

Amateur Radio General License Training

Welcome to 2023 Amateur
Radio General Class License
Training

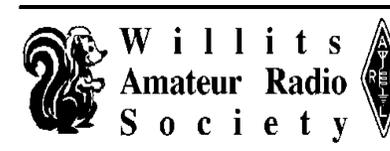
Amateur Radio General License Training

These presentations are sponsored by:

Mendocino Auxiliary Communications Service (MACS)

Mendocino County Amateur Radio Communications Service (McARCS)

Willits Amateur Radio Society (WARS)



Topics on General Class Exam

Section	Contents	Questions on Exam	Questions in Pool	Covered in Session
G1	FCC Rules and Regulations	5	57	Session 5
G2	Operating Procedures	5	50	Session 4
G3	Radio Wave Propagation	3	37	Session 2
G4	Amateur Radio Practices	5	60	Session 3
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G0	<i>Electrical and RF Safety</i>	2	25	Session 4

Sub-element G0 – Electrical and RF Safety

Topics in G0:

Electrical and RF Safety

- RF safety principles, rules, and guidelines; routine station evaluation
- Station safety: electrical shock, grounding, fusing, interlocks, and wiring; antenna and tower safety

One question from each of the two categories on exam

Review questions:

G6B03

Which of the following is an advantage of CMOS integrated circuits compared to TTL integrated circuits?

- A. Low power consumption
- B. High power handling capability
- C. Better suited for RF amplification
- D. Better suited for power supply regulation

Review questions:

G8C07

Which of the following narrow-band digital modes can receive signals with very low signal-to-noise ratios?

- A. MSK144
- B. FT8
- C. AMTOR
- D. MFSK32

Review questions:

G3B03

Which frequency will have the least attenuation for long-distance skip propagation?

- A. Just below the MUF
- B. Just above the LUF
- C. Just below the critical frequency
- D. Just above the critical frequency

Review questions:

G7A08

Which of the following is characteristic of a switchmode power supply as compared to a linear power supply?

- A. Faster switching time makes higher output voltage possible
- B. Fewer circuit components are required
- C. High-frequency operation allows the use of smaller components
- D. Inherently more stable

Review questions:

G4C06

What is a possible effect of a resonant ground connection?

- A. Overheating of ground straps
- B. Corrosion of the ground rod
- C. High RF voltages on the enclosures of station equipment
- D. A ground loop

Review questions:

G9B10

What is the approximate length for a 1/2 wave dipole antenna cut for 14.250 MHz?

- A. 8 feet
- B. 16 feet
- C. 24 feet
- D. 33 feet

Review questions:

G5C13

Which of the following components should be added to a capacitor to increase the capacitance?

- A. An inductor in series
- B. An inductor in parallel
- C. A capacitor in parallel
- D. A capacitor in series

Review questions:

G4B05

Why do voltmeters have high input impedance?

- A. It improves the frequency response
- B. It allows for higher voltages to be safely measured
- C. It improves the resolution of the readings
- D. It decreases the loading on circuits being measured

Electrical Safety

Human body:

- **Electrical current does the damage**
 - Heats tissue
 - Disrupts electrical function of cells
 - Causes involuntary muscle contractions
- **Most dangerous when passing through chest**
- **Higher voltage = greater risk**
 - As little as 30V can be fatal
 - *Power supply interlock ensures that dangerous voltages are removed when cabinet is opened*

Electrical Safety

Electrical safety:

Station electrical safety covered by National Electrical Code (NEC)

- AWG (American wire gauge) higher number = smaller diameter wire
- Higher AWG = lower current capacity
- *NEC specifies AWG #14 wire appropriate up to 15 amperes*
- *Minimum AWG #12 used for safely wiring a 20-ampere circuit breaker*

Electrical Safety

AC equipment protection:

- Install fuse/circuit breaker in “hot” conductor only
- *Four-conductor 240 VAC circuit*
 - Two “hot” conductors
 - One “neutral” one “ground”
 - *Fuse “hot” wires only*
- Ground fault circuit interrupter (GFCI)
 - *Current flowing from hot wires to neutral will cause GFCI to disconnect AC*

Electrical Safety

Health related questions:

- *Danger from lead-tin solder*
 - *Lead can contaminate food if hands are not washed carefully*
 - Use lead-free solder
- *Emergency generator installation*
 - *Generator should be operated in a well-ventilated area*
 - Ground generator, fuel storage, fire extinguisher

Antenna and Tower Safety

Lightning protection:

- **Serious risk of personal and property damage**
- ***Coaxial lightning arrestors protect equipment***
 - *Locate where feed lines enter building.*
 - *Attach to the station's lightning ground system*
 - *Should be close as possible to the station equipment*
- **Lightning protection ground rods bonded to all other grounds**



Antenna and Tower Safety

Tower safety:

Climber safety

- Tower climber exposed to significant risk
- *Confirm safety harness is rated for weight of climber and within allowable service life*
- *If tower supports electrically powered devices, lock out/tag supply power*

Section questions:

GOB06

Which of the following is covered by the National Electrical Code?

- A. Acceptable bandwidth limits
- B. Acceptable modulation limits
- C. Electrical safety of the station
- D. RF exposure limits of the human body

Section questions:

GOB08

What should be done before climbing a tower that supports electrically powered devices?

- A. Notify the electric company that a person will be working on the tower
- B. Make sure all circuits that supply power to the tower are locked out and tagged
- C. Unground the base of the tower
- D. All these choices are correct

Section questions:

GOB03

Which size of fuse or circuit breaker would be appropriate to use with a circuit that uses AWG number 14 wiring?

- A. 30 amperes
- B. 25 amperes
- C. 20 amperes
- D. 15 amperes

Section questions:

GOB10

Which of the following is a danger from lead-tin solder?

- A. Lead can contaminate food if hands are not washed carefully after handling the solder
- B. High voltages can cause lead-tin solder to disintegrate suddenly
- C. Tin in the solder can “cold flow,” causing shorts in the circuit
- D. RF energy can convert the lead into a poisonous gas

Section questions:

G0B13

Where should lightning arrestors be located?

- A. Where the feed lines enter the building
- B. On the antenna, opposite the feed point
- C. In series with each ground lead
- D. At the closest power pole ground electrode

RF Exposure Safety

RF exposure guidelines:

- Established to protect hams and neighbors
- RF energy - non-ionizing
- *RF energy affects the human body, heats body tissue*
- Touching antenna while transmitting = RF burn

RF Exposure Safety

FCC establishes guidelines:

Not limited to amateur radio stations

- *Apply to all stations with time-averaged transmission > 1 mW*
- *“time averaging” = total RF exposure averaged over a certain period.*

Amateur operator must *take steps to ensure compliance*

- *Perform a routine RF exposure evaluation*
- *Prevent access to any identified high exposure areas*

RF Exposure Safety

RF exposure guidelines:

Ways to determine that station complies with FCC RF exposure regulations

- *Calculations based on FCC OET Bulletin 65*
- *Calculations based computer modeling*
- *Measure field strength with calibrated equipment*

Instrument that can accurately measure an RF field strength

- *Calibrated field strength meter with calibrated antenna*

RF Exposure Safety

RF exposure guidelines:

Factors determining RF exposure from transmitted signal

- *Duty cycle*
- *Frequency*
- *Power density*
- All these choices are correct

Effect of modulation duty cycle on RF exposure

- Lower duty cycle permits greater tx power levels

RF Exposure Safety

RF exposure guidelines:

Station likely to fail to meet the FCC RF exposure exemption criteria

- *Need to perform RF Exposure Evaluation in accordance with FCC OET Bulletin 65*

Evaluation shows that the RF energy radiated exceeds permissible limits

- *Take action to prevent human exposure to excessive RF fields*

Precautions to take when installing an indoor transmitting antenna

- *Make sure MPE limits are not exceeded in occupied areas*

If neighbor might experience more than allowable limit of RF exposure from main lobe of a directional antenna

- *Take precautions, ensure that antenna not pointed in their direction when present*

Section questions:

G0A07

What is the effect of modulation duty cycle on RF exposure?

- A. A lower duty cycle permits greater power levels to be transmitted
- B. A higher duty cycle permits greater power levels to be transmitted
- C. Low duty cycle transmitters are exempt from RF exposure evaluation requirements
- D. High duty cycle transmitters are exempt from RF exposure requirements

Section questions:

GOA02

Which of the following is used to determine RF exposure from a transmitted signal?

- A. Its duty cycle
- B. Its frequency
- C. Its power density
- D. All these choices are correct

Section questions:

G0A09

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

- A. A receiver with digital signal processing (DSP) noise reduction
- B. A calibrated field strength meter with a calibrated antenna
- C. An SWR meter with a peak-reading function
- D. An oscilloscope with a high-stability crystal marker generator

Section questions:

G0A06

What must you do if your station fails to meet the FCC RF exposure exemption criteria?

- A. Perform an RF Exposure Evaluation in accordance with FCC OET Bulletin 65
- B. Contact the FCC for permission to transmit
- C. Perform an RF exposure evaluation in accordance with World Meteorological Organization guidelines
- D. Use an FCC-approved band-pass filter

Section questions:

G0A04

What does “time averaging” mean when evaluating RF radiation exposure?

- A. The average amount of power developed by the transmitter over a specific 24-hour period
- B. The average time it takes RF radiation to have any long-term effect on the body
- C. The total time of the exposure
- D. The total RF exposure averaged over a certain period

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End of G0 – Electrical and RF Safety

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