

RF EXPOSURE

FCC : 2ADEC-REC-001

1. FCC 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 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/f ²)	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/cm²]

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 : Zigbee

- Frequency Range : 2405 MHz ~ 2480 MHz
- Measured RF Maximum Output Power : 2.93 dBm
- Target Power & Tolerance 3.00 dBm & $\pm$ 1.00 dB
(Maximum : 4.00 dBm & Minimum : 2.00 dBm)
- Maximum Peak Antenna Gain : 4.97 dBi
- Maximum Output Power for the Calculation : 4.00 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 = <u>4.00</u> dBm + <u>4.97</u> dBi = <u>8.97</u> dBm = <u>7.89</u> mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)
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Power Density at the specific separation

- S = EIRP / (4 X R²π) = <u>7.89</u> / (4 X 20² X π) = <u>0.001 569</u> mW/cm² (Limit : 1.00)	- NOTE S : Maximum Power Density (mW/cm²) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (<u>20</u> cm)
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MPE Calculations : Bluetooth

- Frequency Range : 2402 MHz ~ 2480 MHz

- Measured RF Maximum Output Power : 5.09 dBm

- Target Power & Tolerance 5.09 dBm & $\pm$ 1.00 dB

(Maximum : 6.09 dBm & Minimum : 4.09 dBm)

- Maximum Peak Antenna Gain : 4.97 dBi

- **Maximum Output Power for the Calculation :** 6.09 dBm

* pre-certified module used(FCCID: 2APB6-BOT-CDA110)

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>6.09</u> dBm + <u>4.97</u> dBi = <u>11.06</u> dBm = <u>12.76</u> mW	- NOTE P : Max tuneup Power (dBm) G : Maximum Peak Antenna Gain (dBi)
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Power Density at the specific separation

- S = EIRP / (4 X R²π) = <u>12.76</u> / (4 X 20² X π) = <u>0.002 539</u> mW/cm² (Limit : 1.00)	- NOTE S : Maximum Power Density (mW/cm²) EIRP : Equivalent Isotropic Radiated Power (mW) R : Distance to the center of the radiation of the antenna (<u>20</u> cm)
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MPE Calculations : Zigbee + 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 Zigbee + Bluetooth

- Total (%) = [Zigbee Result(mW/cm2) / Limit(mW/cm2)] + [Bluetooth Result(mW/cm2) / Limit(mW/cm2)] * 100 = [<u>0.001 569</u> / 1] + [<u>0.002 539</u> / 1] * 100 = <u>0.411</u> %	- NOTE Zigbee + Bluetooth Zigbee = <u>0.001 569</u> mW/cm2 Bluetooth = <u>0.002 539</u> mW/cm2 Distance to the center of the radiation of the antenna (<u>20</u> cm) Limit : ≤ 100 %
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