

Ham 176 - Antenna rf exposure

Dr. Marc & Rosemary Durham, Theway Labs, Bixby, OK © 241219

Objective. Operating a transmitter in a safe, healthy manner is paramount.

History. For decades we have known that excessive radiation can lead to health effects. During the 1980s and 1990s, I was the IEEE/IAS representative to the Committee on Man and Radiation, which included members from industry, military, Motorola, FCC, and others.

In 1997, the FCC released revised rules for RF exposure. Then in 2019, a new report was released that went into effect May 3, 2021. The long and short is hams need to determine if they require a detailed evaluation.

Excerpts. The field strength and exposure power density calculations are very complex, but mostly we do not care. Why? The W5YI Group developed charts that lets you do a table lookup.

Even that chart is many pages. We will take excerpts which are most appropriate for the everyday ham. If you use a beam antenna or operate with more than 100 W, then refer to the complete chart available at <https://www.arrl.org/fcc-rf-exposure-regulations-the-station-evaluation> and other locations.

Operating Duty Factor. Each type transmitter radiates a different amount of time when it is transmitting. Use Table 1 to get the percentage.

Antenna Gain. Each type antenna has different gain. Use dBi from Table 2.

Controlled. Uncontrolled is areas where people do not know they are being exposed, like public areas and your property line.

Mobile & Handi. These do not require evaluation because of low power and use.

Distance. How close is the nearest point, measured directly to the antenna. The location is generally the top of your head. The distances are in feet.

Average power. Tables 3/4 are based on average power at 100% duty cycle.

Worst. These are worst case. Typically, if there is an issue, a closer analysis will resolve the circumstance. Obviously high-power stations are at greater risk. Higher gain antennas can concentrate radiated energy in the direction of gain. Review the base charts for conditions not listed.

Further. If people are further away from the antenna than the distance in the chart, then it is safe exposure. If there is an issue, move the antenna or move the people.

Example. Transmitter: VHF, rated 50W, FM modulation.

What is the closest to antenna that you can be as operator?

Chart 1: FM = 100% duty * 50 W rated = 50 W column to use in Chart 3/4.

Chart 2: Triad vertical = 1 dB, so use 3 dB row in Chart 3/4.

Operator controlled = 'con' in column of Chart 3/4.

VHF = Chart 4.

Chart 4: 4.7 ft = closest point of antenna can be to a person.

Results. This station is safe.

Life is good. Enjoy!

Mode	Duty Factor
Conversational SSB, no DSP	20%
Conversational SSB, some DSP	40%
Voice FM	100%
FSK/RTTY	100%
AFSK	100%
Conversational CW	40%
Carrier	100%

Antenna	dBi
Quarter-wave vertical	1.0
Half-wave dipole	2.15
2-element Yagi	6.0

HF MHz	dBi	100 W	
		Con	Unc
2	0	0.5	0.7
	3	0.7	1.0
4	0	0.6	1.4
	3	0.9	2.0
7.3	0	1.1	2.5
	3	1.6	3.6
10.15	0	1.6	3.5
	3	2.2	5.0
14.35	0	2.2	5.0
	3	3.2	7.1
18.168	0	2.8	6.3
	3	4.0	9.0
21.45	0	3.3	7.5
	3	4.7	10.6
24.99	0	3.9	8.7
	3	5.5	12.3
29.7	0	4.6	10.4
	3	6.5	14.6

VHF, UHF MHz	dBi	50 W		100 W	
		Con	Unc	Con	Unc
50, 144, 222	0	3.3	7.4	4.7	10.5
	3	4.7	10.5	6.6	14.8
420	0	2.8	6.3	4.0	8.8
	3	4.0	8.8	5.6	12.5

