Table 1--Transmitters, Facilities and Operations Subject to Routine Environmental Evaluation

Service (title 47 CFR rule part)	Evaluation required if
Amateur Radio Service (Part 97)	Transmitter output power > levels specified in 97.13(c)(1) of this chapter

1.1310 Radiofrequency radiation exposure limits

The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in § 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of § 2.1093 of this chapter. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, *"Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation"*.

Table 1--Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm\2\)	Averaging time (minutes)
(A) **Limits for Occupational/Controlled Exposures** *(See Note 1)*				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f^2)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000	-		5	6
(B) **Limits for General Population/Uncontrolled Exposure** *(See Note 2)*				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f^2)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000	-		1.0	30

f = frequency in MHz* = Plane-wave equivalent power density

Note 1 to Table 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where Occupational / controlled limits apply provided he or she is made aware of the potential for exposure.

Note 2 to Table 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the

potential for exposure or cannot exercise control over their exposure.

Note to Introductory Paragraph:

These limits are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP) in *"Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,"* NCRP Report No. 86, Sections 17.4.1, 17.4.1.1, 17.4.2 and 17.4.3. Copyright NCRP, 1986, Bethesda, Maryland 20814. In the frequency range from 100 MHz to 1500 MHz, exposure limits for field strength and power density are also generally based on guidelines recommended by the American National Standards Institute (ANSI) in Section 4.1 of *"IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,"* ANSI/IEEE C95.1-1992, Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017.

Reference Notes:

Radiofrequency Exposure Standards - Amateur Radio Service

In 1996, the FCC adopted new guidelines and procedures for evaluating human exposure to environmental radiofrequency (RF) electromagnetic fields from FCC-regulated transmitters.

The new policy now requires that amateur radio facilities will be subject to routine evaluation when they are operated above certain power threshold levels. *(See page 11, Restrictions on station location.)*
A routine evaluation is a determination as to whether your station conforms to the FCC's radiofrequency expo-sure requirements. In the past, although amateur stations were expected to comply with the FCC's guidelines, routine station evaluation was not required.

For further information, consult the FCC's revised technical publication, OET Bulletin 65, *Evaluating Compliance with FCC Guidelines for Human Expo-sure to Radiofrequency Electromagnetic Fields* and its Supplement B, *Additional Information for Amateur Radio Stations.* Both of these publications are available on the Internet at the FCC's website:
http://transition.fcc.gov/oet/info/documents/bulletins/

It should be noted that although Bulletin No. 65 and Supplement B offer guidelines and suggestions for evaluating compliance, they do not establish mandatory procedures, and other methods and procedures are acceptable if based on sound engineering practice.

There is a chart in Supplement B which was developed by The W5YI Group in collaboration with Ed Hare, W1RFI of the ARRL Laboratory. This chart contains a table of typical amateur station transmitter power levels and antenna gains for all amateur service frequency bands between 160 meters and 23 cm. You can determine the required distance (in meters) to the Controlled and Uncontrolled environment on a worst case basis by simply looking up the distance indicated for your station's technical parameters.

The W5YI Radiofrequency Exposure Evaluation Charts

Estimated distances in meters from transmitting antennas necessary to meet the FCC power density limits for Maximum Permissible Exposure (MPE) for either occupational/controlled exposures ("Con") or general population/uncontrolled exposures "Unc") using typical antenna gains for the amateur service and assuming 100% duty cycle and maximum surface reflection. Charts represents worst case scenario.

Freq (Mhz/ (MF/HF)	Antenna Gain (dBi)	Distance from antenna (in meters) and the necessary environment							
		100W PEP		500W PEP		1000W PEP		1500W PEP	
		Con.	Unc.	Con.	Unc.	Con.	Unc.	Con.	Unc.
2.0 (160m)	0	0.1	0.2	0.3	0.5	0.5	0.7	0.6	0.8
2.0 (160m)	3	0.2	0.3	0.5	0.7	0.6	1.0	0.8	1.2
4.0 (75/80m)	0	0.2	0.4	0.4	1.0	0.6	1.3	0.7	1.6
4.0 (75/80m)	3	0.3	0.6	0.6	1.3	0.9	1.9	1.0	2.3
7.30 (40m)	0	0.3	0.8	0.8	1.7	1.1	2.5	1.3	3.0
7.30 (40m)	3	0.5	1.1	1.1	2.5	1.6	3.5	1.9	4.2
7.30 (40m)	6	0.7	1.5	1.5	3.5	2.2	4.9	2.7	6.0
10.15 (30m)	0	0.5	1.1	1.1	2.4	1.5	3.4	1.9	4.2
10.15 (30m)	3	0.7	1.5	1.5	3.4	2.2	4.8	2.6	5.9
10.15 (30m)	6	1.0	2.2	2.2	4.8	3.0	6.8	3.7	8.3
14.350 (20m)	0	0.7	1.5	1.5	3.4	2.2	4.8	2.6	5.9
14.350 (20m)	3	1.0	2.2	2.2	4.8	3.0	6.8	3.7	8.4
14.350 (20m)	6	1.4	3.0	3.0	6.8	4.3	9.6	5.3	11.8
14.350 (20m)	9	1.9	4.3	4.3	9.6	6.1	13.6	7.5	16.7
18.168 (17m)	0	0.9	1.9	1.9	4.3	2.7	6.1	3.3	7.5
18.168 (17m)	3	1.2	2.7	2.7	6.1	3.9	8.6	4.7	10.6
18.168 (17m)	6	1.7	3.9	3.9	8.6	5.5	12.2	6.7	14.9
18.168 (17m)	9	2.4	5.4	5.4	12.2	7.7	17.2	9.4	21.1
21.145 (15m)	0	1.0	2.3	2.3	5.1	3.2	7.2	4.0	8.8
21.145 (15m)	3	1.4	3.2	3.2	7.2	4.6	10.2	5.6	12.5
21.145 (15m)	6	2.0	4.6	4.6	10.2	6.4	14.4	7.9	17.6
21.145 (15m)	9	2.9	6.4	6.4	14.4	9.1	20.3	11.1	24.9
24.990 (12m)	0	1.2	2.7	2.7	5.9	3.8	8.4	4.6	10.3
24.990 (12m)	3	1.7	3.8	3.8	8.4	5.3	11.9	6.5	14.5
24.990 (12m)	6	2.4	5.3	5.3	11.9	7.5	16.8	9.2	20.5
24.990 (12m)	9	3.4	7.5	7.5	16.8	10.6	23.7	13.0	29.0
29.700 (10m)	0	1.4	3.2	3.2	7.1	4.5	10.0	5.5	12.2
29.700 (10m)	3	2.0	4.5	4.5	10.0	6.3	14.1	7.7	17.3
29.700 (10m)	6	2.8	6.3	6.3	14.1	8.9	19.9	10.9	24.4
29.700 (10m)	9	4.0	8.9	8.9	19.9	12.6	28.2	15.4	34.5

Freq./Band	(dBi)	50W PEP		100W PEP			500W PEP		1000W PEP
(VHF/UHF)		Con.	Unc.	Con.	Unc.	Con.	Unc.	Con.	Unc.
50 (6m)	0	1.0	2.3	1.4	3.2	3.2	7.1	4.5	10.1
50 (6m)	3	1.4	3.2	2.0	4.5	4.5	10.1	6.4	14.3
50 (6m)	6	2.0	4.5	2.8	6.4	6.4	14.2	9.0	20.1
50 (6m)	9	2.8	6.4	4.0	9.0	9.0	20.1	12.7	28.4
50 (6m)	12	4.0	9.0	5.7	12.7	12.7	28.4	18.0	40.2
50 (6m)	15	5.7	12.7	8.0	18.0	18.0	40.2	25.4	56.8
50 (6m)	20	10.1	22.6	14.3	32.0	32.0	71.4	45.1	101.0

144 (2m)	0	1.0	2.3	1.4	3.2	3.2	7.1	4.5	10.1
144 (2m)	3	1.4	3.2	2.0	4.5	4.5	10.1	6.4	14.3
144 (2m)	6	2.0	4.5	2.8	6.4	6.4	14.2	9.0	20.1
144 (2m)	9	2.8	6.4	4.0	9.0	9.0	20.1	12.7	28.4
144 (2m)	12	4.0	9.0	5.7	12.7	12.7	28.4	18.0	40.2
144 (2m)	15	5.7	12.7	8.0	18.0	18.0	40.2	25.4	56.8
144 (2m)	20	10.1	22.6	14.3	32.0	32.0	71.4	45.1	101.0
222 (1.25m)	0	1.0	2.3	1.4	3.2	3.2	7.1	4.5	10.1
222 (1.25m)	3	1.4	3.2	2.0	4.5	4.5	10.1	6.4	14.3
222 (1.25m)	6	2.0	4.5	2.8	6.4	6.4	14.2	9.0	20.1
222 (1.25m)	9	2.8	6.4	4.0	9.0	9.0	20.1	12.7	28.4
222 (1.25m)	12	4.0	9.0	5.7	12.7	12.7	28.4	18.0	40.2
222 (1.25m)	15	5.7	12.7	8.0	18.0	18.0	40.2	25.4	56.8
222 (1.25m)	20	10.1	22.6	14.3	32.0	32.0	71.4	45.1	101.0
420 (70cm)	0	0.8	1.8	1.2	2.6	2.6	5.8	3.7	8.2
420 (70cm)	3	1.2	2.6	1.6	3.7	3.7	8.2	5.2	11.6
420 (70cm)	6	1.6	3.7	2.3	5.2	5.2	11.6	7.4	16.4
420 (70cm)	9	2.3	5.2	3.3	7.3	7.3	16.4	10.4	23.2
420 (70cm)	12	3.3	7.3	4.6	10.4	10.4	23.2	14.7	32.8
902 (33cm)	0	0.6	1.3	0.8	1.8	1.8	4.1	2.6	5.8
902 (33cm)	3	0.8	1.8	1.2	2.6	2.6	5.8	3.7	8.2
902 (33cm)	6	1.2	2.6	1.6	3.7	3.7	8.2	5.2	11.6
902 (33cm)	9	1.6	3.7	2.3	5.2	5.2	11.6	7.3	16.4
902 (33cm)	12	2.3	5.2	3.3	7.3	7.3	16.4	10.4	23.2
1240 (23cm)	0	0.5	1.1	0.7	1.6	1.6	3.5	2.2	5.0
1240 (23cm)	3	0.7	1.6	1.0	2.2	2.2	5.0	3.1	7.0
1240 (23cm)	6	1.0	2.2	1.4	3.1	3.1	7.0	4.4	9.9
1240 (23cm)	9	1.4	3.1	2.0	4.4	4.4	9.9	6.3	14.0
1240 (23cm)	12	2.0	4.4	2.8	6.2	6.2	14.0	8.8	19.8

Note: Multiply above distances by 0.707 if duty cycle is 50% - such as during a typical back and forth communications exchange. To convert from meters to feet multiply meters by 3.28. Distance indicated is shortest line-of-sight distance to point where MPE limit for appropriate exposure tier is predicted to occur. Amateur radio operators should be aware that the new FCC radiofrequency safety regulations address exposure to people -- and not the strength of the signal. Amateurs may exceed the *Maximum Permissible Exposure* (MPE) limits as long as no one is exposed to the radiation. There are two ways to determine whether your station's radio frequency radiation is within the MPE guidelines established for "controlled" and "uncontrolled" environments. One way is direct "measurement" of the RF fields. The second way is through "prediction" using various equations and calculation methods described in *OET Bulletin 65* and *Supplement B.* The above tables were developed using the equations supplied by the FCC.