



Polk County Amateur Radio Association
2010 General Class Study Guide
Lesson 16

Instructor: Greg N9CHA – ARRL Registered Instructor
Greg@N9CHA.com

Week 4 - February 27th - Lessons 13 - 16

Lesson 16 - "Electrical and RF Safety"

- Chapter 7, pp 8-1 to 8-14

Radio is basically quite safe, but no activity is completely without risk. With your new set of privileges comes increased responsibility to be aware of potential hazards. In this final Lesson, you will learn the basics of Electrical and RF Safety. We'll use selected questions from the question pool to study for this Lesson.

G0B10 – Which of the following is a danger from lead-tin solder? Lead can contaminate food if hands are not washed carefully after handling. In 2006, a new set of environmental regulations called “Reduction of Hazardous Substances: or RoHS went into effect. The goal is to reduce the toxic materials that are used in electronic manufacturing.

G0B04 – What is the mechanism by which electrical shock can be lethal? Current through the heart can cause the heart to stop pumping. Take a look at Table 8-1 on page 8-3. Currents as little as 100 mA can affect normal heart rhythm or electrocution.

G0B13 – Which of the following is the most hazardous type of electrical energy? 60 cycle Alternating current.

G0B14 – What is the maximum amount of electrical current flow through the human body that can be tolerated safely? 50 microamperes.

Current (1 sec contact)	Effect
1 mA	Just perceptible.
5 mA	Maximum harmless current.
10-20 mA	Lower limit for sustained muscular contractions.
30-50 mA	Pain.
50 mA	Pain, possible fainting. "Can't let go" current.
100-300 mA	Normal heart rhythm disrupted. Electrocution if sustained current.
6 A	Sustained heart contractions.

G4C10 – Which of the following is covered in the National Electrical Code? Electrical safety inside the ham shack. The NEC publishes a very nice manual for you to use when wiring your ham shack for that new 240-VAC linear, or other house projects. You can pick them up at Lowe's and Home Depot. It's also available at your local public library.

G0B06 – Why must the metal chassis of every item of station equipment be grounded (assuming the item has such a chassis)? It ensures that hazardous voltages cannot appear on the chassis. Never defeat the safety ground plug on your line cord. The ground plug, while at the same potential as the Neutral, is there to prevent the chassis from being inadvertently being connected to the Hot side of the circuit.

G0B01 – Which wire(s) in a four-conductor line cord should be attached to fuses or circuit breakers in a device operated from a 240-VAC single-phase source? Only the "hot" (black and red) wires.

G0B05 – Which of the following conditions will cause a Ground Fault Circuit Interrupter (GFCI) to disconnect the 120 or 240 Volt AC line power to a device? Current flowing from the hot wire to the neutral wire. Figure 8-5 shows a picture of a typical GFCI receptacle. Source power from your electrical panel goes in the “Source” side of the receptacle. All additional receptacles in the same circuit are connected to the “Load” side of the receptacle and are thus protected.



G4E06 – Which of the following is true of an emergency generator installation? The generator should be located in a well ventilated area. There are several types of stand-by generators. In our area they are mostly the Natural or LP Gas powered types which are actually modified automotive engines with generators attached. Temporary power, such as a portable generator will run on either gas or diesel.

G0B09 – Why is it not safe to use soldered joints when the wires that connect the base of a tower to a system of ground rods? A soldered joint will likely be destroyed by the heat of a lightning strike. Use mechanical clamps, brazing, or welding to be sure the ground connection is heavy enough. Figure 8-8 on page 8-7 shows a metal entrance panel which serves as a common grounding point for all coaxial cable feed lines.



G0B11 – Which of the following is good engineering practice for lightning protection grounds? They must be bonded together with all other grounds.

G0A01 – What is one way that RF energy can affect human body tissue? It heats body tissue. The intensity of the RF energy is called “power density” and it is measured in mW/cm² (milliwatts per square centimeter), which is power per unit of area.

Table 8-3

Maximum Permissible Exposure (MPE) Limits

<i>Controlled Exposure (6-Minute Average)</i>		<i>Uncontrolled Exposure (30-Minute Average)</i>	
<i>Frequency Range (MHz)</i>	<i>Power Density (mW/cm²)</i>	<i>Frequency Range (MHz)</i>	<i>Magnetic Field Power Density (mW/cm²)</i>
0.3-3.0	(100)*	0.3-1.34	(100)*
3.0-30	(900/f ²)*	1.34-30	(180/f ²)*
30-300	1.0	30-300	0.2
300-1500	f/300	300-1500	f/1500
1500-100,000	5	1500-100,000	1.0

f = frequency in MHz

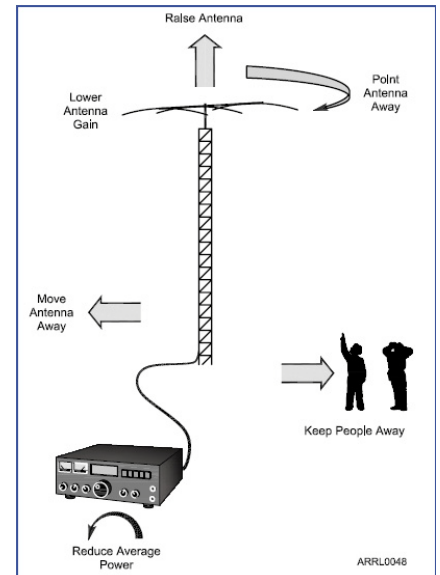
* = Plane-wave equivalent power density

G0A03 – Which of the following has the most direct effect on the permitted exposure level of RF radiation? The power level and frequency of the energy. Figure Table 8-3 on page 8-8 presents the Maximum Permissible Exposure (MPE) Limits, listed as a controlled or uncontrolled exposure during a 6 minute average.

G0A06 – Which transmitter(s) at a multiple user site is/are responsible for RF safety compliance? Any transmitter that contributes 5% or more of the MPE. There is a blue inset on page 8-11 that explains how this is implemented at a commercial repeater site.

G0A15 – How can you determine that your station complies with FCC RF exposure regulations? By calculation based on FCC OET Bulletin 65, by calculation based on computer modeling, by measurement of field strength using calibrated equipment. (all choices)

G0A13 – What precaution should be taken when installing a ground-mounted antenna? It should be installed so no one can be exposed to RF radiation in excess of maximum permissible limits. When designing an antenna system it's important to take RF safety into serious consideration. Figure 8-10 on page 8-12 shows how proper planning can reduce RF exposure to nearby people.



G0A14 – What is one thing that can be done if evaluation shows that a neighbor might receive more than the allowable limit of RF exposure from the main lobe of a directional antenna? Take precautions to ensure that the antenna cannot be pointed at their house. Don't take anything for granted, do your homework and calculate the MPE for both you and those around you.

G0A12 – What precaution should you take whenever you make adjustments or repairs to an antenna? Turn off the transmitter and disconnect the feed-line.

G0B07 – Which of the following should be observed for safety when climbing on a tower using a safety belt or harness? Always attach the belt safety hook to the belt "D" ring with the hook opening away from the tower. A proper climbing harness makes working on towers more comfortable as well as providing essential safety features. Figure 8-12 on page 8-14 shows a proper harness. Climbing belts are no longer acceptable.



G0B08 – What should be done by any person preparing to climb a tower that supports electrically powered devices? Make sure all circuits that supply power to the tower are locked out and tagged. A properly designed circuit panel that feeds power to a tower will have provisions for lock-out tag-out procedures. Figure 8-13 on page 8-14 shows a clasp and locks secured to an electrical panel.