW)</p> <p>R : Distance to the center of the radiation of the antenna ( <u>20</u> cm )</p> <p>Limit : 1.00 mW/cm<sup>2</sup></p>
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## MPE Calculations : WLAN5GHz(802.11a 5 200 MHz )

- Frequency Range : 5180 MHz ~ 5805 MHz
- Measured RF Maximum Output Power(Avg.) : 17.81 dBm
- Target Power & Tolerance 17.00 dBm &  $\pm$  1.00 dB  
( Maximum : 18.00 dBm & Minimum : 16.00 dBm )
- Maximum Peak Antenna Gain : 5.73 dBi
- Maximum Output Power for the Calculation : 18.00 dBm

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the  
The MPE Calculations for this exposure is shown below.

<p>- EIRP = P + G</p> <p>= <u>18.00</u> dBm + <u>5.73</u> dBi</p> <p>= <u>23.73</u> dBm</p> <p>= <u>236.05</u> mW</p>	<p>- NOTE</p> <p>P : Max tuneup Power (dBm)</p> <p>G : Maximum Peak Antenna Gain (dBi)</p>
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### Power Density at the specific separation

<p>- S = EIRP / (4 X R<sup>2</sup>π)</p> <p>= <u>236.05</u> / ( 4 X 20<sup>2</sup> X π )</p> <p>= <u>0.046 96</u> mW/cm<sup>2</sup></p>	<p>- NOTE</p> <p>S : Maximum Power Density (mW/cm<sup>2</sup>)</p> <p>EIRP : Equivalent Isotropic Radiated Power (mW)</p> <p>R : Distance to the center of the radiation of the antenna ( <u>20</u> cm )</p> <p>Limit : 1.00 mW/cm<sup>2</sup></p>
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## MPE Calculations : WLAN2.4GHz+5GHz

The EUT will only be used with a separation of 20 centimeters or greater between the antenna and the body of the  
The MPE Calculations for this exposure is shown below.

### simultaneous MPE for Wi-Fi and Bluetooth

WLAN2.4GHz+5GHz

<p>- Total (%) =</p> $[ 2.4\text{GHz Result(mW/cm}^2) / \text{Limit(mW/cm}^2) ] +$ $[ 5\text{GHz Result(mW/cm}^2) / \text{Limit(mW/cm}^2) ] * 100$ $= [ \underline{0.035\ 215} / 1 ] +$ $[ \underline{0.046\ 960} / 1 ] * 100$ $= \underline{8.218} \%$	<p>- NOTE</p> <p>WLAN2.4GHz + 5GHz</p> <p>WLAN2.4GHz = <u>0.035 215</u> mW/cm<sup>2</sup></p> <p>WLAN5GHz = <u>0.046 96</u> mW/cm<sup>2</sup></p> <p>Distance to the center of the radiation of the antenna ( <u>20</u> cm )</p> <p>Limit : ≤ 100 %</p>
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