

# 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 : 802.11b

- Frequency Range : 2412 MHz ~ 2462 MHz
- Measured RF Maximum Output Power (Avg.) : 12.23 dBm
- Target Power & Tolerance 12.00 dBm &  $\pm$  1.00 dB  
( Maximum : 13.00 dBm & Minimum : 11.00 dBm )
- Maximum Peak Antenna Gain : 3.10 dBi
- Maximum Output Power for the Calculation : 13.00 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>13.00</u> dBm + <u>3.10</u> dBi</p> <p>= <u>16.10</u> dBm</p> <p>= <u>40.74</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>= 40.74 / ( 4 X 20<sup>2</sup> X π )</p> <p>= <u>0.008 105</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>
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## MPE Calculations : 802.11g

- Frequency Range : 2412 MHz ~ 2462 MHz
- Measured RF Maximum Output Power (Avg.) : 12.18 dBm
- Target Power & Tolerance 12.00 dBm &  $\pm$  1.00 dB  
( Maximum : 13.00 dBm & Minimum : 11.00 dBm )
- Maximum Peak Antenna Gain : 3.10 dBi
- Maximum Output Power for the Calculation : 13.00 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>13.00</u> dBm + <u>3.10</u> dBi</p> <p>= <u>16.10</u> dBm</p> <p>= <u>40.74</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>= 40.74 / ( 4 X 20<sup>2</sup> X π )</p> <p>= <u>0.008 105</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>
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## MPE Calculations : 802.11n\_HT20

- Frequency Range : 2412 MHz ~ 2462 MHz
- Measured RF Maximum Output Power (Avg.) : 12.18 dBm
- Target Power & Tolerance 12.00 dBm &  $\pm$  1.00 dB  
( Maximum : 13.00 dBm & Minimum : 11.00 dBm )
- Maximum Peak Antenna Gain : 3.10 dBi
- Maximum Output Power for the Calculation : 13.00 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>13.00</u> dBm + <u>3.10</u> dBi</p> <p>= <u>16.10</u> dBm</p> <p>= <u>40.74</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>= 40.74 / ( 4 X 20<sup>2</sup> X π )</p> <p>= <u>0.008 105</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>
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## MPE Calculations : 802.11n\_HT40

- Frequency Range : 2422 MHz ~ 2452 MHz
- Measured RF Maximum Output Power (Avg.) : 12.17 dBm
- Target Power & Tolerance 12.00 dBm &  $\pm$  1.00 dB  
( Maximum : 13.00 dBm & Minimum : 11.00 dBm )
- Maximum Peak Antenna Gain : 3.10 dBi
- Maximum Output Power for the Calculation : 13.00 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>13.00</u> dBm + <u>3.10</u> dBi</p> <p>= <u>16.10</u> dBm</p> <p>= <u>40.74</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>= 40.74 / ( 4 X 20<sup>2</sup> X π )</p> <p>= <u>0.008 105</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>
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## MPE Calculations : Bluetooth\_GFSK

- Frequency Range : 2402 MHz ~ 2480 MHz
- Measured RF Maximum Output Power (Avg.) : 2.99 dBm
- Target Power & Tolerance 2.99 dBm &  $\pm$  0.00 dB  
( Maximum : 2.99 dBm & Minimum : 2.99 dBm )
- Maximum Peak Antenna Gain : 3.10 dBi
- Maximum Output Power for the Calculation : 2.99 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>2.99</u> dBm + <u>3.10</u> dBi</p> <p>= <u>6.09</u> dBm</p> <p>= <u>4.06</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>= 4.06 / ( 4 X 20<sup>2</sup> X π )</p> <p>= <u>0.000 809</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>*In the case of Bluetooth, conducted peak output power value of the module report was used. FCCID : RKXFC6000TN</p>
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## MPE Calculations : WLAN+Bluetooth

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

WLAN802.11b + Bluetooth(GFSK)

<p>- Total (%) =</p> $[ 802.11b \text{ Result(mW/cm}^2) / \text{Limit(mW/cm}^2) ] +$ $[ \text{GFSK Result(mW/cm}^2) / \text{Limit(mW/cm}^2) ] * 100$ $= [ \underline{0.008\ 105} / 1 ] +$ $[ \underline{0.000\ 809} / 1 ] * 100$ $= \underline{0.891} \%$	<p>- NOTE</p> <p>WLAN802.11b + Bluetooth(GFSK)</p> <p>WLAN802.11b = <u>0.008 105</u> mW/cm<sup>2</sup></p> <p>Bluetooth(GFSK) = <u>0.000 809</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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