Technician Licensing Class

AC power circuits, antenna installation, RF hazards

T0A - T0C

Valid
July 1, 2018 Through June 30, 2022

Developed by Bob Bytheway, K3DIO, and
updated to 2018 Question Pool by NQ4K for Sterling Park Amateur Radio Club

T 0 A
Topics

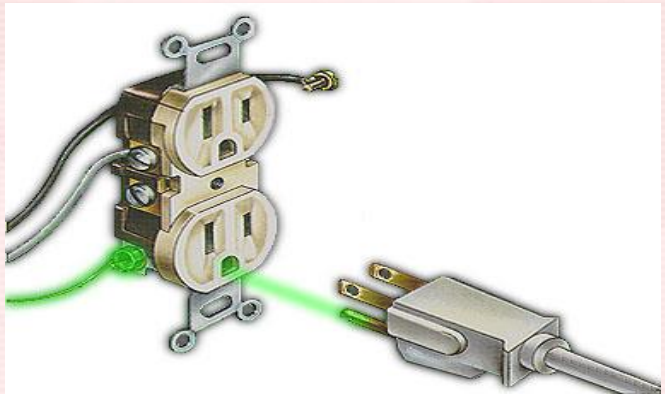
- Power circuits and hazards:
  - hazardous voltages;
  - fuses and circuit breakers;
  - grounding; lightning protection;
  - battery safety;
  - electrical code compliance

T 0 A

- A safety hazard of a 12-volt storage battery is that shorting the terminals can cause burns, fire, or explosion.
  T0A01

T 0 A

- Current flowing thru the body can cause a health hazard:
  - By heating tissue;
  - It disrupts the electrical functions of cells;
  - It causes involuntary muscle contractions.
    - ✓ All of these are correct. T0A02
- In the United States, the green wire in a three-wire electrical AC plug is the equipment ground. T0A03



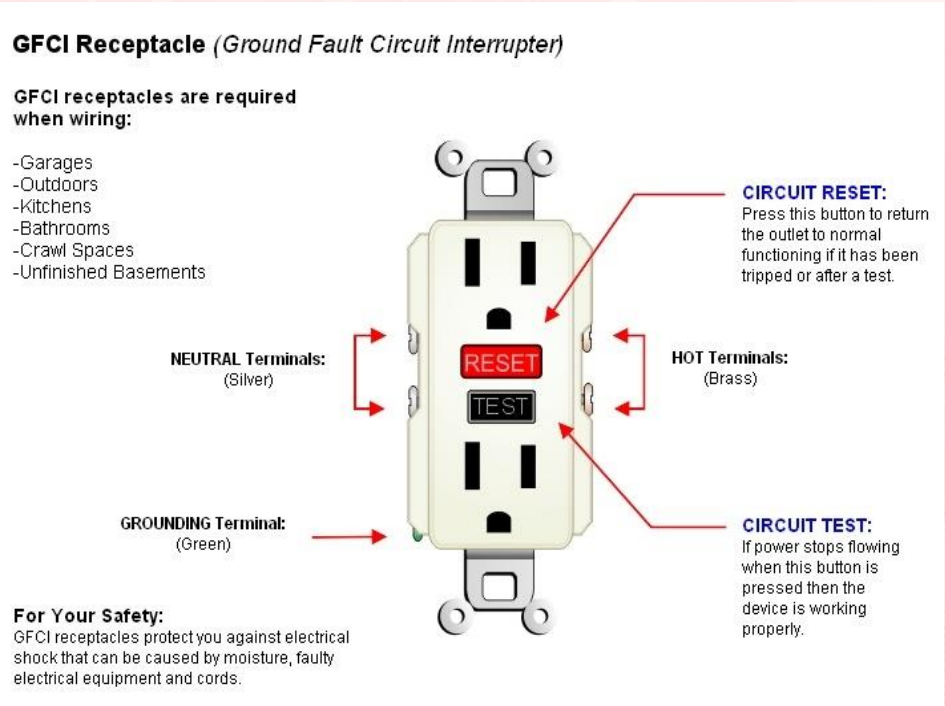
T 0 A

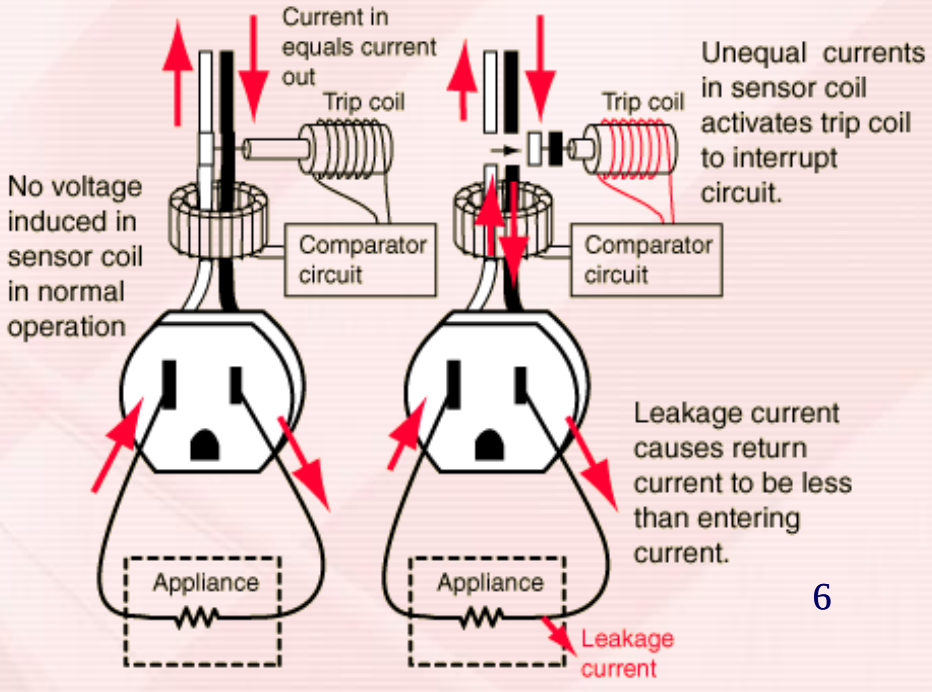
- The purpose of a fuse in an electrical circuit is to interrupt power in case of overload. T0A04

- It’s unwise to install a 20-ampere fuse in place of a 5-ampere fuse as excessive current could cause a fire. T0A05

Safety First!

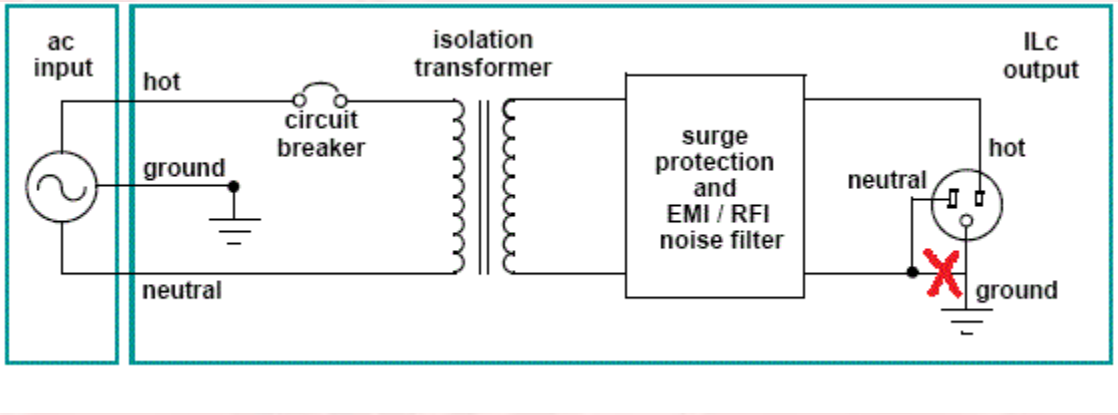
- Good ways to guard against electrical shock at your station:
  - Use three-wire cords and plugs for all AC powered equipment.
  - Connect AC powered station equipment to a common safety ground.
  - Use a circuit protected by a ground-fault interrupter.
    - ✓ All of these choices are correct. T0A06





T 0 A

- When installing devices for lightning protection in a coaxial cable feed line, mount all of the protectors on a metal plate that is in turn connected to an external ground rod. T0A07
- A fuse or circuit breaker in series with the AC hot conductor should always be included in home-built equipment that is powered from 120 VAC. T0A08



T 0 A

- All external ground rods or earth connections should be bond together with heavy wire or conductive strap. T0A09
- If a lead-acid storage battery is charged or discharged too fast it could overheat, give off flammable gas, or explode. T0A10
- A hazard might exist in a power supply when it's turned off and disconnected from a charge stored in a large capacitor that will give you a shock. T0A11

T0B
Topics

- Antenna safety:
  - tower safety and grounding;
  - erecting an antenna support;
  - safely installing an antenna

Safety First!

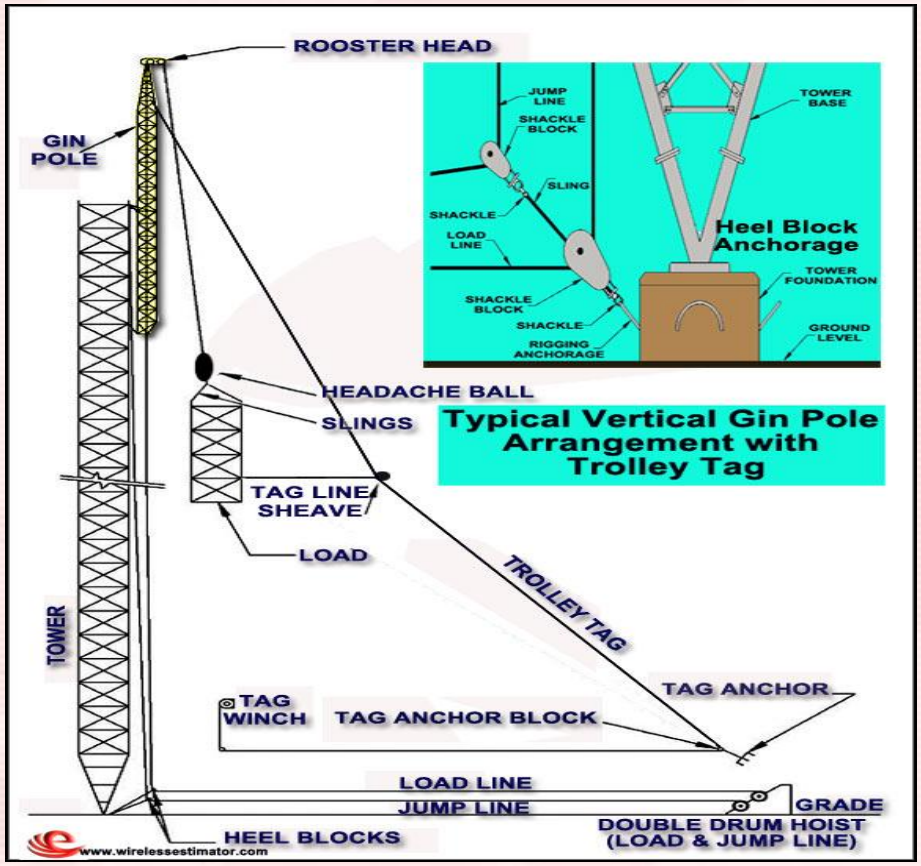
- At all times when any work is being done on a tower, all members should wear a hard hat. T0B01
- Put on a carefully inspected climbing harness and safety glasses before climbing an antenna tower. T0B02

- It is never safe to climb a tower without a helper or observer. T0B03

T 0 B

- An important safety precaution when putting up an antenna tower make sure to look for and stay clear of any overhead electrical wires.

- A gin pole is used to lift tower sections or antennas. T0B05



T 0 B

- A minimum safe distance from a power line is enough distance so that if an antenna falls, no part can come closer than 10 feet to power wires. T0B06

- When using a crank-up tower, never climb the tower unless it is in the fully retracted position or mechanical safety locking devices have been installed. T0B07

T 0 B

- Proper grounding for a tower is accomplished by using separate eight-foot long ground rods for each tower leg, bonded to the tower and each other. T0B08

- You should avoid attaching an antenna to a utility pole because the antenna could contact high-voltage power lines. T0B09

T 0 B

- Avoid sharp bends when installing grounding conductors used for lightning protection. T0B10
- Local electrical codes establish grounding requirements for an amateur radio tower or antenna. T0B11
- A good practice when installing ground wires on a tower for lightning protection is to ensure that the connections are short and direct. T0B12

T 0 B

- The purpose of a safety wire through a turnbuckle used to tension guy wires is to prevent loosening of the guy wire from vibration. T0B13

T 0 C
Topics

- RF hazards:
  - radiation exposure;
  - proximity to antennas;
  - recognized safe power levels;
  - exposure to others;
  - radiation types;
  - duty cycle

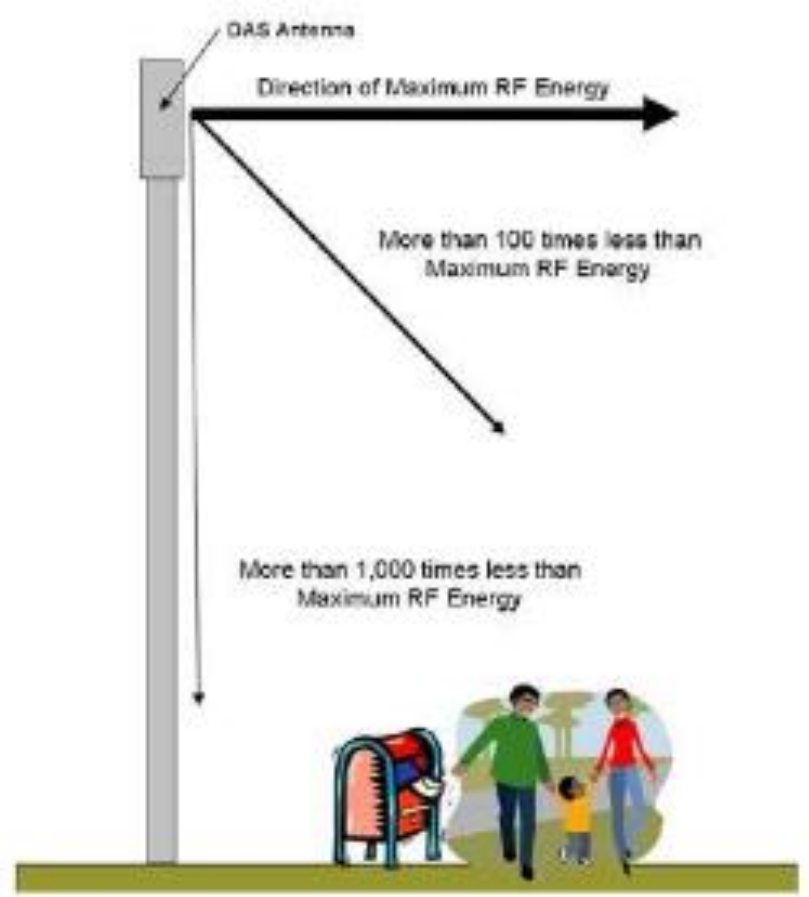
T 0 C

- VHF and UHF radio signals are a non-ionizing type of radiation. T0C01
- 50 MHz is the frequency that has the lowest value for Maximum Permissible Exposure limit. T0C02
- The maximum power level that an amateur radio station may use at VHF frequencies before an RF exposure evaluation is required is 50 watts PEP at the antenna. T0C03

T 0 C

- Factors affecting RF exposure of people near an amateur station antenna:
  - Frequency and power level of the RF field;
  - Distance from antenna to a person;
  - Radiation pattern of the antenna;
    - ✓ All of these choices are correct.

T0C04



T 0 C

- Exposure limits vary with frequency because the human body absorbs more RF energy at some frequencies than at others. T0C05
- Acceptable methods to 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 of these choices are correct. T0C06

T 0 C

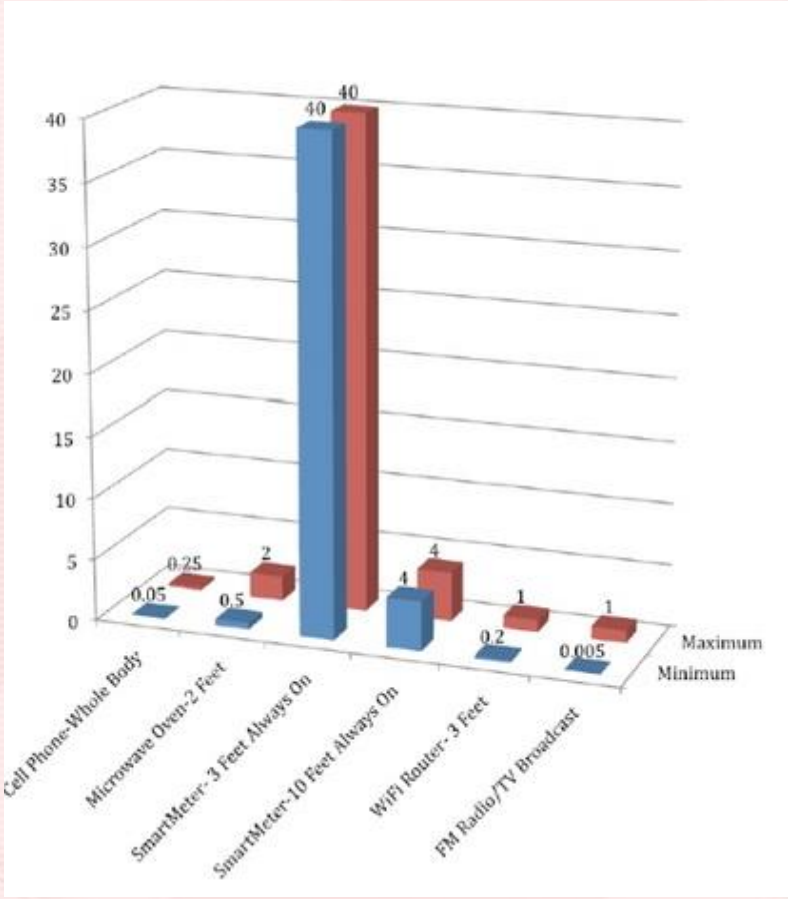
- One might receive a painful RF burn if they accidentally touch an antenna while transmitting. T0C07

- Relocate an antenna to prevent exposure to RF radiation in excess of FCC-supplied limits. T0C08
- Re-evaluate your station whenever an item of equipment is changed to make sure your station stays in compliance with RF safety regulations. T0C09

T 0 C

- Duty cycle is one factor used to determine safe RF radiation exposure levels because it affects the average exposure of people to radiation. T0C10

- Duty cycle during the averaging time for RF exposure is the percentage of the time that a transmitter is transmitting. T0C11



T 0 C

- RF radiation differs from ionizing radiation (radioactivity) in that RF radiation does not have sufficient energy to cause genetic damage. T0C12

- If the averaging time for exposure is 6 minutes, there is two times as much exposure when transmitting for an entire 6 minutes versus transmitting for three minutes and absent for three minutes. T0C13

Element 2 Technician Class Question Pool

T 0 A – T 0 C

T0A01 Which of the following is a safety hazard of a 12 voltage 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

T0A02 What health hazard is presented by current flowing through the body?

A. It may cause injury by heating tissue
B. It may disrupt the electrical functions of cells
C. It may cause involuntary muscle contractions
D. All of these choices are correct

T0A03 In the United States, what is connected to the green wire in a three-wire electrical AC plug?

A. Neutral

B. Hot

C. Equipment ground

D. The white wire

T0A04 What is the purpose of a fuse in an electrical circuit?

A. To prevent power supply ripple from damaging a circuit

B. To interrupt power in case of overload

C. To limit current to prevent shocks

D. All of these choices are correct

T0A05 Why is it unwise to install a 20-ampere fuse in the place of a 5-ampere fuse?

A. The larger fuse would be likely to blow because it is rated for higher current

B. The power supply ripple would greatly increase

C. Excessive current could cause a fire

D. All of these choices are correct

T0A06 What is a good way to guard against electrical shock at your station?

A. Use three-wire cords and plugs for all AC powered equipment

B. Connect all AC powered station equipment to a common safety ground

C. Use a circuit protected by a ground-fault interrupter

D. All of these choices are correct

T0A07 Which of these precautions should be taken when installing devices for lightning protection in a coaxial cable feedline?

A. Include a parallel bypass switch for each protector so that it can be switched out of the circuit when running high power

B. Include a series switch in the ground line of each protector to prevent RF overload from inadvertently damaging the protector

C. Keep the ground wires from each protector separate and connected to station ground

D. Ground all of the protectors to a common plate which is in turn connected to an external ground

T0A08 What safety equipment should always be included in home-built equipment that is powered from 120V AC power circuits?

A. A fuse or circuit breaker in series with the AC hot conductor

B. An AC voltmeter across the incoming power source

C. An inductor in series with the AC power source

D. A capacitor across the AC power source

T0A09 What should be done to all external ground rods or earth connections?

A. Waterproof them with silicone caulk or electrical tape

B. Keep them as far apart as possible

C. Bond them together with heavy wire or conductive strap

D. Tune them for resonance on the lowest frequency of operation

T0A10 What can happen if a lead-acid storage battery is charged or discharged too quickly?

A. The battery could overheat, give off flammable gas, or explode

B. The voltage can become reversed

C. The memory effect will reduce the capacity of the battery

D. All of these choices are correct

T0A11 What kind of hazard might exist in a power supply when it is turned off and disconnected?

A. Static electricity could damage the grounding system

B. Circulating currents inside the transformer might cause damage

C. The fuse might blow if you remove the cover

D. You might receive an electric shock from stored charge in large capacitors

T0B01 When should members of a tower work team wear a hard hat and safety glasses?

A. At all times except when climbing the tower

B. At all times except when belted firmly to the tower

C. At all times when any work is being done on the tower

D. Only when the tower exceeds 30 feet in height

T0B02 What is a good precaution to observe before climbing an antenna tower?

A. Make sure that you wear a grounded wrist strap

B. Remove all tower grounding connections

C. Put on a carefully inspected climbing harness (fall arrester) and safety glasses

D. All of the these choices are correct

T0B03 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

T0B04 Which of the following is an important safety precaution to observe when putting up an antenna tower?

A. Wear a ground strap connected to your wrist at all times

B. Insulate the base of the tower to avoid lightning strikes

C. Look for and stay clear of any overhead electrical wires

D. All of these choices are correct

T0B05 What is the purpose of a gin pole?

A. To temporarily replace guy wires

B. To be used in place of a safety harness

C. To lift tower sections or antennas

D. To provide a temporary ground

T0B06 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

T0B07 Which of the following is an important safety rule to remember when using a crank-up tower?

A. This type of tower must never be painted

B. This type of tower must never be grounded

C. This type of tower must never be climbed unless retracted or mechanical safety locking devices have been installed

D. All of these choices are correct

T0B08 What is considered to be a proper grounding method for a tower?

A. A single four-foot ground rod, driven into the ground no more than 12 inches from the base

B. A ferrite-core RF choke connected between the tower and ground

C. Separate eight-foot long ground rods for each tower leg, bonded to the tower and each other

D. A connection between the tower base and a cold water pipe

T0B09 Why should you avoid attaching an antenna to a utility pole?

A. The antenna will not work properly because of induced voltages

B. The utility company will charge you an extra monthly fee

C. The antenna could contact high-voltage power wires

D. All of these choices are correct

T0B10 Which of the following is true when installing grounding conductors used for lightning protection?

A. Only non-insulated wire must be used

B. Wires must be carefully routed with precise right-angle bends

C. Sharp bends must be avoided

D. Common grounds must be avoided

T0B11 Which of the following establishes grounding requirements for an amateur radio tower or antenna?

A. FCC Part 97 Rules

B. Local electrical codes

C. FAA tower lighting regulations

D. UL recommended practices

T0B12 Which of the following is good practice when installing ground wires on a tower for lightning protection?

A. Put a loop in the ground connection to prevent water damage to the ground system

B. Make sure that all bends in the ground wires are clean, right angle bends

C. Ensure that connections are short and direct

D. All of these choices are correct

T0B13 What is the purpose of a safety wire through a turnbuckle used to tension guy lines?

A. Secure the guy if the turnbuckle breaks

B. Prevent loosening of the guy line from vibration

C. Prevent theft or vandalism

D. Deter unauthorized climbing of the tower

T0C01 What type of radiation are VHF and UHF radio signals?

A. Gamma radiation

B. Ionizing radiation

C. Alpha radiation

D. Non-ionizing radiation

T0C02 Which of the following frequencies has the lowest Maximum Permissible Exposure limit?

A. 3.5 MHz

B. 50 MHz

C. 440 MHz

D. 1296 MHz

T0C03 What is the maximum power level that an amateur radio station may use at VHF frequencies before an RF exposure evaluation is required?

A. 1500 watts PEP transmitter output

B. 1 watt forward power

C. 50 watts PEP at the antenna

D. 50 watts PEP reflected power

T0C04 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

T0C05 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

T0C06 Which of the following is an acceptable method to determine that your station complies with FCC RF exposure regulations?

A. By calculations based FCC OET Bulletin 65

B. By calculation based on computer modeling

C. By measurement of field strength using calibrated equipment

D. All of these choices are correct

T0C07 What could happen if a person accidentally touched your antenna while you were transmitting?

A. Touching the antenna could cause television interference

B. They might receive a painful RF burn

C. They might develop radiation poisoning

D. All of these choices are correct

T0C08 Which of the following actions might amateur operators take to prevent exposure to RF radiation in excess of FCC-supplied limits?

A. Relocate antennas

B. Relocate the transmitter

C. Increase the duty cycle

D. All of these choices are correct

T0C09 How can you make sure your station stays in compliance with RF safety regulations?

A. By informing the FCC of any changes made in your station

B. By re-evaluating the station whenever an item of equipment is changed

C. By making sure your antennas have low SWR

D. All of these choices are correct

T0C10 Why is duty cycle one of the factors used to determine safe RF radiation exposure levels?

A. It affects the average exposure of people to radiation

B. It affects the peak exposure of people to radiation

C. It takes into account the antenna feedline loss

D. It takes into account the thermal effects of the final amplifier

T0C11 What is the definition of duty cycle during the averaging time for RF exposure?

A. The difference between lowest power output and highest output power of a transmitter

B. The difference between the PEP and average power output power of a transmitter

C. The percentage of time that a transmitter transmits

D. The percentage of time that a transmitter is not transmitting

T0C12 How does RF radiation differ from ionizing radiation (radioactivity)?

A. RF radiation does not have sufficient energy to cause genetic damage

B. RF radiation can only be detected with an RF dosimeter

C. RF radiation is limited in range to a few feet

D. RF radiation is perfectly safe

T0C13

If the averaging time for exposure is 6 minutes, how much power density is permitted if the signal is present for 3 minutes and absent for 3 minutes rather than being present for the entire 6 minutes?

A. 3 times as much

B. 1/2 as much

C. 2 times as much

D. There is no adjustment allowed for shorter exposure times