

MPE Calculation

Product:	Air Purifier
Model no.:	Z-2500, Z-3500
FCC ID:	GV3-22Z3X00A
Contains FCC ID:	B4OEC86XFPX
Rating:	Z-2500: Air Purifier: 120VAC, 60Hz, 0.5A Z-3500: Air Purifier: 120VAC, 60Hz, 1.1A
RF Transmission Frequency:	2.4GHz wireless function: 2469-2479MHz Bluetooth LE: 2402-2480MHz ¹ Wi-Fi 2.4G: 2412-2462MHz ¹ Note 1: The products contain an approved WiFi&Bluetooth modular, FCC ID: B4OEC86XFPX, IC:21698-EC86XFPX
Antenna Type:	PCB Antenna
Max Antenna Gain:	2.4GHz wireless function: 2dBi
Description of the EUT:	The EUT is a Air Purifier which supports 2.4GHz wireless, Bluetooth and 2.4GHz Wi-Fi function. The Bluetooth and 2.4GHz Wi-Fi modular has been approved FCC ID: B4OEC86XFPX, IC:21698-EC86XFPX

According to subpart 15.247(i) and subpart §1.1307(b)(1), 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 level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091, KDB447498 D01 General RF Exposure Guidance v06)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
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/1500	30
1,500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

$S = PG/4\pi R^2$ = power density (in appropriate units, e.g. mW/cm²);

P = power input to the antenna (in appropriate units, e.g., mW);

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

Calculated Data:

According to C63.10 Annex G

$$EIRP = p_t \times g_t = (E \times d)^2 / 30, \text{ so } p_t = (E \times d)^2 / 30 \times g_t$$

where

 p_t is the transmitter output power in watts g_t is the numeric gain of the transmitting antenna (dimensionless) E is the electric field strength in V/m d is the measurement distance in meters (m)

transmitter output power for 2.4GHz Function (nRF24L01)

Field strength (E):	96.6 (dBuV/m) = 0.0676 (V/m)
Measurement distance (D):	3 (m)
Antenna Gain, typical (dBi):	2.0
Numerical gain of the transmit antenna (g_t):	1.58
Transmitter output power (TP):	0.000868(W)
Transmitter output power (TP):	0.868(mW)

Power density for 2.4GHz Function (nRF24L01):

Maximum peak output power at antenna input terminal (mW):	0.868
Prediction distance (cm):	20
Antenna Gain, typical (dBi):	2.0
Maximum Antenna Gain (numeric):	1.58
The worst case is power density at predication frequency at 20 cm (mW/cm2):	0.0002728
MPE limit for general population exposure at prediction frequency (mW/cm2):	1.0
Result :	Pass

For simultaneous transmission

According to the MPE report of the approved WiFi&Bluetooth modular (FCC ID: B4OEC86XFPX, IC:21698-EC86XFPX), the power density of 2.4G Wi-Fi and bluetooth are 0.019 mW/cm2 and 0.0004 mW/cm2 separately.

Simultaneous transmission configuration	Power density	MPE Limit
2.4GHz Wi-Fi +2.4GHz Function(nRF24L01)	0.019+0.0002728=0.0192728	1.0
Bluetooth +2.4GHz Function(nRF24L01)	0.0004+0.0002728=0.0006728	1.0

Result: Compliant

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