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 Permissive Exposure: RF exposure is calculated.

Frequency Range	Electric Field Strength [V/m]	Magnetic Field Strength [A/m]	Power Density [mW/cm^2]	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/f2)	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 Permissive Exposure) Prediction

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

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

S = power density [mW/cm^2]
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 : 2.4GHz

- Frequency Range :   2412   MHz ~   2464   MHz

- Measured RF Maximum Output Power (Avg.) :   8.61   dBm

- Target Power & Tolerance   8.00   dBm & ± 1.00 dB

                    (Maximum :   9.00   dBm & Minimum :   7.00   dBm)

- Maximum Peak Antenna Gain :   1.50   dBi

- Maximum Output Power for the Calculation :   9.00   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.

- EIRP = P + G
 	
  =   9.00   dBm +   1.50   dBi
 	
  =   10.50   dBm
 	
  =   11.22   mW
	- NOTE
	
	 P : Max tuneup Power (dBm)
	
	 G : Maximum Peak Antenna Gain (dBi)

Power Density at the specific separation

- S   = EIRP / (4 X R^2π)
 	
  = 11.22 / (4 X 20^2 X π)
 	
  = **0.002 232**   mW/cm^2
	- NOTE
	
	 S : Maximum Power Density (mW/cm^2)
	
	 EIRP : Equivalent Isotropic Radiated Power (mW)
	
	 R : Distance to the center of the radiation of the
	     antenna (20 cm)
	 2.4GHz & 5GHz do not operate simultaneously

MPE Calculations : 5.2GHz

- Frequency Range : <u>5180</u> MHz ~ <u>5240</u> MHz

- Measured RF Maximum Output Power (Avg.) : <u>6.84</u> dBm

- Target Power & Tolerance <u>6.00</u> dBm & ± <u>1.00</u> dB

       (Maximum : <u>7.00</u> dBm & Minimum : <u>5.00</u> dBm)

- Maximum Peak Antenna Gain : <u>5.30</u> dBi

- Maximum Output Power for the Calculation : <u>7.00</u> 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.

- EIRP = P + G = <u>7.00</u> dBm + <u>5.30</u> dBi = <u>12.30</u> dBm = <u>16.98</u> mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)

Power Density at the specific separation

- S = EIRP / (4 X $R^2\pi$) = 16.98 / (4 X 20^2 X π) = **<u>0.003 379</u>** mW/cm^2	- NOTE S : Maximum Power Density (mW/cm^2) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (<u>20</u> cm) 2.4GHz & 5GHz do not operate simultaneously

MPE Calculations : 5.8GHz

- Frequency Range :   <u>5736</u>   MHz   ~   <u>5814</u>   MHz

- Measured RF Maximum Output Power (Avg.) :   <u>5.31</u>   dBm

- Target Power & Tolerance   <u>5.00</u>   dBm   &   ±   <u>1.00</u>   dB

        (Maximum :   <u>6.00</u>   dBm   &   Minimum :   <u>4.00</u>   dBm   )

- Maximum Peak Antenna Gain :   <u>2.30</u>   dBi

- Maximum Output Power for the Calculation :   <u>6.00</u>   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.

- EIRP   =   P + G
 	
  =   <u>6.00</u>   dBm   +   <u>2.30</u>   dBi
 	
  =   <u>8.30</u>   dBm
 	
  =   <u>6.76</u>   mW
	- NOTE
	
	  P : Max tuneup Power (dBm)
	
	  G : Maximum Peak Antenna Gain (dBi)

Power Density at the specific separation

- S   =   EIRP / (4 X $R^2\pi$)
 	
  =   6.76   /   (4 X 20^2 X π)
 	
  =   **0.001 345**   mW/cm^2
	- NOTE
	
	  S : Maximum Power Density (mW/cm^2)
	
	  EIRP : Equivalent Isotropic Radiated Power (mW)
	
	  R : Distance to the center of the radiation of the
	  antenna (<u>20</u> cm)
	  2.4GHz & 5GHz do not operate simultaneously