

Maximum Permissible Exposure (MPE) Calculations For AIR-CAP1572xxx-x-K9

Devices are subject to the radio frequency radiation exposure requirements specified in Sec. 1.1307(b), Sec. 2.1091 and Sec. 2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a "general population/uncontrolled" environment. Applications for equipment authorization of devices operating under this section must contain a statement confirming compliance with these requirements for both fundamental emissions and unwanted emissions. Technical information showing the basis for this statement must be submitted to the Commission upon request.

Given

$$E = \sqrt{(30 * P * G) / d} \quad \text{and} \quad S = E^2 / 3770$$

where

E=Field Strength in Volts/meter

P=Power in Watts

G=Numeric Antenna Gain

d=Distance in meters

S=Power Density in mW/cm²

Combine equations and rearrange the terms to express the distance as a function of the remaining variables:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of power in mW and distance in cm, using:

$$P(\text{mW}) = P(\text{W}) / 1000 \quad d(\text{cm}) = 100 * d(\text{m})$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d=Distance in cm

P=Power in mW

G=Numeric Antenna Gain

S=Power Density in mW/cm²

Substituting the logarithmic form of power and gain using:

$$P(\text{mW}) = 10^{(P(\text{dBm}) / 10)} \quad G(\text{numeric}) = 10^{(G(\text{dBi}) / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S}$$

Equation (1)

and

$$s = ((0.282 * 10^{((P + G) / 20)}) / d)^2$$

Equation (2)

where

d=MPE distance in cm

P=Power in dBm

G=Antenna Gain in dBi

S=Power Density in mW/cm²



Equation (1) and the measured peak power are used to calculate the MPE distance. Note that for mobile or fixed location transmitters such as an access point, the minimum separation distance is 20 cm even if the calculations indicate that the MPE distance may be less.

$S=1\text{mW}/\text{cm}^2$ maximum. Using the peak power levels recorded in the test report along with Equation 1 above, the MPE distances are calculated as follows.

Antennas Up to 7 dBi Gain:

Frequency (MHz)	Bit Rate (Mbps)	Power Density (mW/cm ²)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	Limit (cm)	Margin (cm)
2412	11	1	29.2	6	16.23	20	3.77
2437	11	1	29.5	6	16.80	20	3.20
2462	11	1	23.1	6	8.04	20	11.96
2412	54	1	24.7	6	9.67	20	10.33
2437	54	1	29.7	6	17.19	20	2.81
2462	54	1	25.0	6	10.01	20	9.99
5180	54	1	16.0	7	3.98	20	16.02
5200	54	1	20.0	7	6.31	20	13.69
5240	54	1	20.0	7	6.31	20	13.69
5280	54	1	17.2	7	4.57	20	15.43
5320	54	1	18.6	7	5.37	20	14.63
5500	54	1	16.1	7	4.03	20	15.97
5560	54	1	16.7	7	4.32	20	15.68
5700	54	1	16.4	7	4.17	20	15.83
5745	54	1	18.9	7	5.56	20	14.44
5785	54	1	25.3	7	11.62	20	8.38
5825	54	1	21.3	7	7.33	20	12.67
5180	M0-M15	1	18.9	7	5.56	20	14.44
5200	M0-M15	1	20.6	7	6.76	20	13.24
5240	M0-M15	1	20.5	7	6.69	20	13.31
5280	M0-M15	1	19.3	7	5.82	20	14.18
5320	M0-M15	1	18.7	7	5.44	20	14.56
5500	M0-M15	1	17.7	7	4.84	20	15.16
5560	M0-M15	1	18.7	7	5.44	20	14.56
5700	M0-M15	1	17.9	7	4.96	20	15.04
5745	M0-M15	1	18.6	7	5.37	20	14.63
5785	M0-M15	1	27.4	7	14.80	20	5.20
5795	M0-M15	1	24.7	7	10.85	20	9.15
5825	M0-M15	1	21.9	7	7.86	20	12.14

To maintain compliance, installations will assure a separation distance of at least 20cm.



Antennas up to 14 dBi Gain

Frequency (MHz)	Bit Rate (Mbps)	Power Density (mW/cm ²)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	Limit (cm)	Margin (cm)
2412	11	1	22.7	16	24.28	50	25.72
2437	11	1	26.9	16	39.38	50	10.62
2462	11	1	19.4	16	16.61	50	33.39
2412	54	1	13.5	16	8.42	50	41.58
2437	54	1	26.4	16	37.17	50	12.83
2462	54	1	13.1	16	8.04	50	41.96
5280	54	1	11.6	17	7.59	50	42.41
5320	54	1	12.1	17	8.04	50	41.96
5500	54	1	12.2	17	8.13	50	41.87
5560	54	1	13.6	17	9.56	50	40.44
5700	54	1	12.1	17	8.04	50	41.96
5745	54	1	26.9	17	44.18	50	5.82
5785	54	1	27.7	17	48.45	50	1.55
5795	54	1	27.7	17	48.45	50	1.55
5825	54	1	26.8	17	43.68	50	6.32
5280	M0-M15	1	12.1	17	8.04	50	41.96
5320	M0-M15	1	12.4	17	8.32	50	41.68
5500	M0-M15	1	12.1	17	8.04	50	41.96
5560	M0-M15	1	13.3	17	9.23	50	40.77
5700	M0-M15	1	11.7	17	7.68	50	42.32
5745	M0-M15	1	26.8	17	43.68	50	6.32
5785	M0-M15	1	27.6	17	47.89	50	2.11
5795	M0-M15	1	27.4	17	46.80	50	3.20
5825	M0-M15	1	26.7	17	43.18	50	6.82

To maintain compliance, installations will assure a separation distance of at least 50cm.



Using Equation 2, the MPE levels (s) for antennas up to 14dBi at 50 cm are calculated as follows:

Frequency (MHz)	Bit Rate (Mbps)	MPE Distance (cm)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Margin (mW/cm ²)
2412	11	50	22.7	16	0.24	1	0.76
2437	11	50	26.9	16	0.62	1	0.38
2462	11	50	19.4	16	0.11	1	0.89
2412	54	50	13.5	16	0.03	1	0.97
2437	54	50	26.4	16	0.55	1	0.45
2462	54	50	13.1	16	0.03	1	0.97
5280	54	50	11.6	17	0.02	1	0.98
5320	54	50	12.1	17	0.03	1	0.97
5500	54	50	12.2	17	0.03	1	0.97
5560	54	50	13.6	17	0.04	1	0.96
5700	54	50	12.1	17	0.03	1	0.97
5745	54	50	26.9	17	0.78	1	0.22
5785	54	50	27.7	17	0.94	1	0.06
5795	54	50	27.7	17	0.94	1	0.06
5825	54	50	26.8	17	0.76	1	0.24
5280	M0-M15	50	12.1	17	0.03	1	0.97
5320	M0-M15	50	12.4	17	0.03	1	0.97
5500	M0-M15	50	12.1	17	0.03	1	0.97
5560	M0-M15	50	13.3	17	0.03	1	0.97
5700	M0-M15	50	11.7	17	0.02	1	0.98
5745	M0-M15	50	26.8	17	0.76	1	0.24
5785	M0-M15	50	27.6	17	0.92	1	0.08
5795	M0-M15	50	27.4	17	0.88	1	0.12
5825	M0-M15	50	26.7	17	0.75	1	0.25

(MHz)	MPE Distance (cm)	Peak Transmit Power (dBm)	Power Density (mW/cm ²)	Limit Frequency (mW/cm ²)	Margin (mW/cm ²)
2437+5795	50	30.4	0.86	1	0.14

Engineer: *Bud Chilton*

Date: *10/8/2014*