

*RF safety recommendations can change from time to time therefore the following compiled reference material is only provided as a general guide. Please refer to the RF Safety Recommendations that are published in the country where you intend to operate.*

*(Compiled Oct 2011)*

## Guidelines For Human Exposure To Electromagnetic Fields

### 1. FCC Links

[http://www.fcc.gov/Bureaus/Engineering\\_Technology/Documents/bulletins/oet65/oet65b.pdf](http://www.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65b.pdf)

The following link gives details of frequently asked questions about the safety of radiofrequency (RF) and microwave emissions from transmitters and facilities regulated by the FCC.

<http://transition.fcc.gov/oet/rfsafety/rf-faqs.html>

You can also contact the FCC on RF safety at [rfsafety@fcc.gov](mailto:rfsafety@fcc.gov)

### 2. Occupational Safety & Health Administration Link

[http://www.osha.gov/SLTC/radiofrequencyradiation/electromagnetic\\_fieldmemo/electromagnetic.html](http://www.osha.gov/SLTC/radiofrequencyradiation/electromagnetic_fieldmemo/electromagnetic.html)

3. RSGB RF SAFETY LINK <http://www.rsgb.org/emc/docs/pdf/leaflets/emc-leaflet-13.pdf>

4. ARRL RF SAFETY LINK <http://www.arrl.org/rf-radiation-and-electromagnetic-field-safety>

### 5. UK HEALTH PROTECTION AGENCY

i). Reference Levels for UK Amateur Radio Bands

[http://www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/InformationSheets/info\\_AmateurRadio/](http://www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/InformationSheets/info_AmateurRadio/)

ii). Advice on Limiting Exposure to Electromagnetic Fields (0-300 GHz)

[http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb\\_C/1254510609795](http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1254510609795)

**WARNING** Even when fed at low power levels, small mag loop antennas produce very high voltages across the capacitor and concentrated electromagnetic radiation



Supplement B  
(Edition 97-01)  
to  
OET Bulletin 65 (Edition 97-01)

## Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

Federal Communications Commission  
Office of Engineering & Technology

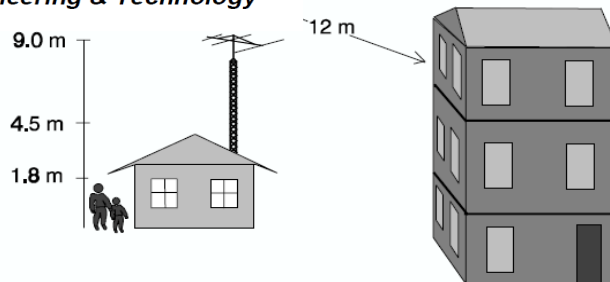


FIGURE 2. Illustration of use of Table 24.

In Figure 2, an amateur station located at a residence is transmitting using a three-element Yagi antenna (20 meter/14.35 MHz) that is located approximately 9 m above ground level. Maximum *average* operating power is 1,000 watts. From Table 24 it is apparent that a person standing at ground level (taken as the 1.8 meters level based on a person's height) would always be exposed below the guidelines, regardless of whether they are considered under the occupational/controlled or the general population/uncontrolled tiers of exposure limits. If only single story residences were located near this amateur station then the station would be assumed to be in compliance with FCC exposure guidelines. However, in the case shown in Figure 2 a three-story apartment building is located adjacent to the amateur station. People living in this building would have to be considered under the general population/uncontrolled exposure guidelines. Since the antenna is the same height (9 meters) as the third story of this building, the amateur would have to ensure that the transmitting antenna is at least 8.8 meters from the apartment building. Since the actual distance in this case is 12 meters, the amateur station can be assumed to be in compliance. However, if the distance were not at least 8.8 meters, the amateur station may not comply but there would still be several options for actions that could ensure compliance. These include (but are not necessarily limited to) raising the center of radiation of the antenna to an appropriate height above the apartment building, moving the antenna to the other side of his property, or possibly incorporating duty cycle considerations into determining exposure levels.

### Tables Based on Computer Modeling

The following tables were developed by the American Radio Relay League (ARRL). The information in these tables was created by use of the Numeric Electromagnetic Code (NEC4), a computer program developed by the Lawrence Livermore Laboratory.<sup>17</sup> The various heights listed for exposure represent different configurations in a typical residential building. For example, the 1.8-meter height was used to estimate ground-level or first-floor exposure. The 3.7 meter height represents the ceiling of a typical first floor or the lower part of a second floor. The 6.1 meter height represents the ceiling of a second floor, or the lower level of a third floor. The 9.1 or 4.6 meter heights represent typical exposure if someone were standing at the same height as the antenna in its main beam. This is a typical "worst-case" exposure for each antenna type. In addition, an 18.2 meter height was included to show how significantly the exposure would drop if antennas were placed at this height or above.

In modeling these antennas, a dielectric constant of 13.0 and a conductivity of 0.005 Seimens were assumed for all antennas. This is generally recognized as "average" ground.

TABLE 24. Twenty (20)-meter band, three-element Yagi,  $f = 14.35$  MHz, HAG = 9.1 m.

Power (watts)	Distance (meters) from any part of the antenna for compliance with either occupational/controlled or general population/uncontrolled exposure limits							
	Height above ground (meters)							
	1.8		3.7		6.1		9.1	
	con.	unc.	con.	unc.	con.	unc.	con.	unc.
50	0	0	0	0	0	0	4.4	4.9
100	0	0	0	0	0	0	4.6	5.2
150	0	0	0	0	0	0	4.7	5.3
250	0	0	0	0	0	0	4.9	5.8
500	0	0	0	0	0	4.0	5.2	6.7
750	0	0	0	0	0	5.5	5.3	7.8
1000	0	0	0	0	0	6.7	5.6	8.8
1500	0	0	0	0	0	8.7	6.0	10.8

# Amateur Radio RF Safety - G8ODE

Extracts from FCC OET Bulletin 65 Supplement B Edition 97-01



## Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

Supplement B  
(Edition 97-01)  
to  
OET Bulletin 65 (Edition 97-01)

Federal Communications Commission  
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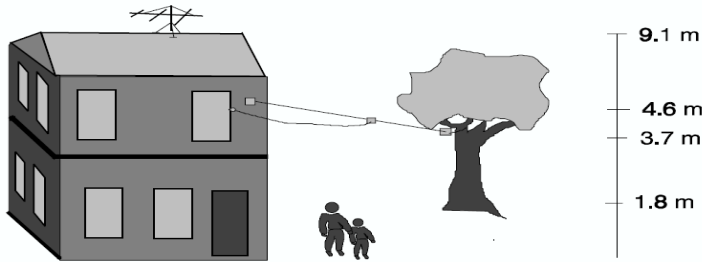


FIGURE 3. Illustration of use of Table 26.

In Figure 3, an amateur station is using a 40 meter/ 7.3 MHz horizontal half-wave dipole antenna that extends from outside a second floor window to a nearby tree. The antenna is approximately 4.6 meters off the ground, and average transmitter power is 1,500 watts. From Table 26 the station would be in compliance with FCC RF guidelines if the amateur or members of his/her immediate household (occupational/controlled exposure) remained directly below the antenna (see 1.8 m column in the table). However, in this example, a household member on the second floor of the house would have to maintain a minimum distance of 2.7 m from the antenna (see 3.7 m and 4.6 m columns for occupational/controlled exposure) in order to ensure compliance. Note also that from Table 26 compliance distances required for a height of 1.8 m are 2 m (general population/uncontrolled). Neighbors of the amateur or persons who do not fit the category of occupational/controlled must stay at least 2 m from the antenna, while at ground level, in order to ensure compliance for continuous exposure. Since the antenna is approximately 4.6 m. off the ground, a person of around 1.8 m. tall would be 2.8 meters from the antenna while they were standing at ground level. Therefore, this station would be in compliance with uncontrolled limits using the parameters listed above.

Also, for the case shown in Figure 3, the amateur station is using a ten-meter, three-element Yagi antenna mounted on the roof of the house that is operated with 100 watts of average power. This power level was chosen because the second floor of the house is located between 3.7-6.1 meters above ground (see Table 19). Since the antenna is mounted approximately 9 meters above ground level, the amateur has decided to operate without any duty factor or time-averaging restrictions that might be necessary if higher power levels were used. As shown in Table 19, the station would be in compliance with the RF guidelines for both occupational/controlled and general population/uncontrolled categories for ground-level and 2nd floor (3.7 and 6.1 m. heights) exposure. If the amateur in this case were to choose to transmit using both antennas simultaneously it would be necessary to consider the total contributions of both antennas to field strength or power density levels at possible exposure locations. This topic is discussed in detail in Bulletin 65, Section 2 (multiple transmitter environments).

TABLE 19. Ten (10)-meter band, three (3)-element Yagi antenna,  $f = 29.7$  MHz, HAG = 9.1 m.

Power (watts)	Distance (meters) from any part of the antenna for compliance with either occupational/controlled or general population/uncontrolled exposure limits							
	Height above ground where exposure occurs (meters)							
	1.8		3.7		6.1		9.1	
	con.	unc.	con.	unc.	con.	unc.	con.	unc.
50	0	0	0	0	0	0	2.6	4.0
100	0	0	0	0	0	0	3.0	5.5
150	0	0	0	0	0	4.7	3.4	6.6
250	0	0	0	0	0	7.5	4.0	8.2
500	0	0	0	14.3	0	15.0	5.5	11.0
750	0	10.7	0	18.0	4.6	21.6	6.5	13.7
1000	0	14.0	0	20.7	6.4	25.3	7.3	18.3
1500	0	17.4	0	24.1	8.5	30.5	8.8	31.4

### Prediction Methods and Derivation of Tables

The tables, figures and graphs provided in this supplement should allow most amateur station licensees and applicants to easily determine the steps necessary to ensure that their stations will comply with the FCC's guidelines. By using the appropriate table or figure for a given antenna type, the station licensee should be able to obtain the necessary compliance information. As an example, to ensure compliance for a station using a certain antenna type and transmitter power level, the minimum separation distance between a person and an antenna is given in the appropriate table. Since continuous exposure is assumed for convenience, and because time-averaging of exposure is allowed, these distances will be conservative (most amateur station transmissions are two-way and thus not continuous for significant periods of time).

TABLE 26. Forty (40)-meter band, horizontal, half-wave dipole wire antenna,  $f = 7.3$  MHz, HAG = 4.6 m.

Power (watts)	Distance (meters) from any part of the antenna for compliance with either occupational/controlled or general population/uncontrolled exposure limits							
	Height above ground (meters)							
	1.8		3.7		4.6		6.1	
	con.	unc.	con.	unc.	con.	unc.	con.	unc.
50	0	0	0	0	0.2	0.5	0	0
100	0	0	0	0	0.3	0.6	0	0
150	0	0	0	0.2	0.4	0.8	0	0
250	0	0	0	0.8	0.5	1.1	0	0
500	0	0	0	1.4	0.6	1.5	0	0.2
750	0	0	0.2	1.8	0.8	2.0	0	1.1
1000	0	0.9	0.6	2.1	0.9	2.1	0	1.5
1500	0	2.0	0.9	2.7	1.2	2.7	0	2.1