

Prediction of MPE limit at given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG / 4\pi R^2$$

where: S = Power density
P = Power input to the antenna
G = Antenna gain
R = Distance to the center of radiation of the antenna

Solving this equation for G

$$G = S (4\pi R^2) / P$$

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled "Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure"

Frequency Range (MHz)	Power Density (mW/cm ²)	Averaging Time (minutes)
300 -1500	f/1500	30
1500 - 100000	1.0	30

where f = Frequency (MHz)

Based on the above table the limits are for

Part 24 device: 1 mW/cm²

Part 22 device: 0.567 mW/cm²

Prediction for Part 24:

P Max power input to the antenna: 30.0 dBm / 1000 mW
R Distance: 20 cm
S MPE limit for uncontrolled exposure: 1 mW/cm²

G Antenna gain: 5.0256 numerical
G Antenna gain: 7.01 dBi

EIRP peak power limit according to §24.232(b): 2 W / 33 dBm

Therefore the maximum antenna gain for part 24 shall not exceed 3 dBi

Prediction for Part 22:

P Max power input to the antenna: 33.0 dBm / 2000 mW
R Distance: 20 cm
S MPE limit for uncontrolled exposure: 0.567 mW/cm²

G Antenna gain: 1.424 numerical
G Antenna gain: 1.54 dBi or -0.6 dBd

ERP power limit according to §22.913(a): 7 W

Therefore the maximum antenna gain for part 22 shall not exceed -0.6 dBd