PREDICTION OF MPE AT A GIVEN DISTANCE

Calculations can be made to predict RF field strength and power density levels around typical RF sources using the general equations (3) and (4) on page 19 of the following FCC document:
"OET Bulletin 65, Edition 97-01 - Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields".

These equations are generally accurate in the far field of an antenna but will over predict power density in the near field, where they could be used for making a "worst case" prediction.

$S = PG/4\pi R^2$ (3)

Where S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units e.g. mW)
G = power gain of the antenna in the direction of interest relative to the isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units e.g. cm)

or, $S = EIRP/4\pi R^2$ (4)

Where EIRP = Equivalent Isotropically radiated power

General Limits:

§1.1307
Cellular Radiotelephone Service (subpart H of part 22)
Non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 1000 W ERP (1640 W EIRP)

§1.1307
Personal Communications Services (part 24)
Broadband PCS (subpart E): non-building-mounted antennas: height above ground level to lowest point of antenna < 10 m and total power of all channels > 2000 W ERP (3280 W EIRP)

§1.1310 LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)
(B) Limits for General Population/Uncontrolled Exposure
300–1500 MHz: f/1500 mW/cm²
1500–100,000 MHz: 1.0 mW/cm²

§2.1091

No routine evaluation required when the device …operate at frequencies of 1.5 GHz or below and their effective radiated power (ERP) is 1.5 watts or more, or if they operate at frequencies above 1.5 GHz and their ERP is 3 watts or more.

§24.232
(a) Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna height up to 300 meters HAAT.
b) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power, …

§22.913
(a) Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

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)
300 -1500	f/1500
1500 - 100000	1.0

Prediction for Part 22

Maximum radiated power EIRP**: 27.48dBm (560mW) @ 836MHz**
Maximum conducted peak power: **31.96dBm**.

Lowest limit for 850 MHz fixed operations (@20cm) where no routine evaluation is required is § 1.1310: (f/1500)mW/cm^2 **=0.5659 mW/cm^2**

Calculated at distance of 20cm for reference antenna:

Power density = $560 / (4 * \pi * 20^2)$ = **0.1114 mW/cm^2**

Maximum allowed antenna gain:

$G = 10\log(0.5659 * 4 * \pi * 20^2) - 31.96 = 2.58dBi$

Result: Configuration complies with rules as power density is below MPE limit.

FCC-ID	PDC-ILM317XSW
IC-ID (Industry Canada)	5079A-ILM317X

Prediction for Part 24

Maximum radiated power EIRP: **24.6dBm (288mW) @1880MHz**
Maximum conducted peak power: **29.54 dBm**.

Lowest limit for 1900 MHz fixed operations (@20cm) where no routine evaluation is required is § 1.1310: **1 mW/cm^2**

Calculated at distance of 20cm:

Power density = 288 / (4 * π * 20^2) **= 0.0573mW/cm^2**

Maximum allowed antenna gain:

G = 10log(1 * 4 * π * 20^2) – 29.54 = 7.47dBi

Result: Configuration complies with rules as power density is below MPE limit.

Prediction for Part 15

Maximum radiated power EIRP: **12.49dBm (18mW)**

Calculated at distance of 20cm for reference antenna:

Power density = 18 / (4 * π * 20^2) = **0.00358 mW/cm^2**

Result: Configuration complies with rules as power density is below MPE limit.

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