Maximum Permissible Exposure (MPE) Calculations

For

AIR-CAP1552x-E-K9, AIR-CAP1552C-E-K9, AIR-CAP1552E-E-K9,
AIR-CAP1552I-E-K9, AIR-CAP1552CU-E-K9, AIR-CAP1552EU-E-K9,
AIR-CAP1552E-S-K9, AIR-CAP1552I-S-K9, AIR-CAP1552EU-S-K9,
and AIR-CAP1552x-S-K9 Series Cisco Aironet 802.11n Mesh
Access Points.

15.407: U-NII 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=√(30*P*G)/d and 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/cm^2

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

d=√((30*P*G)/(3770*S))

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

P(mW)=P(W)/1000 d(cm)=100*d(m)

yields

d=100*√((30*(P/1000)*G)/(3770*S))
d=0.282*√(P*G/S)

where

d=Distance in cm
P=Power in mW
G=Numerica Antenna Gain
S=Power Density in mW/cm^2

Substituting the logarithmic form of power and gain using:

P(mW)=10^(P(dBm)/10) G(numeric)=10^(G(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/cm^2

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=1mW/cm^2 maximum. The highest supported antenna gain is 14 dBi (17 if beamforming). Using the peak power levels recorded in the test report along with Equation 1 above, the MPE distances are calculated as follows:

Frequency (MHz)	Bit Rate (Mbps)	Power Density (mW/cm^2)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	Limit (cm)	Margin (cm)
5280	54	1	12.8	17	**8.71**	20	11.29
5320	54	1	11.4	17	**7.42**	20	12.58
5500	54	1	12.6	17	**8.52**	20	11.48
5560	54	1	12.1	17	**8.04**	20	11.96
5700	54	1	12.6	17	**7.42**	20	11.48

MPE Calculations

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

Using Equation 2, the MPE levels (s) at 20 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)
5280	54	20	12.8	17	**0.19**	1	0.81
5320	54	20	11.4	17	**0.14**	1	0.86
5500	54	20	12.6	17	**0.18**	1	0.82
5560	54	20	12.1	17	**0.16**	1	0.84
5700	54	20	12.6	17	**0.18**	1	0.82