Prediction of MPE limit at given distance

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

$$S \;=\; \frac{PG}{4\,\boldsymbol{p}\,R^{\,2}}$$

where:

S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest
   relative to an isotropic radiator
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^2)	Averaging Time (minutes)
300 – 1500	f/1500	30
1500 – 100.000	1.0	30

where f = frequency in MHz

Prediction GSM 1900

Antenna Type: 0dBi Antenna / 3dBi Antenna / 6 dBi Antenna / 7 dBi Antenna

Maximum peak output power at antenna input terminal:	28,70	dBm
Maximum peak output power at antenna input terminal:	741,31	mW
Antenna gain(typical):	0,00	dBi
Maximum antenna gain:	1,00	numeric
Prediction distance:	20,00	cm
Prediction frequency:	1.880,00	MHz

MPE limit for uncontrolled exposure at prediction frequency: **1,00** $\frac{mW}{cm^2}$

Power density at prediction frequency:
with Antenna Gain of **0dBi**   **0,147** $\frac{mW}{cm^2}$

Power density at prediction frequency:
with Antenna Gain of **3dBi**   **0,294** $\frac{mW}{cm^2}$

Power density at prediction frequency:
with Antenna Gain of **6dBi**   **0,587** $\frac{mW}{cm^2}$

Power density at prediction frequency:
with Antenna Gain of **7dBi**   **0,739** $\frac{mW}{cm^2}$

Maximum allowable antenna gain for GSM 1900 operations: **8,31 dBi**

<u>Prediction GSM 850</u>

Antenna Type: 0dBi Antenna / 3dBi Antenna / 6 dBi Antenna / 7 dBi Antenna

Maximum peak output power at antenna input terminal:	33,00	dBm
Maximum peak output power at antenna input terminal:	1.995,26	mW
Antenna gain(typical):	0,00	dBi
Maximum antenna gain:	1,00	numeric
Prediction distance:	20,00	cm
Prediction frequency:	836,40	MHz

MPE limit for uncontrolled exposure at prediction frequency: $\underline{\textbf{0,5576}}$ $\dfrac{mW}{cm^2}$

Power density at prediction frequency: **0,397** $\dfrac{mW}{cm^2}$
with Antenna Gain of **0dBi**

Power density at prediction frequency: **0,792** $\dfrac{mW}{cm^2}$
with Antenna Gain of **3dBi**

Power density at prediction frequency: **1,580** $\dfrac{mW}{cm^2}$
with Antenna Gain of **6dBi**

Power density at prediction frequency: **1,989** $\dfrac{mW}{cm^2}$
with Antenna Gain of **7dBi**

Maximum allowable antenna gain for GSM 1900 operations: **1,48 dBi**