

Technician License Course

Chapter 5

Lesson Plan Module 12 –
Power Sources and RF Interference (RFI)



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Power Supplies

- Most modern radio equipment runs from 12 volts dc.
 - Actual preferred voltage is 13.8 volts.
- Household ac power is 120 volts ac.
- Power supplies convert 120 volts ac to regulated, filtered dc.
 - If you use a lab-type 12 volt power supply, be sure it is adjustable to 13.8 volts.



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Types of Power Supplies

- Linear:
 - Use iron transformers
 - Heavy (physically)
 - Do not emit RF, generally immune to strong RF
- Switching:
 - Electronics instead of transformers
 - Lightweight and small
 - Can emit RF if not properly filtered
 - Check product reviews



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Power Supply Ratings

Voltage and Current

- Continuous duty – how much current can be supplied continuously.
- Intermittent duty – how much current can be supplied for short surges, such as on voice peaks.
- Regulation – how well the power supply maintains a constant output voltage.



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Mobile Power Wiring Safety

- Car batteries hold lots of energy – shorting a battery could cause a fire.
- Special requirements for safe car wiring:
 - Fuse both positive and negative leads.
 - Connect radio's negative lead to negative terminal or engine block ground strap.
 - Use grommets or protective sleeves to protect wires.
 - Don't assume all metal in the car is grounded; modern cars are as much plastic as metal.



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Batteries

- Create current through a chemical reaction
 - Individual cells connected in series or parallel
 - Cell chemistry determines voltage per cell
- Battery types
 - Disposable (primary batteries)
 - Rechargeable (secondary batteries)
 - Storage
- Energy capabilities rated in Ampere-hours
 - Amps X time (at a constant voltage)



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Battery Charging

- Some batteries can be recharged, some cannot.
- Use the proper charger for the battery being charged.
- Batteries will lose capacity with each cycle.
- Best if batteries are maintained fully charged.
 - Over-charging will cause heating and could damage the battery.
- Lead-acid batteries release explosive hydrogen during charging or rapid discharge so adequate ventilation is required.



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Battery Charging

- Automobiles can be a good emergency power source by recharging batteries
- A 12-volt lead-acid station battery can be recharged by connecting it to an automobile's electrical system
 - Monitor battery temperature
 - Make sure battery is well-ventilated



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Handheld Transceivers

- Battery packs – packages of several individual rechargeable batteries connected together.
 - NiCd (nickel-cadmium)
 - NiMH (nickel-metal hydride)
 - Li-ion (lithium-ion)
- For emergencies, have a battery pack that can use disposable batteries (AA size).



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Radio Frequency Interference (RFI)

- Signals that interfere with radio reception.
- Interference can be FROM your station or TO your station.
- Solving the problem might take a little detective work!



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Types of RFI

- Direct detection – offending signals get into the electronic circuits to cause interference.
- Overload – strong signal that overwhelms the ability of the receiver to reject it.
- RF Current – can be picked up by cables of consumer equipment.
- Transmitted harmonics – must be filtered out at the transmitter.



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Filters

- Filters attenuate (reduce) signals
- High-pass – reduce low-frequency signals
- Low-pass – reduce high-frequency signals
- Band-pass – only pass a range of signals
- Notch – reduces a narrow range of signals
- Selecting correct filter requires understanding the source of the interference



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Ferrite Chokes

- Creates impedance (opposition to ac) on cables and wires.
- Can be used to block RF current that causes interference to entertainment equipment, microphones, monitors, amplifiers, etc.
- Wind cable through ferrite core to create blocking impedance.



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Cable TV Interference

- Usually the result of broken shielding somewhere in the cable.
 - Loose connections
 - Broken connections
 - Corroded connections
- Usually solved by proper cable maintenance by cable supplier.



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Noise Sources

- Electrical arcs (motors, thermostats, electric fences, neon signs)
- Power lines
- Motor vehicle ignitions or alternators
- Switching power supplies
- Computers, networks and TV sets



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RFI Guidelines

- Operate your equipment properly.
- Eliminate interference in your own home.
- Use good station building practices to eliminate unwanted signals.
 - Shielded wire and cables
 - Shielded equipment
 - Good connections and filters



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Dealing with RFI

- Take interference complaints seriously.
- Make sure that you're really not the cause (demonstrate that you don't interfere within your own home).
- Offer to help eliminate the RFI, even if you are not at fault.
- Consult ARRL RFI Resources for help and assistance.



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Part 15 Rules

- Applies only to unlicensed devices
- Unlicensed devices may not interfere with licensed services, such as amateur radio
- Unlicensed devices must accept any interference they receive from licensed services
- RFI from and to unlicensed devices is the responsibility of the users of such devices



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What the Rules Say

- Bottom line – If your station is operating properly, you are protected against interference complaints
- BUT – Be a good neighbor because they are probably not familiar with Part 15 rules and regulations



Electrical Safety Grounding and Circuit Protection (in the Home)

- Make sure your home is “up to code.”
- Most ham equipment does not require special wiring or circuits.
 - Use 3-wire power cords.
 - Use circuit breakers, circuit breaker outlets, or Ground Fault Interrupter (GFI) circuit breakers.
 - Use proper fuse or circuit breaker size.
 - Don’t overload single outlets.



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RF “Grounding”

- Not the same as ac safety grounding
- “Bonding” is more accurate
- Keep all equipment at the same RF voltage
 - Current will not flow between pieces of equipment which can cause RF feedback
 - Minimizes RF “hot spots” (RF burns)
 - Use solid strap or wire for best RF connection



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Practice Questions



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What is one way to recharge a 12-volt lead-acid station battery if the commercial power is out?

- A. Cool the battery in ice for several hours
- B. Add acid to the battery
- C. Connect the battery in parallel with a vehicle's battery and run the engine
- D. All of these choices are correct

T2C02 HRLM (5-18)



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T2C02 HRLM (5-18)



Which is a good reason to use a regulated power supply for communications equipment?

- A. It prevents voltage fluctuations from reaching sensitive circuits
- B. A regulated power supply has FCC approval
- C. A fuse or circuit breaker regulates the power
- D. Power consumption is independent of load

T4A03 HRLM (5-15)



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T4A03 HRLM (5-15)



Where must a filter be installed to reduce harmonic emissions from your station?

- A. Between the transmitter and the antenna
- B. Between the receiver and the transmitter
- C. At the station power supply
- D. At the microphone

T4A04 HRLM (5-21)



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- A. Between the transmitter and the antenna**
- B. Between the receiver and the transmitter
- C. At the station power supply
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T4A04 HRLM (5-21)



Which type of conductor is best to use for RF grounding?

- A. Round stranded wire
- B. Round copper-clad steel wire
- C. Twisted-pair cable
- D. Flat strap

T4A08 HRLM (5-25)



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T4A08 HRLM (5-25)



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Which of the following could you use to cure distorted audio caused by RF current flowing on the shield of a microphone cable?

- A. Band-pass filter
- B. Low-pass filter
- C. Preamplifier
- D. Ferrite choke

T4A09 HRLM (5-20)



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T4A09 HRLM (5-20)



What is the source of a high-pitched whine that varies with engine speed in a mobile transceiver's receive audio?

- A. The ignition system
- B. The alternator
- C. The electric fuel pump
- D. Anti-lock braking system controllers

T4A10 HRLM (5-16)



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T4A10 HRLM (5-16)



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Where should the negative return connection of a mobile transceiver's power cable be connected?

- A. At the battery or engine block ground strap
- B. At the antenna mount
- C. To any metal part of the vehicle
- D. Through the transceiver's mounting bracket

T4A11 HRLM (5-15)



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T4A11 HRLM (5-15)



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What could be happening if another operator reports a variable high-pitched whine on the audio from your mobile transmitter?

- A. Your microphone is picking up noise from an open window
- B. You have the volume on your receiver set too high
- C. You need to adjust your squelch control
- D. Noise on the vehicle's electrical system is being transmitted along with your speech audio

T4A12 HRLM (5-16)



What could be happening if another operator reports a variable high-pitched whine on the audio from your mobile transmitter?

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T4A12 HRLM (5-16)



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How much voltage does a mobile transceiver usually require?

- A. About 12 volts
- B. About 30 volts
- C. About 120 volts
- D. About 240 volts

T5A06 HRLM (5-15)



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T5A06 HRLM (5-15)



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Which of the following battery types is rechargeable?

- A. Nickel-metal hydride
- B. Lithium-ion
- C. Lead-acid gel-cell
- D. All of these choices are correct

T6A10 HRLM (5-17)



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T6A10 HRLM (5-17)



Which of the following battery types is not rechargeable?

- A. Nickel-cadmium
- B. Carbon-zinc
- C. Lead-acid
- D. Lithium-ion

T6A11 HRLM (5-17)



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T6A11 HRLM (5-17)



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What type of circuit controls the amount of voltage from a power supply?

- A. Regulator
- B. Oscillator
- C. Filter
- D. Phase inverter

T6D05 HRLM (5-15)



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T6D05 HRLM (5-15)



Which of the following is a common reason to use shielded wire?

- A. To decrease the resistance of DC power connections
- B. To increase the current carrying capability of the wire
- C. To prevent coupling of unwanted signals to or from the wire
- D. To couple the wire to other signals

T6D12 HRLM (5-22)



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T6D12 HRLM (5-22)



What would cause a broadcast AM or FM radio to receive an amateur radio transmission unintentionally?

- A. The receiver is susceptible to strong signals outside the AM or FM band
- B. The microphone gain of the transmitter is turned up too high
- C. The audio amplifier of the transmitter is overloaded
- D. The deviation of an FM transmitter is set too low

T7B02 HRLM (5-21)



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T7B02 HRLM (5-21)



Which of the following may be a cause of radio frequency interference?

- A. Fundamental overload
- B. Harmonics
- C. Spurious emissions
- D. All of these choices are correct

T7B03 HRLM (5-19)



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T7B03 HRLM (5-19)



Which of the following is a way to reduce or eliminate interference by an amateur transmitter to a nearby telephone?

- A. Put a filter on the amateur transmitter
- B. Reduce the microphone gain
- C. Reduce the SWR on the transmitter transmission line
- D. Put a RF filter on the telephone

T7B04 HRLM (5-21)



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T7B04 HRLM (5-21)



How can overload of a non-amateur radio or TV receiver by an amateur signal be reduced or eliminated?

- A. Block the amateur signal with a filter at the antenna input of the affected receiver
- B. Block the interfering signal with a filter on the amateur transmitter
- C. Switch the transmitter from FM to SSB
- D. Switch the transmitter to a narrow-band mode

T7B05 HRLM (5-21)



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T7B05 HRLM (5-21)



Which of the following actions should you take if a neighbor tells you that your station's transmissions are interfering with their radio or TV reception?

- A. Make sure that your station is functioning properly and that it does not cause interference to your own radio or television when it is tuned to the same channel
- B. Immediately turn off your transmitter and contact the nearest FCC office for assistance
- C. Tell them that your license gives you the right to transmit and nothing can be done to reduce the interference
- D. Install a harmonic doubler on the output of your transmitter and tune it until the interference is eliminated

T7B06 HRLM (5-22)



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T7B06 HRLM (5-22)



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Which of the following may be useful in correcting a radio frequency interference problem?

- A. Snap-on ferrite chokes
- B. Low-pass and high-pass filters
- C. Band-reject and band-pass filters
- D. All of these choices are correct

T7B07 HRLM (5-19)



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T7B07 HRLM (5-19)



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What should you do if something in a neighbor's home is causing harmful interference to your amateur station?

- A. Work with your neighbor to identify the offending device
- B. Politely inform your neighbor about the rules that prohibit the use of devices which cause interference
- C. Check your station and make sure it meets the standards of good amateur practice
- D. All of these choices are correct

T7B08 HRLM (5-23)



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T7B08 HRLM (5-23)



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What is a Part 15 device?

- A. An unlicensed device that may emit low powered radio signals on frequencies used by a licensed service
- B. A type of amateur radio that can legally be used in the citizen's band
- C. A device for long distance communications using special codes sanctioned by the International Amateur Radio Union
- D. A type of test set used to determine whether a transmitter is in compliance with FCC regulation 91.15

T7B09 HRLM (5-23)



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T7B09 HRLM (5-23)



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What is a symptom of RF feedback in a transmitter or transceiver?

- A. Excessive SWR at the antenna connection
- B. The transmitter will not stay on the desired frequency
- C. Reports of garbled, distorted, or unintelligible transmissions
- D. Frequent blowing of power supply fuses

T7B11 HRLM (5-24)



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T7B11 HRLM (5-24)



What might be the first step to resolve cable TV interference from your ham radio transmission?

- A. Add a low pass filter to the TV antenna input
- B. Add a high pass filter to the TV antenna input
- C. Add a preamplifier to the TV antenna input
- D. Be sure all TV coaxial connectors are installed properly

T7B12 HRLM (5-21)



What might be the first step to resolve cable TV interference from your ham radio transmission?

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T7B12 HRLM (5-21)



What kind of hazard is presented by a conventional 12-volt storage battery?

- A. It emits ozone which can be harmful to the atmosphere
- B. Shock hazard due to high voltage
- C. Explosive gas can collect if not properly vented
- D. All of these choices are correct

T0A09 HRLM (5-18)



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T0A09 HRLM (5-18)



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

- A. The battery could overheat and 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

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