



Come out to the BARS Meeting on Thursday September 17th

Come on out to the monthly BARS meeting at the Brandon Assembly of God at 710 South Kings (next to the golf driving range). This month we are back in our usual location in the Annex. Things get underway at 7:30 p.m. when Doris WB9VDT bangs the gavel.

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Ham Radio Classes Offered

Jon Rubin KJ4NYD passes along this information about upcoming ham radio classes.

This is just a reminder that Hillsborough County ARES/RACES will be offering classes for those that would like to either get a new Technician license, or upgrade to a General license. Details below...

WHAT: Technician and General classes

WHERE: Hillsborough County EOC

WHEN: September 26 and October 3 (Both days start at 9AM. Week 1 ends at 5PM. Week 2 ends whenever your exam is finished and graded. This is typically mid to late afternoon)

COST: \$14 for the exam

\$20 deposit for a study guide that students can borrow. The deposit will be returned if the book is returned at the end of class.

There's also a separate optional text that students can purchase to keep. This book is different from the study guide. I'm still trying to get prices on those.

If anybody is interested but has not yet signed up, please reply to me directly at the email address below.

Maximum Permissible RF Exposure¹

Bernie Huth, W4BGH

On August 1, 1996, the FCC announced a significant rules change: Effective January 1, 1997, most radio services including amateur radio must comply with new requirements regulating human exposure to RF radiated fields. The rules set limits on the RF exposure levels to which individuals may be subjected.

The Maximum Permissible Exposure (MPE) limits vary with frequency. The MPE levels represent the amount of energy that can be present where and when people are being exposed. They do not limit the permitted radiated strength from a radio station and do not change the maximum power levels permitted to Amateur Radio operators.

The rules define two exposure environments, each with different MPE levels. The *uncontrolled* environment applies to areas where people would not normally know they are being exposed. This includes "public" areas such as your property line or a neighboring apartment.

Controlled environments apply where people are aware of their exposure and have the ability and knowledge to control it. Greater MPE levels are permitted in controlled areas. A good rule of thumb is that the controlled exposure limit can be applied to those areas in which you can control access. An example of this is your fenced-in backyard. Your own household can also be a controlled environment if your family or guests have been given instruction about RF exposure and safety.

Section 97.13 of the Commission's Rules, 47 C.F.R. § 97.13, requires the licensee to take certain actions before causing or allowing an amateur station to transmit from any place where the operation of the station would cause human exposure to levels of RF fields that are in excess of the FCC guidelines. The licensee must perform an evaluation if the transmitter power of the station *exceeds* the levels specified in 47 CFR § 97.13(c)(1) and repeated in Table 1.

All mobile amateur stations are categorically excluded from this requirement. Such mobile stations are presumed to be used only for very infrequent intermittent two-way operation. They are, however, required to comply with the exposure guidelines.

A comprehensive estimate of RF Exposure can be complex, and involves calculating so-called "far-field" patterns and gains from antennas, conversion of electromagnetic field strengths to RF power densities, antenna efficiencies, and emission types and duty cycles.

Table 4a and Table 4b are taken from the FCC's Supplement B² and give estimates of controlled and

¹<http://www.arrl.org/the-fcc-s-new-rf-exposure-regulations>

²https://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65b.pdf

uncontrolled situations for the amateur MF/HF/VHF/UHF bands. Several powers and antenna gains are shown in these tables. You should note that these estimates for small aperture antennas such a magnetic loop antenna may not be accurate, and these types of antennas should be investigated by other methods.

Table 1. Power Thresholds for Routine Evaluation of Amateur Radio Stations

Wavelength Band	Evaluation Required if Power* (watts) Exceeds:
MF	
160 m	500
HF	
80 m	500
75 m	500
40 m	500
30 m	425
20 m	225
17 m	125
15 m	100
12 m	75
10 m	50
VHF (all bands)	50
UHF	
70 cm	70
33 cm	150
23 cm	200
13 cm	250
SHF (all bands)	250
EHF (all bands)	250
Repeater stations (all bands)	<u>non-building-mounted antennas:</u> height above ground level to lowest point of antenna < 10 m <u>and</u> power > 500 W ERP <u>building-mounted antennas:</u> power > 500 W ERP

* Transmitter power = PEP input to antenna. For repeater stations *only*, power exclusion based on ERP (effective radiated power).

TABLE 4a. (MF/HF Bands)

(Developed by Fred Maia, W5YI Group, working in cooperation with the ARRL.)

Estimated distances in meters from transmitting antennas necessary to meet 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. Chart represents worst case scenario.

Freq. (MF/HF) (MHz/Band)	Antenna Gain (dBi)	Peak Envelope Power (watts)							
		100 watts		500 watts		1000 watts		1500 watts	
		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	1.06	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
7.3 (40m)	0	0.3	0.8	0.8	1.7	1.1	2.5	1.3	3.0
7.3 (40m)	3	0.5	1.1	1.1	2.5	1.6	3.5	1.9	4.2
7.3 (40m)	6	0.7	1.5	1.5	3.5	2.2	4.9	2.7	6.0
10.1 (30m)	0	0.5	1.1	1.1	2.4	1.5	3.4	1.9	4.2
10.1 (30m)	3	0.7	1.5	1.5	3.4	2.2	4.8	2.6	5.9
10.1 (30m)	6	1.0	2.2	2.2	4.8	3.0	6.8	3.7	8.3
14.3 (20m)	0	0.7	1.5	1.5	3.4	2.2	4.8	2.6	5.9
14.3 (20m)	3	1.0	2.2	2.2	4.8	3.0	6.8	3.7	8.4
14.3 (20m)	6	1.4	3.0	3.0	6.8	4.3	9.6	5.3	11.8
14.3 (20m)	9	1.9	4.3	4.3	9.6	6.1	13.6	7.5	16.7
18.16 (17m)	0	0.9	1.9	1.9	4.3	2.7	6.1	3.3	7.5
18.16 (17m)	3	1.2	2.7	2.7	6.1	3.9	8.6	4.7	10.6
18.16 (17m)	6	1.7	3.9	3.9	8.6	5.5	12.2	6.7	14.9
18.16 (17m)	9	2.4	5.4	5.4	12.2	7.7	17.2	9.4	21.1
21.14 (15m)	0	1.0	2.3	2.3	5.1	3.2	7.2	4.0	8.8
21.14 (15m)	3	1.4	3.2	3.2	7.2	4.6	10.2	5.6	12.5
21.14 (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
24.99 (12m)	0	1.2	2.7	2.7	5.9	3.8	8.4	4.6	10.3
24.99 (12m)	3	1.7	3.8	3.8	8.4	5.3	11.9	6.5	14.5
24.99 (12m)	6	2.4	5.3	5.3	11.9	7.5	16.8	9.2	20.5
24.99 (12m)	9	3.4	7.5	7.5	16.8	10.6	23.7	13.0	29.0
29.7 (10m)	0	1.4	3.2	3.2	7.1	4.5	10.0	5.5	12.2
29.7 (10m)	3	2.0	4.5	4.5	10.0	6.3	14.1	7.7	17.3
29.7 (10m)	6	2.8	6.3	6.3	14.1	8.9	19.9	10.9	24.4
29.7 (10m)	9	4.0	8.9	8.9	19.9	12.6	28.2	15.4	34.5

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.

Table 4b. (VHF/UHF Bands)

(Developed by Fred Maia, W5YI Group, working in cooperation with the ARRL.)

Estimated distances in meters from transmitting antennas necessary to meet 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. Chart represents a worst case scenario.

Freq (VHF/UHF) (MHz/Band)	Antenna Gain (dBi)	Peak Envelope Power (watts)							
		50 watts		100 watts		500 watts		1000 watts	
		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
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
450 (70cm)	0	0.8	1.8	1.2	2.6	2.6	5.8	3.7	8.2
450 (70cm)	3	1.2	2.6	1.6	3.7	3.7	8.2	5.2	11.6
450 (70cm)	6	1.6	3.7	2.3	5.2	5.2	11.6	7.4	16.4
450 (70cm)	9	2.3	5.2	3.3	7.3	7.3	16.4	10.4	23.2
450 (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.

There is a web-based calculator for estimating RF Power Density prepared by Paul Evans, VP9KF at http://hintlink.com/power_density.htm . Enter 1. Average power at the antenna in Watts, 2. The antenna gain in dBi (e.g. 2.2 for dipoles), 3. The distance in feet, and the frequency in MHz. You can also include

the effects of ground reflections, and the program will calculate the Estimated Power Density and the “Distance of Compliance” from the center of the antenna.

One final note: These Maximum Permissible Exposure limits vary from country to country. The UK and other European country use ICNIRP guidelines.³ In general the FCC allows higher levels of RF exposure than the ICNIRP guidelines. Thilo Kootz, DL9KCE has written a Windows application called ICNIRPcalc Version 1.3 and has a library of antennas available. It will calculate RF exposure given the RF power, the transmission line type and attenuation, and the mode of operation. It is free and available online at: <http://iaru-r1.org/index.php/documents/func-startdown/630/>

Keep in Mind Our Weekly Nets and Bulletins

**Monday 8 p.m. The Two Meter Net 147.765 - 147.165 MHz Hosted by Doris Haskell
WB9VDT**

**Tuesday 7 p.m. 6-meter Roundtable 50.200 MHz USB followed at 8 p.m. with the 10
Meter Roundtable 28.365 MHz USB**

**Send us your articles AND PICTURES! We do much more in the digital format! I
would like to have pictures of BARS members and their ham shacks!**

Remember to check out the BARS website:

brandonhamradio.org

³ ICNIRP stands for the International Commission on Non-Ionizing Radiation Protection. Their website is <http://www.icnirp.org/>