

# Amateur Radio Technician License Training

Welcome to 2023 Amateur  
Radio Technician Class License  
Training

# Amateur Radio Technician License Training

**These presentations are sponsored by:**

**Mendocino Auxiliary Communications Service (MACS)  
Office of Emergency Services**

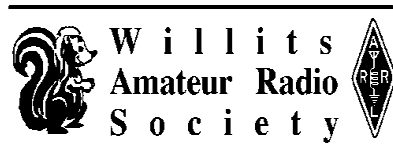
**Mendocino County Amateur Radio Communications Service (McARCS)**

**Willits Amateur Radio Society (WARS)**

**Adventist Health**

**Public Health of Mendocino County**

**Long Valley Health Center**



# Topics on Exam

Section	Contents	Questions on Exam	Questions in Pool	Covered in Session
T1	FCC Rules and Regulations	6	67	Session 5
T2	Operating Procedures	3	36	Session 4
T3	<b>Radio Wave Propagation</b>	3	34	Session 2
T4	Amateur Radio Practices	2	24	Session 4
T5	Electrical Principles	4	52	Session 1
T6	Electronic Components	4	47	Session 1
T7	<i>Practical Circuits</i>	4	43	Session 3
T8	<i>Signals and Emissions</i>	4	48	Session 3
T9	<i>Antennas and Feedlines</i>	2	24	Session 3
T0	<b>Safety</b>	3	36	Session 2

# Safety

Topics in the lesson:

- **Safety elements**
  - Power circuits, hazardous voltages
  - Electrical code compliance, circuit protection
  - Lightning protection
  - Antenna and tower safety
  - Tower grounding
  - RF exposure hazards

# Review questions:

**What type of electrical component consists of conductive surfaces separated by an insulator?**

- A. Resistor
- B. Capacitor
- C. Potentiometer
- D. Oscillator

# Review questions:

**What is the name for the flow of electrons in an electric circuit?**

- A. Voltage
- B. Resistance
- C. Capacitance
- D. Current

# Review questions:

**What does the abbreviation FET stand for?**

- A. Field Effect Transistor
- B. Fast Electron Transistor
- C. Free Electron Transmitter
- D. Frequency Emission Transmitter

# Review questions:

**What is the electrical term for the force that causes electron flow?**

- A. Voltage
- B. Ampere-hours
- C. Capacitance
- D. Inductance



# Review questions:

**What electronic component allows current to flow in only one direction?**

- A. Driven element
- B. Fuse
- C. Resistor
- D. Diode

# Review questions:

**What formula is used to calculate voltage in a circuit?**

- A.  $E = I - R$
- B.  $E = I \times R$
- C.  $E = I / R$
- D.  $E = I + R$

# Review questions:

**What is the term that describes a device's ability to amplify a signal?**

- A. On resistance
- B. Forward voltage drop
- C. Forward resistance
- D. Gain

# Review questions:

**Which is equal to one microvolt?**

- A. One one-millionth of a volt
- B. One million volts
- C. One thousand kilovolts
- D. One one-thousandth of a volt

# 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**
  - Meter and leads must be rated for high voltage

# Electrical Safety

## Battery safety:

- **12 volt storage batteries can deliver massive current**
  - Shorted terminals = fire, explosion or burns
- **Danger if charged/discharged too quickly**
  - Heat released by rapid discharge/excessive charge
  - Out-gassing
  - Flammable/explosive gas released by charging

# Electrical Safety

## **AC powered equipment:**

- Use 3 wire power cords/outlets
- Black wire = “hot”
- White wire = “neutral”
- Green wire = equipment (safety) ground
- Mechanical interlocks on high voltage compartments
- Risk of charged capacitors even when off and unplugged

# Electrical Safety

## Fuses:

- Provide protection by removing power in case of overload (excessive current)
- Replacement fuse must be same capacity (rated in maximum amps)
- Fire may result if replacement is higher capacity
- Fuse or circuit breaker in series with the AC hot (black) conductor



# Antenna and Tower Safety

## **Antennas:**

- Do not mount near power lines!
- Allow at least 10 foot clearance for unexpected falls
- Look up before installing antenna or tower components

# Antenna and Tower Safety

## **Tower safety:**

- **Climber safety**
  - NEVER climb alone
  - Sufficient training, appropriate tie-off, approved harness
  - Fully retract crank up tower or install mechanical safety locks before climbing
- **Look up for overhead wires**
- **Use safety wires on guy line turnbuckles**

# Antenna and Tower Safety

## Lightning protection:

- **Serious risk of personal and property damage**
- **Devices in coax protect equipment**
  - Mount on grounded panel
  - Near entrance to structure
- **Bond all ground rods with heavy wire/strap**
- **Grounding requirement set by local code**



# Antenna and Tower Safety

## **Tower grounding:**

- Separate 8 foot rod for each leg
- Bonded (connected) to each other and tower
- Ground wire connections short, direct
- No sharp bends

# Section questions:

**Which of the following is a safety hazard of a 12-volt storage battery?**

- A. Touching both terminals with the hands can cause electrical shock
- B. Shorting the terminals can cause burns, fire, or an explosion
- C. RF emissions from the battery
- D. All of these choices are correct

# Section questions:

**What is the purpose of a fuse in an electrical circuit?**

- A. To prevent power supply ripple from damaging a circuit
- B. To remove power in case of overload
- C. To limit current to prevent shocks
- D. All of these choices are correct

# Section questions:

**Which of the following is good practice when installing ground wires on a tower for lightning protection?**

- A. Put a drip loop in the ground connection to prevent water damage to the ground system
- B. Make sure all ground wire bends are right angles
- C. Ensure that connections are short and direct
- D. All these choices are correct

# Section questions:

**Under what circumstances is it safe to climb a tower without a helper or observer?**

- A. When no electrical work is being performed
- B. When no mechanical work is being performed
- C. When the work being done is not more than 20 feet above the ground
- D. Never



# Section questions:

**What is the minimum safe distance from a power line to allow when installing an antenna?**

- A. Half the width of your property
- B. The height of the power line above ground
- C.  $1/2$  wavelength at the operating frequency
- D. So that if the antenna falls unexpectedly, no part of it can come closer than 10 feet to the power wires

# Section questions:

**Why should you avoid attaching an antenna to a utility pole?**

- A. The antenna will not work properly because of induced voltages
- B. The 60 Hz radiations from the feed line may increase the SWR
- C. The antenna could contact high-voltage power lines
- D. All these choices are correct

# RF Exposure Safety

## FCC Guidelines:

- Established to protect hams and neighbors
- VHF/UHF signals = RF energy, non-ionizing
- Unlike radioactivity, RF lacks energy to change cells/damage DNA
- Does not mean RF is harmless

# RF Exposure Safety

## FCC Guidelines:

- **Ham responsible for compliance**
  - Calculations based on FCC OET Bulletin 65
  - Calculations based computer modeling
  - Measure field strength with calibrated equipment
- **Re-evaluate if station equipment changes**

# RF Exposure Safety

## FCC Guidelines:

- **Station licensee is responsible**
- **Exposure limits vary with frequency**
  - Most stringent 30 – 300 MHz
  - Human body absorbs RF effectively at 50 MHz
- **Factors affecting RF exposure**
  - Frequency and power level
  - Distance from antenna
  - Antenna radiation pattern

# RF Exposure Safety

## FCC Guidelines:

- **Duty Cycle**
  - Percentage of time transmitter is on during averaging period
  - Permitted power density increase proportional to duty cycle decrease
- **Keep antenna out of reach to avoid RF burns**

# Section questions:

## **Why do exposure limits vary with frequency?**

- A. Lower frequency RF fields have more energy than higher frequency fields
- B. Lower frequency RF fields do not penetrate the human body
- C. Higher frequency RF fields are transient in nature
- D. The human body absorbs more RF energy at some frequencies than at others

# Section questions:

**What hazard is created by touching an antenna during a transmission?**

- A. Electrocution
- B. RF burn to skin
- C. Radiation poisoning
- D. All these choices are correct



# Section questions:

**At which of the following frequencies does maximum permissible exposure have the lowest value?**

- A. 1296 MHz
- B. 3.5 MHz
- C. 440 MHz
- D. 50 MHz

# Section questions:

**What type of radiation are radio signals?**

- A. Gamma radiation
- B. Ionizing radiation
- C. Alpha radiation
- D. Non-ionizing radiation

# Section questions:

**What factors affect the RF exposure of people near an amateur station antenna?**

- A. Frequency and power level of the RF field
- B. Distance from the antenna to a person
- C. Radiation pattern of the antenna
- D. All of these choices are correct

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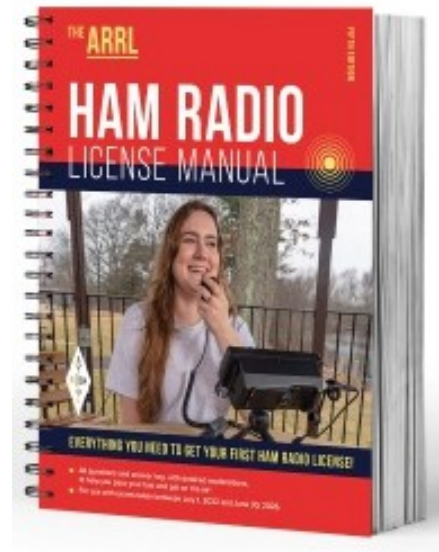
## Test Review Resources

ARRL.org Question Pool

Hamstudy.org Free app

Alternative Study Guide

ARRL Ham Radio License Manual, 5th edition



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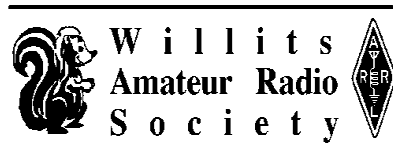
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