

6. Prediction of MPE Limit

6.1. Friis Formula

Friis transmission formula : $S = (P_{out} \times G) / (4 \times \pi \times R^2)$

$$R = \sqrt{\frac{P_{out} \times G}{4\pi \times S}}$$

S = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

Power density(S) is limit of MPE, **1.0 mW/cm²**. If we know the maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

6.2. Test Results

6.2.1 Antenna Gain

The maximum Gain measured in Fully Anechoic Chamber is 2.5dBi or **1.778**(numeric).

6.2.2 Prediction for power density

Channel	Frequency (MHz)	Maximum Output Power at Antenna Terminal(mW)	Power Density at 20cm (mW/cm ²)	Limit (mW/cm ²)
600	1880	158.49	0.056	1.0

Note: Limit of Power Density(S)= **1.0 mW/cm²**

Calculation Power Density at 20 cm

$$\begin{aligned} S &= (P \times G) / (4 \times \pi \times R^2) \\ &= (158.49 \times 1.778) / (4 \times 3.1416 \times 20^2) \\ &= \mathbf{0.056 \text{ (mW/cm}^2\text{)}} \end{aligned}$$

where : P = 158.49 mW (Maximum output power is 22dBm at antenna terminal)

G = 1.778(numeric gain)

π = 3.1416

R = 20 cm