

* 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^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	/	/	1.0	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^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.

3. Calculation Result of RF Exposure

	Target power [dBm]	Tune up tolerance [dB]	Max tune up power [dBm]	Max tune up power [mW]	Ant Gain [dBi]	Ant Gain [mW]	Power Density at 20 cm [mW/cm ²]	Limit [mW/cm ²]
Zigbee O-QPSK	16.5	±2.0	18.5	70.79	3.43	2.20	0.031 03	1.000 00
Bluetooth Low Energy _GFSK	-7.5	±2.0	-5.5	0.28	3.29	2.13	0.000 12	1.000 00

4. Target power and tolerance, Max tune up power

Mode	Target power [dBm]	Tolerance [dB]	Max tune up power [dBm]	Average Power [dBm]
Zigbee_O-QPSK Lowest	16.5	±2.0	18.5	17.15
Zigbee_O-QPSK Middle	16.5	±2.0	18.5	18.19
Zigbee_O-QPSK Highest	16.5	±2.0	18.5	18.19
Bluetooth Low Energy _GFSK Lowest	-7.0	±2.0	-5.0	-5.43
Bluetooth Low Energy _GFSK Middle	-7.0	±2.0	-5.0	-5.82
Bluetooth Low Energy _GFSK Highest	-7.0	±2.0	-5.0	-6.85