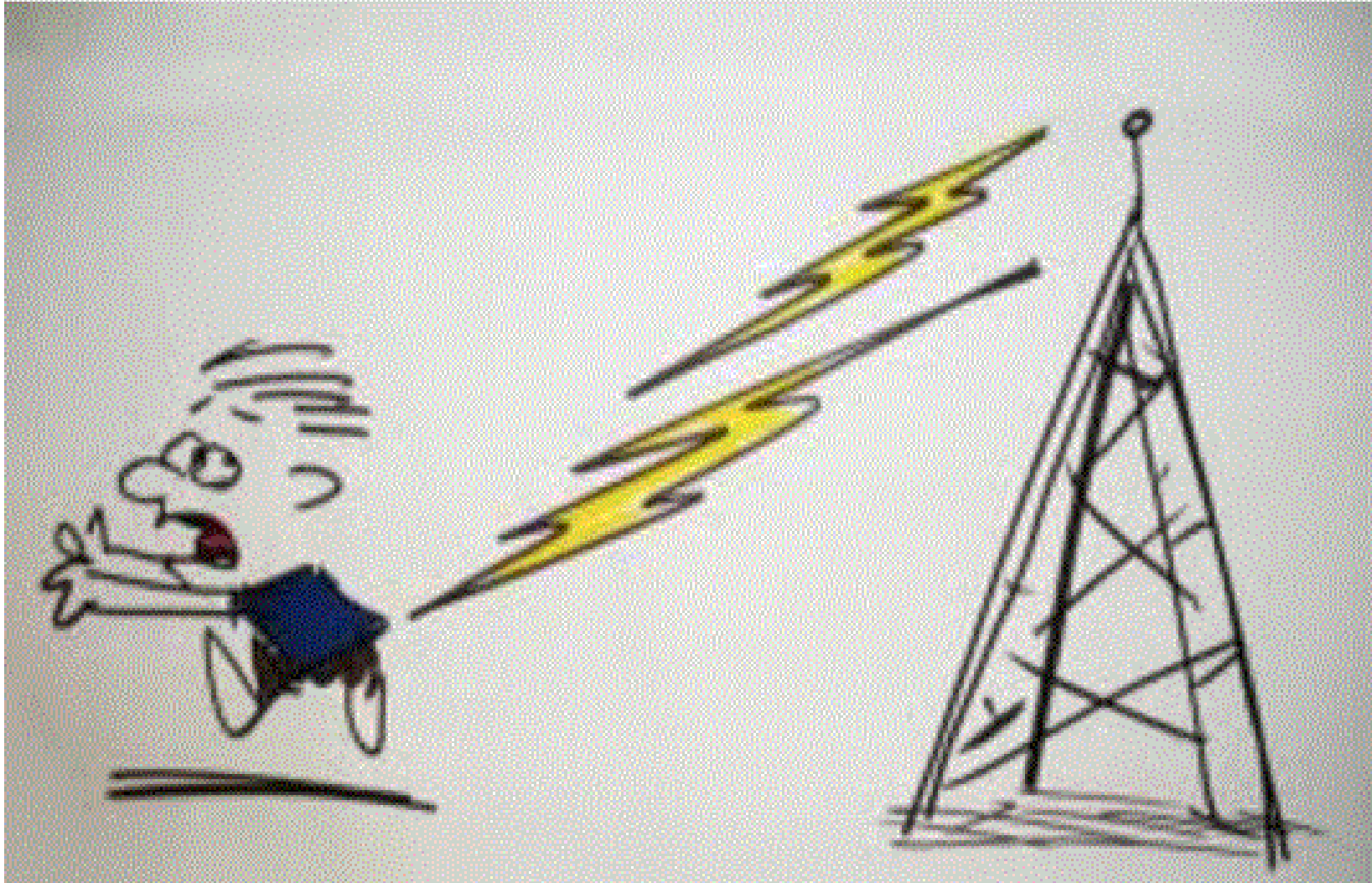
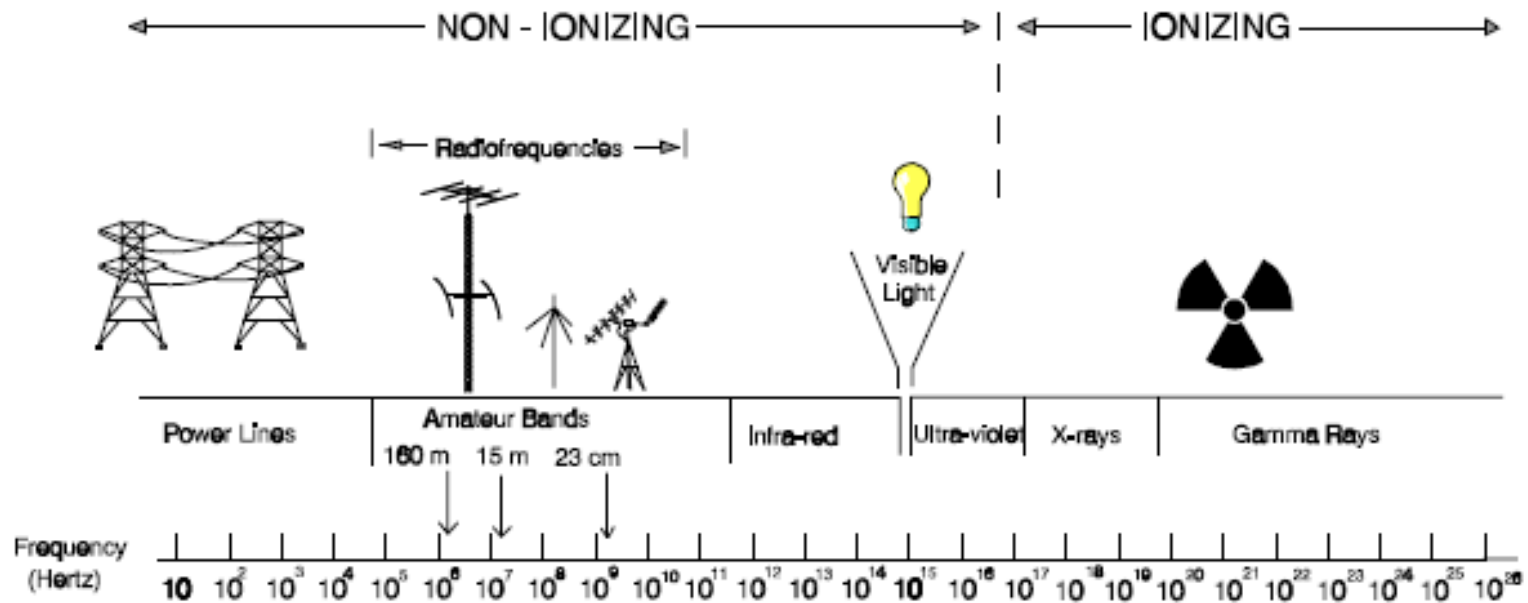


# RF Safety



# Non Ionizing Radiation

Also Known As RF



# RF Exposure Effects on Health

Thermal Effects - heating of body tissue, fairly well understood

Effects are non-cumulative

Areas of particular concern are the eyes and testes - human body does not cool these areas efficiently.

Resonant frequency of an adult human whole body ranges from 35 MHz to about 80 MHz.

Adult human head is resonant at about 400 MHz

Small child's head: about 700MHz.

## RF Exposure Effects on Health, Continued

Non-thermal effects - cancer, leukemia, immuno-deficiency, etc.

Far less understood than thermal effects.

Some studies show an elevated risk factor of 1.5x to 2x others indicate no association at all.

Compare that to a 10x elevated cancer risk factor for a 1-pack per day smoker.

There is no conclusive proof of risk, but no proof that the risk does not exist, so athermal risks remain a controversial topic.

# Safe Exposure Levels

How much is safe? Several factors are involved:

Transmitter power

Antenna Gain

Coax Loss

Duty Cycle

Average Key-Up Time

Distance from Antenna

Standards are a wonderful thing – Everyone has one!

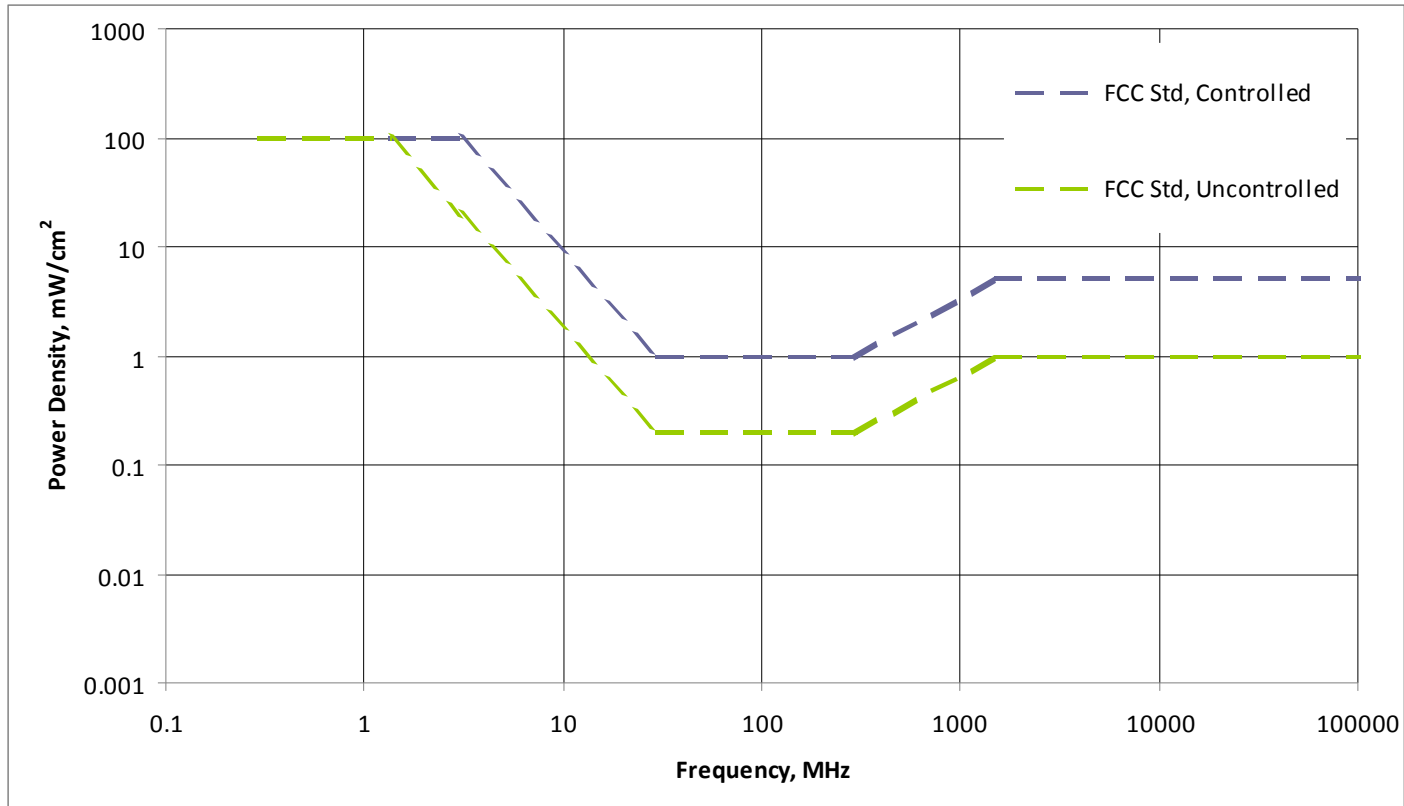
FCC OET65

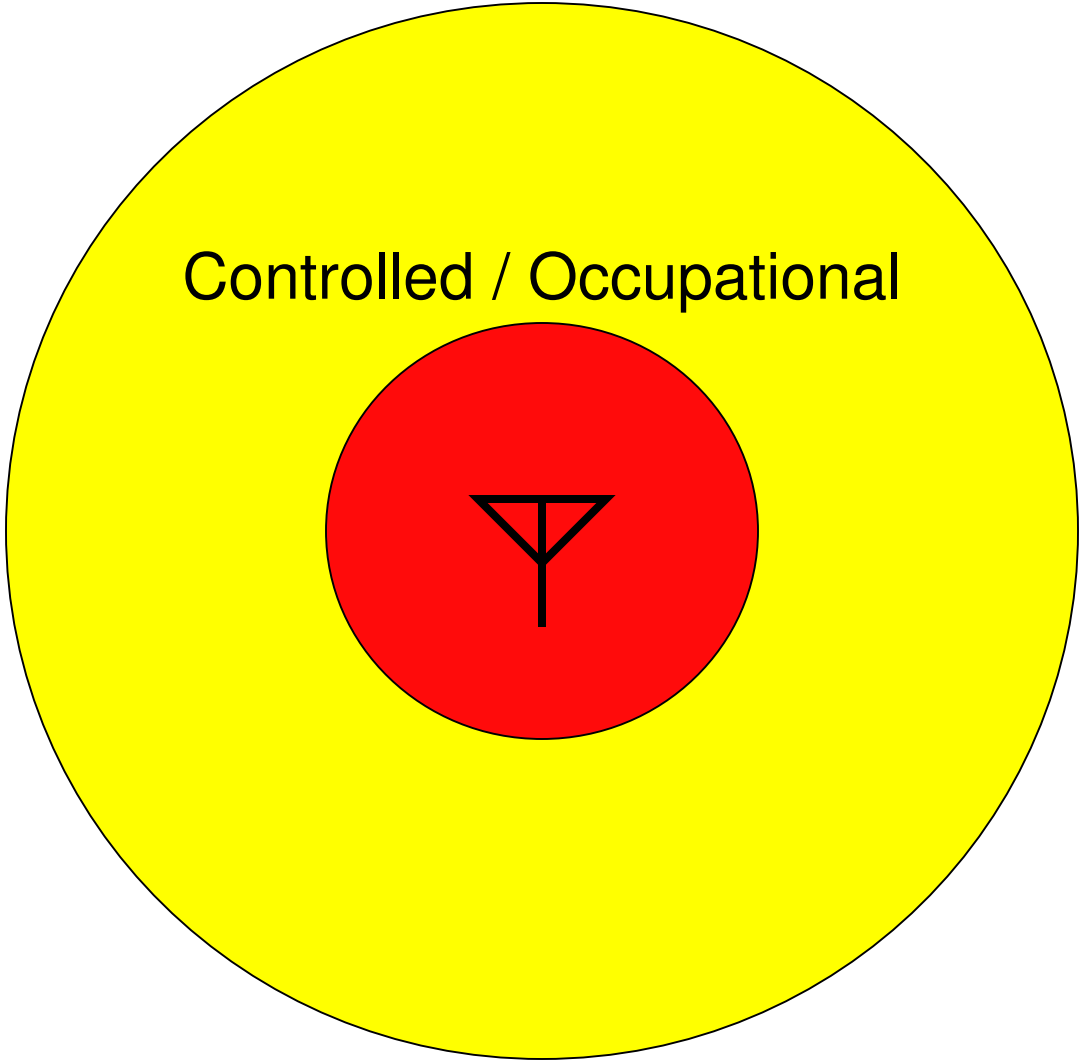
IEEE C95.1

Canadian Safety Code SC-6

ICNIRP (International Commission on Non-Ionizing Radiation Protection)

# FCC Exposure Limits





Controlled / Occupational

Uncontrolled / General Public



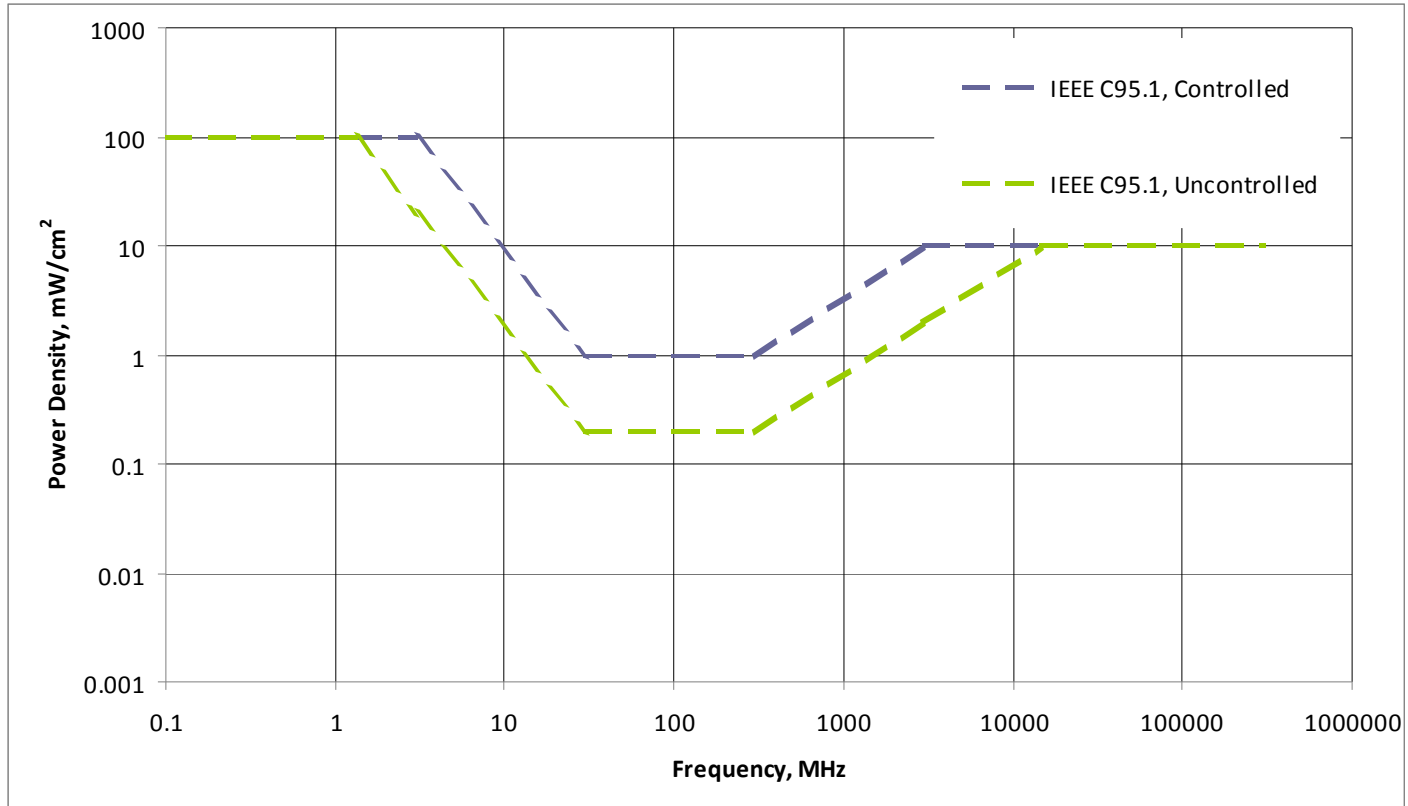
## Other Standards

IEEE c95.1

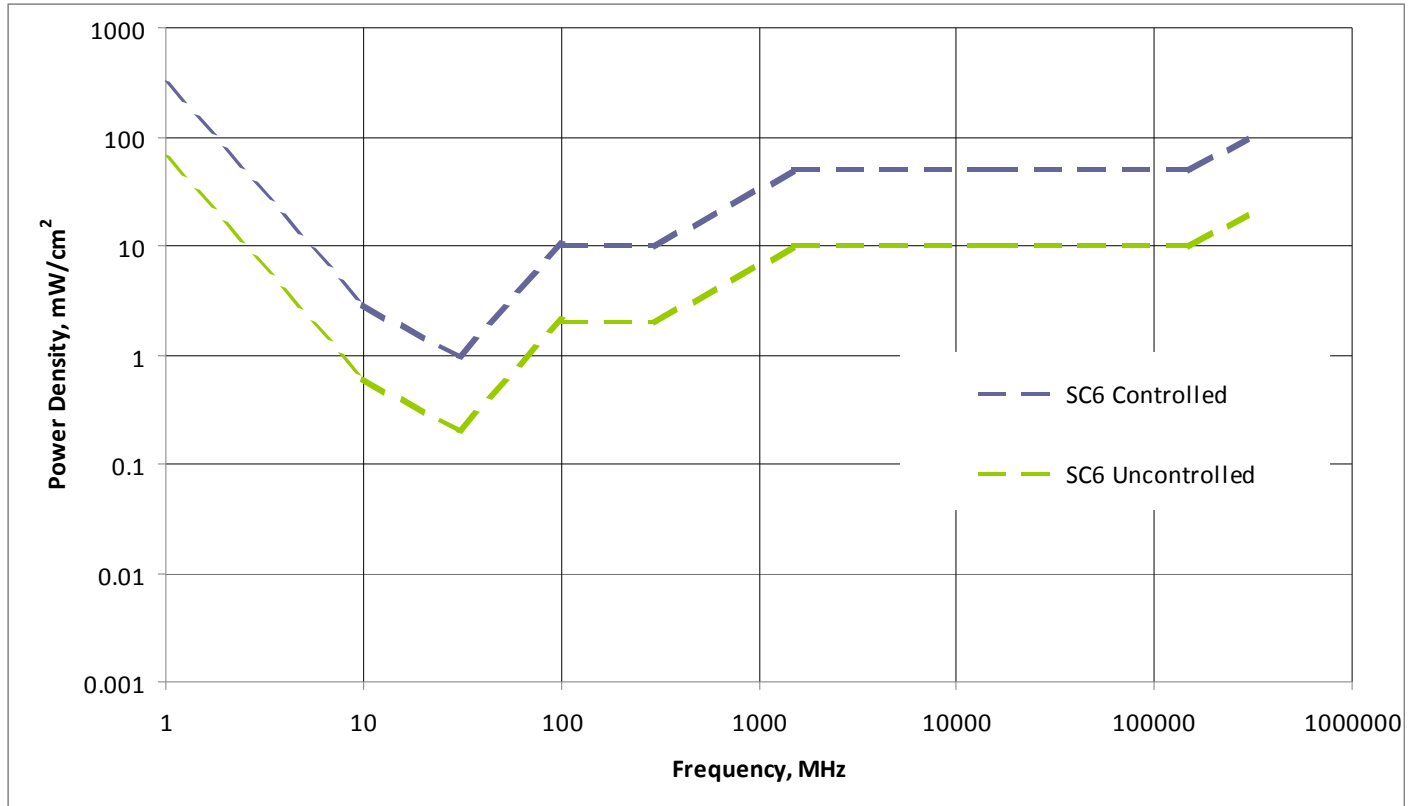
Canadian Safety Code 6 (SC6)

ICNIRP (International Commission on Non-Ionizing  
Radiation Protection)

# IEEE c95.1

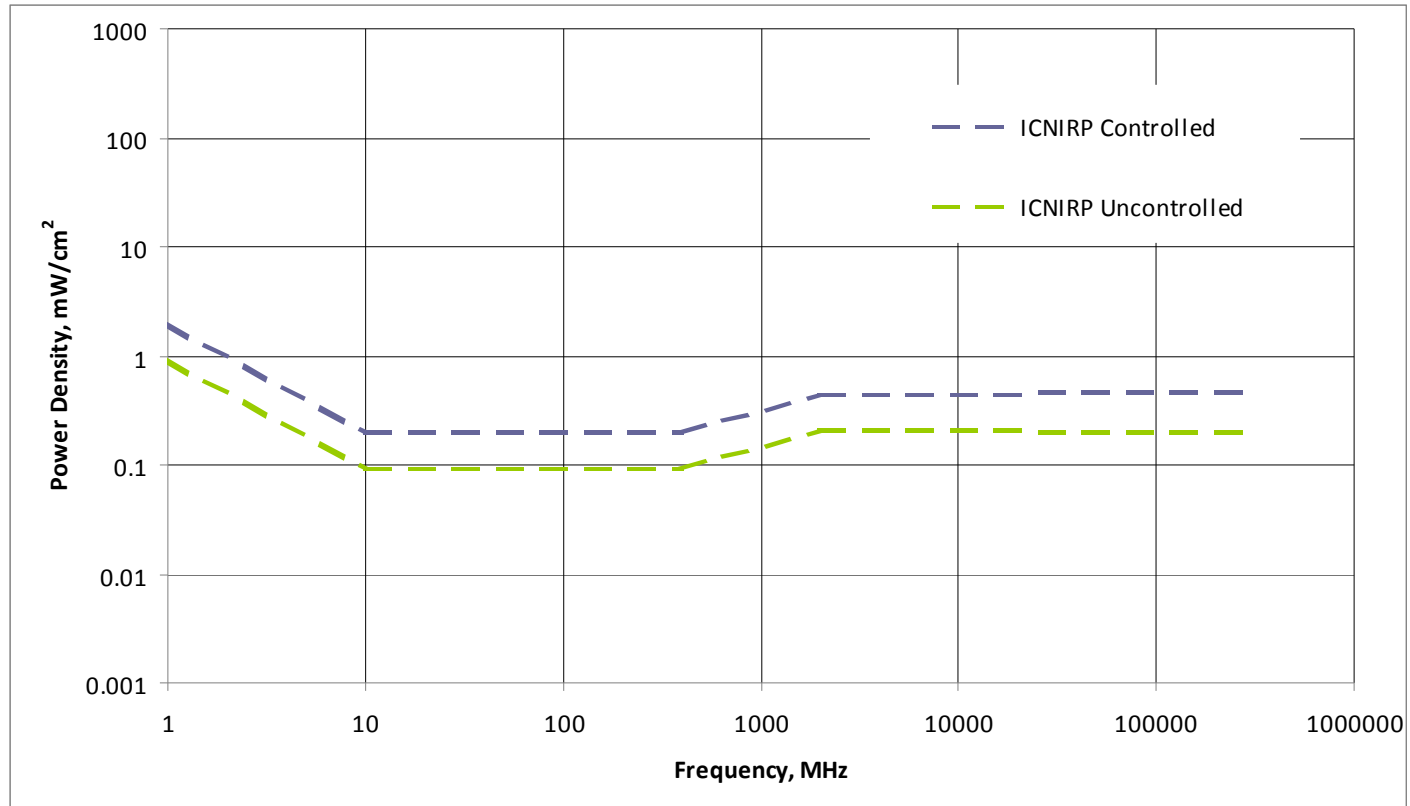


# Canadian Safety Code 6 (SC6)



# ICNIRP

(International Commission on Non-Ionizing Radiation Protection)



## Assessing RF levels in Your Shack

1. Get a copy of FCC OET-65 Supplement B
2. W0JEC MPE Calculator
3. On Line Web Based MPE Calculator
  - [http://hintlink.com/power\\_density.php](http://hintlink.com/power_density.php)
4. Excel Spread sheet created by KC2KY

# W0JEC MPE Calculator

W0JEC Maximum Permissible RF Exposure Calculator, V 1.0

Help Save Results Calculate Power Density Exit

### Maximum Permissible Exposure (MPE) Calculator

Following the procedures recommended in FCC OET bulletin No. 65, Supplement B, this program utilizes your antenna type, frequency of operation, transmitter power, transmission line losses, and ground reflection effects to calculate power density in the main lobe of your antenna. The distance from the antenna that must be maintained to meet the Maximum Permissible Exposure limits in both controlled and uncontrolled environments is then shown.

#### Enter Antenna and Operating Data

Enter type of antenna. Select the closest description from those shown. If none fits, select "Other Antenna Type"	Select the transmission line used from the types listed below.	Enter Transmission Line Length, feet	80
3-element Yagi Array	9913	Enter Transmitter power (Avg. or Max. PEP), watts	100
Antenna Gain, dBi	7.2	Enter Frequency of Operation, MHz	14
		Calculated Power at Antenna, (minus line loss), watts	92.8

The effects of ground reflection must be taken into consideration for most if not all antenna configurations and transmitter power levels in order to arrive at valid results when calculating near field power density. Do you wish to include ground effects?

Yes  
 No

Estimated distances that must be maintained from your transmitting antenna (in feet) in order to meet FCC power density limits for Maximum Permissible Exposure (MPE):

	Controlled Environment	Uncontrolled Environment
SSB w/o Processor (20% duty cycle)	2.1 ft.	4.8 ft.
Conversational CW (40% duty cycle)	3 ft.	6.8 ft.
SSB w/Heavy Processor (50% duty cycle)	2.4 ft.	7.6 ft.

Antenna and Operating Data can be changed by clicking on the data boxes. MPE results must then be recalculated.

9:05 6/24/2

# Online RF Safety Calculator

## Amateur Radio RF Safety Calculator

### Calculation Results

Average Power at the Antenna	100 watts
Antenna Gain in dBi	8 dBi
Distance to the Area of Interest	25 feet 7.62 metres
Frequency of Operation	14 MHz
Are Ground Reflections Calculated?	Yes
Estimated RF Power Density	0.2214 mW/cm <sup>2</sup>

	Controlled Environment	Uncontrolled Environment
Maximum Permissible Exposure (MPE)	4.5968 mW/cm <sup>2</sup>	0.9234 mW/cm <sup>2</sup>
Distance to Compliance From Centre of Antenna	5.5392 feet 1.6883 metres	12.3242 feet 3.7564 metres
Does the Area of Interest Appear to be in Compliance?	yes	yes

### Interpretation of Results

1. The power value entered into these calculations should be the average power seen at the antenna and not Peak Envelope Power (PEP). You should also consider feedline loss in calculating your average power at the antenna.
2. If you wish to estimate the power density at a point below the main lobe of a directional antenna, and if the antenna's vertical pattern is known, recalculate using the antenna's gain in the relevant direction.
3. Please also consult FCC OET Bulletin 65 Supplement B, the Amateur Radio supplement to FCC OET Bulletin 65. It contains a thorough discussion of the RF Safety regulations as they apply to amateur stations and contains numerous charts, tables, worksheets and other data to help determine station compliance.

[Perform another computation](#)

**No Warranties:** This information is provided "as is" without any warranty, condition, or representation of any kind, either express or implied, including but not limited to, any warranty respecting non-infringement, and the implied warranties of conditions of merchantability and fitness for a particular purpose. In no event shall we be liable for any direct, indirect, special, incidental, consequential or other damages howsoever caused whether arising in contract, tort, or otherwise, arising out of or in connection with the use or performance of the information contained on this web site.

[http://hintlink.com/power\\_density.php](http://hintlink.com/power_density.php)

# KC2KY's Excel Spread Sheet

Frequency	Power	Antenna gain	Antenna Height	Minimum distance, base of tower to property line	EIRP, Main Beam	S No Reflection	S With Reflection
MHz	Watts	dBi	Feet	Feet	Watts	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>
1.8	100	0	25	25	100	0.00484297	0.019371881
3.5	100	0	25	25	100	0.00484297	0.019371881
5	50	0	25	25	50	0.002421485	0.009685941
7	100	1.6	25	25	144.5439771	0.007000222	0.028000888
10	100	1.6	25	25	144.5439771	0.007000222	0.028000888
14	100	8	25	25	630.9573445	0.030557077	0.122228308
18	100	8	25	25	630.9573445	0.030557077	0.122228308
21	100	8	25	25	630.9573445	0.030557077	0.122228308
24	100	8	25	25	630.9573445	0.030557077	0.122228308
28	100	8	25	25	630.9573445	0.030557077	0.122228308
50	100	8	25	25	630.9573445	0.030557077	0.122228308
144	35	6	35	25	139.3375097	0.00455951	0.018238039
220	0.1	0	25	25	0.1	4.84297E-06	1.93719E-05
432	20	6	35	25	79.62143411	0.002605434	0.010421736
1296	0.1	0	25	25	0.1	4.84297E-06	1.93719E-05

