

Calculation of Antenna safety distance

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Calculations of the safety distance due to emitted RF power from an Antenna connected to the " *Sailor System 5000 MF/HF150W* " transmitter.

The calculations in this document are made in accordance with the FCC rules described in OET bulletin 65 Edition 97-01 concerning Human exposure to RF Electromagnetic Fields. The limit Occupational / Controlled MPE is stated in accordance with Appendix A page 67.

Calculus assumptions:

Antenna:	Whip antenna with ground plane. The Antenna is assumed to be a half wave monopole and the ground plane assumed to be ideal. These assumptions result in radiation pattern and gain similar to a half wave dipole antenna.
Antenna pattern:	Omni directional
Transmitter Power:	P = 150 W
Frequency modulation:	CW
Gain relative to isotropic:	Gi = 2 equals 3dB
Frequency range:	1.6MHz to 30MHz
Equation used for calculus:	$MPE = \frac{EIRP}{4 \cdot \pi \cdot R^2} \quad 1)$ <p>The equation regarding MPE is generally accurate in the antenna far field, but it will over-predict the Power density in the near field. This means that the calculus can be regarded as a "worst case" or conservative prediction.</p> $EIRP = Gi \cdot P \quad 2)$ $MPE = \frac{900}{f^2} \quad [mW/cm^2] \quad 3)$ <p>"f" is the frequency inserted in MHz. The expression for MPE is in accordance with OET bulletin 65 Edition 97-01 Appendix A page 67</p>

Calculation of safety distance:

Using equation 1):

$$MPE = \frac{EIRP}{4 \cdot \pi \cdot R^2} \Rightarrow R = \sqrt{\frac{EIRP}{4 \cdot \pi \cdot MPE}} \quad 4)$$

Equation 2) inserted into 4):

$$R = \sqrt{\frac{Gi \cdot P}{4 \cdot \pi \cdot MPE}} \quad 5)$$

Equation 3) inserted into 5):

$$R = \sqrt{\frac{Gi \cdot P}{4 \cdot \pi \cdot \frac{900}{f^2}}} \Rightarrow R = f \cdot \sqrt{\frac{Gi \cdot P}{4 \cdot \pi \cdot 900}} \quad 6)$$

Values for Gi and P are inserted into equation 6). P is inserted in mW and the distance R is in cm, due to the unit of MPE, which is [mW/cm²]:

$$R = 5.2 \cdot f \quad 7)$$

Value for safety distance R is calculated:

$$f = 30MHz \Rightarrow R = 156cm \quad 8)$$

$$f = 1,6MHz \Rightarrow R = 8.3cm \quad 9)$$

The safety distance is stated to 6 feet which are equal to 184cm > 156cm

Note:

The safety distance is issued in the SAILOR System 5000 MF/HF Operators Manual