

General Class Study Group Chapter 10 RF Safety

Five questions from this chapter will be on the test.

Manual pages 10-1 to 10-7

G0A01

1. Depending on the wavelength of the signal, the energy density of the RF field, and other factors, in what way can RF energy affect body tissue?

- A. It heats body tissue
- B. It causes radiation poisoning
- C. It causes the blood count to reach a dangerously low level
- D. It cools body tissue

G0A02

2. Which property is NOT important in estimating RF energy's effect on body tissue?

- A. Its duty cycle
- B. Its critical angle
- C. Its power density
- D. Its frequency

G0A03

3. Which of the following has the most direct effect on the permitted exposure level of RF radiation?

- A. The maximum usable frequency of the ionosphere
- B. The frequency (or wavelength) of the energy
- C. The environment near the transmitter
- D. The distance from the antenna

G0A04

4. What unit of measurement best describes the biological effects of RF fields at frequencies used by amateur operators?

- A. Electric field strength (V/m)
- B. Magnetic field strength (A/m)
- C. Specific absorption rate (W/kg)
- D. Power density (W/cm²)

G0A05

5. RF radiation in which of the following frequency ranges has the most effect on the human eyes?

- A. The 3.5-MHz range
- B. The 2-MHz range
- C. The 50-MHz range
- D. The 1270-MHz range

G0A06

6. What does the term "athermal effects" of RF radiation mean?

- A. Biological effects from RF energy other than heating

- B. Chemical effects from RF energy on minerals and liquids
- C. A change in the phase of a signal resulting from the heating of an antenna
- D. Biological effects from RF energy in excess of the maximum permissible exposure level

G0A07

7. At what frequencies does the human body absorb RF energy at a maximum rate?
- A. The high-frequency (3-30-MHz) range
 - B. The very-high-frequency (30-300-MHz) range
 - C. The ultra-high-frequency (300-MHz to 3-GHz) range
 - D. The super-high-frequency (3-GHz to 30-GHz) range

G0A08

8. What does "time averaging" mean when it applies to RF radiation exposure?
- A. The average time of day when the exposure occurs
 - B. The average time it takes RF radiation to have any long term effect on the body
 - C. The total time of the exposure, e.g. 6 minutes or 30 minutes
 - D. The total RF exposure averaged over a certain time

G0A12

9. What factors can affect the thermal aspects of RF energy exposure to human body tissues?
- A. The body part and duration of its exposure
 - B. Frequency and power density
 - C. Wave polarization
 - D. All of these choices are correct

G0B03

10. What effect does duty cycle have when evaluating RF exposure?
- A. Low duty-cycle emissions permit greater short-term exposure levels
 - B. High duty-cycle emissions permit greater short-term exposure levels
 - C. The duty cycle is not considered when evaluating RF exposure
 - D. Any duty cycle may be used as long as it is less than 100 percent

Manual pages 10-7 to 10-13

G0A09

11. What guideline is used to determine whether or not a routine RF evaluation must be performed for an amateur station?
- A. If the transmitter's PEP is 50 watts or more, an evaluation must always be performed
 - B. If the RF radiation from the antenna system falls within a controlled environment, an evaluation must be performed
 - C. If the RF radiation from the antenna system falls within an uncontrolled environment, an evaluation must be performed
 - D. If the transmitter's PEP and frequency are within certain limits given in Part 97, an evaluation must be performed

G0A10

12. If you perform a routine RF evaluation on your station and determine that its RF fields exceed the FCC's exposure limits in human-accessible areas, what are you required to do?

- A. Take action to prevent human exposure to the excessive RF fields
- B. File an Environmental Impact Statement (EIS-97) with the FCC
- C. Secure written permission from your neighbors to operate above the controlled MPE limits
- D. Nothing; simply keep the evaluation in your station records

G0A11

13. At a site with multiple transmitters operating at the same time, how is each transmitter included in the RF exposure site evaluation?

- A. Only the RF field of the most powerful transmitter need be considered
- B. The RF fields of all transmitters are multiplied together
- C. Transmitters that produce more than 5% of the maximum permissible power density exposure limit for that transmitter must be included
- D. Only the RF fields from any transmitters operating with high duty-cycle modes (greater than 50%) need to be considered

G0B01

14. What are the FCC's RF-safety rules designed to control?

- A. The maximum RF radiated electric field strength
- B. The maximum RF radiated magnetic field strength
- C. The maximum permissible human exposure to all RF radiated fields
- D. The maximum RF radiated power density

G0B02

15. At a site with multiple transmitters, who must ensure that all FCC RF-safety regulations are met?

- A. All licensees contributing more than 5% of the maximum permissible power density exposure for that transmitter are equally responsible
- B. Only the licensee of the station producing the strongest RF field is responsible
- C. All of the stations at the site are equally responsible, regardless of any station's contribution to the total RF field
- D. Only the licensees of stations which are producing an RF field exceeding the maximum permissible exposure limit are responsible

G0B04

16. What is the threshold power used to determine if an RF environmental evaluation is required when the operation takes place in the 15-meter band?

- A. 50 watts PEP
- B. 100 watts PEP
- C. 225 watts PEP
- D. 500 watts PEP

G0B05

17. Why do the power levels used to determine if an RF environmental evaluation is required vary with frequency?

- A. Because amateur operators may use a variety of power levels

- B. Because Maximum Permissible Exposure (MPE) limits are frequency dependent
- C. Because provision must be made for signal loss due to propagation
- D. All of these choices are correct

G0B06

18. What is the threshold power used to determine if an RF environmental evaluation is required when the operation takes place in the 10-meter band?

- A. 50 watts PEP
- B. 100 watts PEP
- C. 225 watts PEP
- D. 500 watts PEP

G0B07

19. What is the threshold power used to determine if an RF environmental evaluation is required for transmissions in the amateur bands with frequencies less than 10 MHz?

- A. 50 watts PEP
- B. 100 watts PEP
- C. 225 watts PEP
- D. 500 watts PEP

G0B08

20. What amateur frequency bands have the lowest power limits above which an RF environmental evaluation is required?

- A. All bands between 17 and 30 meters
- B. All bands between 10 and 15 meters
- C. All bands between 40 and 160 meters
- D. All bands between 1.25 and 10 meters

G0B09

21. What is the threshold power used to determine if an RF safety evaluation is required when the operation takes place in the 20-meter band?

- A. 50 watts PEP
- B. 100 watts PEP
- C. 225 watts PEP
- D. 500 watts PEP

G0B10

22. Which of the following amateur radio stations are subject to routine environmental evaluation?

- A. Those stations that use gain-type antennas at HF frequencies
- B. All except portable stations
- C. All except those stations where no one is exposed to RF radiation
- D. Those stations with transmitter output levels exceeding 500-watts PEP on the 40, 75/80 and 160 meter bands

Manual pages 10-13 to 10-14

G0C07

23. Which of the following steps might an amateur operator take to ensure compliance with the RF safety regulations?

- A. Post a copy of FCC Part 97 in the station
- B. Post a copy of OET Bulletin 65 in the station
- C. Nothing; amateur compliance is voluntary
- D. Perform a routine RF exposure evaluation

G0C10

24. If your station complies with the RF safety rules and you reduce its power output from 500 to 40 watts, how would the RF safety rules apply to your operations?

- A. You would need to reevaluate your station for compliance with the RF safety rules because the power output changed
- B. You would need to reevaluate your station for compliance with the RF safety rules because the transmitting parameters changed
- C. You would not need to perform an RF safety evaluation, but your station would still need to be in compliance with the RF safety rules
- D. The RF safety rules would no longer apply to your station because it would be operating with less than 50 watts of power

G0C11

25. If your station complies with the RF safety rules and you reduce its power output from 1000 to 500 watts, how would the RF safety rules apply to your operations?

- A. You would need to reevaluate your station for compliance with the RF safety rules because the power output changed
- B. You would need to reevaluate your station for compliance with the RF safety rules because the transmitting parameters changed
- C. You would need to perform an RF safety evaluation to ensure your station would still be in compliance with the RF safety rules
- D. Since your station was in compliance with RF safety rules at a higher power output, you need to do nothing more

G0E02

26. If measurements indicate that individuals in your station are exposed to more than the maximum permissible level of radiation, which of the following corrective measures would be effective?

- A. Ensure proper grounding of the equipment
- B. Ensure that all equipment covers are tightly fastened
- C. Use the minimum amount of transmitting power necessary
- D. All of these choices are correct

G0E03

27. If calculations show that you and your family may be receiving more than the maximum permissible RF radiation exposure from your 20-meter indoor dipole, which of the following steps might be appropriate?

- A. Use RTTY instead of CW or SSB voice emissions
- B. Move the antenna to a safe outdoor environment

- C. Use an antenna-matching network to reduce your transmitted SWR
- D. All of these choices are correct

G0E05

28. What might you do if an RF radiation evaluation shows that your neighbors may be receiving more than the maximum RF radiation exposure limit from your Yagi antenna when it is pointed at their house?

- A. Change from horizontal polarization to vertical polarization
- B. Change from horizontal polarization to circular polarization
- C. Use an antenna with a higher front to rear ratio
- D. Take precautions to ensure you can't point your antenna at their house

G0E06

29. What might you do if an RF radiation evaluation shows that your neighbors may be receiving more than the maximum RF radiation exposure limit from your quad antenna when it is pointed at their house?

- A. Reduce your transmitter power to a level that reduces their exposure to a value below the maximum permissible exposure (MPE) limit
- B. Change from horizontal polarization to vertical polarization
- C. Use an antenna with a higher front to side ratio
- D. Use an antenna with a sharper radiation lobe

G0E09

30. From an RF radiation exposure point of view, what is the advantage to using a high-gain, narrow-beamwidth antenna for your VHF station?

- A. High-gain antennas absorb stray radiation
- B. The RF radiation can be focused in a direction away from populated areas
- C. Narrow-beamwidth antennas eliminate exposure in areas directly under the antenna
- D. All of these choices are correct

G0E10

31. From an RF radiation exposure point of view, what is the disadvantage in using a high-gain, narrow-beamwidth antenna for your VHF station?

- A. High-gain antennas must be fed with coaxial cable feed-line, which radiates stray RF energy
- B. The RF radiation can be better focused in a direction away from populated areas
- C. Individuals in the main beam of the radiation pattern will receive a greater exposure than when a low-gain antenna is used
- D. All of these choices are correct

G0E11

32. If your station is located in a residential area, which of the following would best help you reduce the RF exposure to your neighbors from your amateur station?

- A. Use RTTY instead of CW or SSB voice emissions
- B. Use top-quality coaxial cable to reduce RF losses in the feed-line
- C. Install your antenna as high as possible to maximize the distance to nearby people
- D. Use an antenna matching network to reduce your transmitted SWR

G0E12

33. What could be done to ensure greater RF safety near a ground mounted vertical antenna?

- A. Construct fencing to exclude people from getting too close to the antenna
- B. Avoid transmitter output power levels above 50-watts
- C. Increase the gain of the antenna
- D. Add a parasitic element to redirect RF energy away from uncontrolled area

Manual pages 10-14 to 10-17

G0D01

34. Considering RF safety, what precaution should you take if you install an indoor transmitting antenna?

- A. Locate the antenna close to your operating position to minimize feed line losses
- B. Position the antenna along the edge of a wall where it meets the floor or ceiling to reduce parasitic radiation
- C. Locate the antenna as far away as possible from living spaces that will be occupied while you are operating
- D. Position the antenna parallel to electrical power wires to take advantage of parasitic effects

G0D02

35. Considering RF safety, what precaution should you take whenever you make adjustments to the feed line of a directional antenna system?

- A. Be sure no one can activate the transmitter
- B. Disconnect the antenna-positioning mechanism
- C. Point the antenna away from the sun so it doesn't concentrate solar energy on you
- D. Be sure you and the antenna structure are properly grounded

G0D03

36. What is the best reason to place a protective fence around the base of a ground-mounted transmitting antenna?

- A. To reduce the possibility of persons being exposed to levels of RF in excess of the maximum permissible exposure (MPE) limits
- B. To reduce the possibility of animals damaging the antenna
- C. To reduce the possibility of persons vandalizing expensive equipment
- D. To improve the antenna's grounding system and thereby reduce the possibility of lightning damage

G0D04

37. What RF-safety precautions should you take before beginning repairs on an antenna?

- A. Be sure you and the antenna structure are grounded
- B. Be sure to turn off the transmitter and disconnect the feed-line
- C. Inform your neighbors so they are aware of your intentions
- D. Turn off the main power switch in your house

G0D05

38. What precaution should be taken when installing a ground-mounted antenna?
- A. It should not be installed higher than you can reach
 - B. It should not be installed in a wet area
 - C. It should be painted so people or animals do not accidentally run into it
 - D. It should be installed so no one can be exposed to RF radiation in excess of the maximum permissible exposure (MPE) limits

G0D06

39. What precaution should you take before beginning repairs on a microwave feed horn or waveguide?
- A. Wear tight-fitting clothes and gloves to protect your body and hands from sharp edges
 - B. Be sure the transmitter is turned off and the power source is disconnected
 - C. Wait until the weather is dry and sunny
 - D. Be sure propagation conditions are not favorable for troposphere ducting

G0D07

34. Why should directional high-gain antennas be mounted higher than nearby structures?
- A. To eliminate inversion of the major and minor lobes
 - B. So they will not damage nearby structures with RF energy
 - C. So they will receive more sky waves and fewer ground waves
 - D. So they will not direct excessive amounts of RF energy toward people in nearby structures

G0D08

41. For best RF safety, where should the ends and center of a dipole antenna be located?
- A. Near or over moist ground so RF energy will be radiated away from the ground
 - B. As close to the transmitter as possible so RF energy will be concentrated near the transmitter
 - C. As far away as possible to minimize RF exposure to people near the antenna
 - D. Close to the ground so simple adjustments can be easily made without climbing a ladder

G0D09

42. What should you do to reduce RF radiation exposure when operating at 1270 MHz?
- A. Make sure that an RF leakage filter is installed at the antenna feed point
 - B. Keep the antenna away from your eyes when RF is applied
 - C. Make sure the standing wave ratio is low before you conduct a test
 - D. Never use a shielded horizontally polarized antenna

G0D10

43. Considering RF safety, which of the following is the best reason to mount the antenna of a mobile VHF transceiver in the center of a metal roof?
- A. The roof will greatly shield the driver and passengers from RF radiation

- B. The antenna will be out of the driver's line of sight
- C. The center of a metal roof is the sturdiest mounting place for an antenna
- D. The wind resistance of the antenna will be centered between the wheels and not drag on one side or the other

G0D11

44. Why should you avoid using attic-mounted antennas?
- A. They may expose people in the house to strong, near field RF energy
 - B. The attic may not have adequate thermal insulation for the antenna
 - C. People moving around in the house might detune the antenna
 - D. All of these choices are correct

G0D12

45. Why must you be careful when aiming EME (moonbounce) arrays toward the horizon?
- A. Their high ERP may produce hazardous RF fields in uncontrolled areas
 - B. They could cause TVI/RFI for your neighbors
 - C. Reflections from nearby objects could detune the array
 - D. All of these choices are correct

G0E01

46. If you receive minor burns every time you touch your microphone while you are transmitting, which of the following statements is true?
- A. You need to use a low-impedance microphone
 - B. You and others in your station may be exposed to more than the maximum permissible level of RF radiation
 - C. You need to use a surge suppressor on your station transmitter
 - D. All of these choices are correct

G0E04

47. Considering RF exposure, which of the following steps should you take when installing an antenna?
- A. Install the antenna as high and far away from populated areas as possible
 - B. If the antenna is a gain antenna, point it away from populated areas
 - C. Minimize feed line radiation into populated areas
 - D. All of these choices are correct

G0E07

48. Why does a dummy antenna provide an RF safe environment for transmitter adjusting?
- A. The dummy antenna carries the RF energy far away from the station before releasing it
 - B. The RF energy is contained in a halo around the outside of the dummy antenna
 - C. The RF energy is not radiated from a dummy antenna, but is converted to heat
 - D. The dummy antenna provides a perfect match to the antenna feed impedance

G0E08

49. From an RF radiation exposure point of view, which of the following materials would be the best to use for your homemade transmatch enclosure?

- A. Aluminum
- B. Bakelite
- C. Transparent acrylic plastic
- D. Any nonconductive material

Manual pages 10-17 to 10-22

G0C01

50. If the free-space far-field strength of a 10-MHz dipole antenna measures 1.0 millivolts per meter at a distance of 5 wavelengths, what will the field strength measure at a distance of 10 wavelengths?

- A. 0.10 millivolts per meter
- B. 0.25 millivolts per meter
- C. 0.50 millivolts per meter
- D. 1.0 millivolts per meter

G0C02

51. If the free-space far-field strength of a 28-MHz Yagi antenna measures 4.0 millivolts per meter at a distance of 5 wavelengths, what will the field strength measure at a distance of 20 wavelengths?

- A. 2.0 millivolts per meter
- B. 1.0 millivolts per meter
- C. 0.50 millivolts per meter
- D. 0.25 millivolts per meter

G0C03

52. If the free-space far-field strength of a 1.8-MHz dipole antenna measures 9 microvolts per meter at a distance of 4 wavelengths, what will the field strength measure at a distance of 12 wavelengths?

- A. 3 microvolts per meter
- B. 3.6 microvolts per meter
- C. 4.8 microvolts per meter
- D. 10 microvolts per meter

G0C04

53. If the free-space far-field power density of a 18-MHz Yagi antenna measures 10 milliwatts per square meter at a distance of 3 wavelengths, what will it measure at a distance of 6 wavelengths?

- A. 11 milliwatts per square meter
- B. 5.0 milliwatts per square meter
- C. 3.3 milliwatts per square meter
- D. 2.5 milliwatts per square meter

G0C05

54. If the free-space far-field power density of an antenna measures 9 milliwatts per square meter at a distance of 5 wavelengths, what will the field strength measure at a distance of 15 wavelengths?

- A. 3 milliwatts per square meter
- B. 1 milliwatt per square meter
- C. 0.9 milliwatt per square meter
- D. 0.09 milliwatt per square meter

G0C06

55. What factors determine the location of the boundary between the near and far fields of an antenna?

- A. Wavelength of the signal and physical size of the antenna
- B. Antenna height and element material
- C. Boom length and element material
- D. Transmitter power and antenna gain

G0C08

56. In the free-space far field, what is the relationship between the electric field (E field) and magnetic field (H field)?

- A. The electric field strength is equal to the square of the magnetic field strength
- B. The electric field strength is equal to the cube of the magnetic field strength
- C. The electric and magnetic field strength has a fixed impedance relationship of 377 ohms
- D. The electric field strength times the magnetic field strength equals 377 ohms

G0C09

57. What type of instrument can be used to accurately measure an RF field?

- A. A receiver with an S meter
- B. A calibrated field-strength meter with a calibrated antenna
- C. A betascope with a dummy antenna calibrated at 50 ohms
- D. An oscilloscope with a high-stability crystal marker generator