Maximum Permissible Exposure Report

Standard Applicable

Accordting to FCC Part1.1310: Radiofrequency radiation exposure limits. The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency radiation as specified in 1.1307(b) LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range	**Electric field strength**	**Magnetic field strength**	**Power density**	**Averaging time**
(MHz)	**(V/m)**	**(A/m)**	**(mW/cm^2)**	**(minutes)**
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f^2	6
30-300	61.4	0.163	1	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) 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/1500	30
1,500-100,000			1	30

F = Frequency in MHz

Calculations

Friis transmission formula: $\mathbf{P_d = (P_{out} * G) / (4 * pi * r^2)}$

Where

P_d = power density in mW/cm^2

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

pi = 3.1416

r = distance between observation point and center of the radiator in cm

The limit of **P_d** is 1 mW/cm^2. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the **P_d** at 20 cm is meet the limit of MPE.

Result (Worse case mode)

測試日期: Oct. 14, 2021 環境溫度: 25℃ 環境濕度: 61%
測試日期: Oct. 13, 2021 環境溫度: 26℃ 環境濕度: 60%

Radio Technology	Operation Frequency (MHz)	Distance (cm)	Maximu Output Power with Antenna Gain (mW)	Power Density (mW/cm^2)	Limit (mW/cm^2)
2.4 GHz	2412	20	279.25	0.0556	1
5 GHz	5200	20	25.35	0.0050	1

The P_d at 20 cm distance calculated from the Friis transmission formula is mush smaller than the limit requirement 1 mW/cm^2 or 10W/m^2.

The **Installation Manual** instructs the user to install the device such that it has a separation of at least 20 cm from persons to comply with the FCC's requirements. This separation of 20 cm more than meets the FCC's and Industry Canada RF exposure requirements.

Simultaneous Evaluation:

The formula of calculated MPE is:

CPD1/LPD1+CPD2/LPD2+…etc. ＜ 1

CPD=Calculated Power Density

LPD=Limit of Power Density

The MPE evaluation is 0.0556/1+0.0050 /1=0.0606＜1, which confirm the device comply the MPE limit.

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