



4.2.2.6 RF Radiation Exposure

FCC, Part 15 Subpart C §15.247(f)
Industry Canada RSS-210 §6.2.2(q1)(iv)(g)

Calculations for Maximum Permissible Exposure Levels

Given

$$E = \sqrt{(30 * P * G)} / d$$

and

$$S = E^2 / 3770$$

where

E = field strength in volts/meter

P = power in watts

G = numeric antenna gain

d = distance in meters

S = power density in milliwatts / square centimeter

Combining and rearranging the terms to express the distance as a function of the variables, yields:

$$d = \sqrt{(30 * P * G)} / (3770 * S)$$

Rearrange to milliwatts and centimeters

$$P(\text{mw}) = P(\text{watts}) / 1000$$

$$d(\text{cm}) = d(\text{m}) * 100$$

yields

$$d = 100 * \sqrt{(30 * (P / 1000) * G)} / (3770 * S)$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in centimetres

P = Power in mW

G = Numeric Antenna Gain

S = Power Density in centimetres²

Substituting the logarithmic form of power and gain using:

$$P(\text{mW}) = 10^{(P(\text{dBm})/10)} \text{ and}$$

$$G(\text{numeric}) = 10^{(G(\text{dBi})/10)}$$



Yields:

$$d = 0.282 * 10^{((P + G) / 20) / \sqrt{S}}$$

where

d = MPE distance in centimetres

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW / centimetres² (Limit S = 1mW / cm² from §1.310 Table 1)

Maximum output power observed from power measurements – **+16.91dBm**

Maximum antenna gain – **14dBi**

Power Density Limit (mW / cm ²)	Maximum Measured Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
1	16.91	14	9.9

Specification

Maximum Permissible Exposure Limits

§15.247 (b)(5) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency levels in excess of the Commission's guidelines. See §1.1307 (b)(1) of this chapter.

Limit S = 1mW / cm² from 1.310 Table 1

Note: for mobile or fixed location transmitters the minimum separation distance is 20cm, even if calculations indicate the MPE distance to be less.

Traceability

METHOD	TEST EQUIPMENT USED
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	Bar 1, PMtr 1, PSnsr 1, coupler, 3dB & 30dB pads

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty (dB)	±1.33
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