

## Annex E Safety exposure levels (MPE calculation)

### Prediction of MPE limit at a 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

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 <sup>2</sup> )	Averaging Time (minutes)
300 -1500	f/1500	30
1500 - 100000	1.0	30

where f = Frequency (MHz)

### **Prediction: (with Rod antenna A)**

P Max power input to the antenna: 10.44 dBm  
 P Max power input to the antenna: 11.07 mW  
 R Distance: 20 cm  
 G Maximum antenna gain: 4.98 dBi  
 G Maximum antenna gain: 3.15 numeric  
 S MPE limit for uncontrolled exposure: 1 mW/cm<sup>2</sup>

Calculated Power density: **0.007 mW/cm<sup>2</sup>**  
**0.069 W/m<sup>2</sup>**

### **Prediction: (with Rod antenna B)**

P Max power input to the antenna: 10.03 dBm  
 P Max power input to the antenna: 10.07 mW  
 R Distance: 20 cm  
 G Maximum antenna gain: 4.62 dBi  
 G Maximum antenna gain: 2.90 numeric  
 S MPE limit for uncontrolled exposure: 1 mW/cm<sup>2</sup>

Calculated Power density: **0.006 mW/cm<sup>2</sup>**  
**0.058 W/m<sup>2</sup>**

**Prediction: (with Planar antenna A)**

P	Max power input to the antenna:	10.44 dBm
P	Max power input to the antenna:	11.07 mW
R	Distance:	20 cm
G	Maximum antenna gain:	6.73 dBi
G	Maximum antenna gain:	4.71 numeric
S	MPE limit for uncontrolled exposure:	1 mW/cm <sup>2</sup>

Calculated Power density: **0.010 mW/cm<sup>2</sup>**  
**0.104 W/m<sup>2</sup>**

**Prediction: (with Planar antenna B)**

P	Max power input to the antenna:	10.03 dBm
P	Max power input to the antenna:	10.07 mW
R	Distance:	20 cm
G	Maximum antenna gain:	6.79 dBi
G	Maximum antenna gain:	4.77 numeric
S	MPE limit for uncontrolled exposure:	1 mW/cm <sup>2</sup>

Calculated Power density: **0.010 mW/cm<sup>2</sup>**  
**0.096 W/m<sup>2</sup>**

**Prediction: (with Omnidirectional antenna A)**

P	Max power input to the antenna:	10.44 dBm
P	Max power input to the antenna:	11.07 mW
R	Distance:	20 cm
G	Maximum antenna gain:	-4.94 dBi
G	Maximum antenna gain:	0.32 numeric
S	MPE limit for uncontrolled exposure:	1 mW/cm <sup>2</sup>

Calculated Power density: **0.001 mW/cm<sup>2</sup>**  
**0.007 W/m<sup>2</sup>**

**Prediction: (with Omnidirectional antenna B)**

P	Max power input to the antenna:	10.03 dBm
P	Max power input to the antenna:	10.07 mW
R	Distance:	20 cm
G	Maximum antenna gain:	-4.33 dBi
G	Maximum antenna gain:	0.37 numeric
S	MPE limit for uncontrolled exposure:	1 mW/cm <sup>2</sup>

Calculated Power density: **0.001 mW/cm<sup>2</sup>**  
**0.007 W/m<sup>2</sup>**

**This prediction demonstrates the following:**

The power density levels at a distance of 20 cm are below the maximum levels allowed by FCC regulations