

Radio Merit Badge—Part 2

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A Radio Station

12-13

● **Transmitter**

- Creates radio waves at a desired frequency (tuning).
- Adds information to those waves.
- For example, takes information (a microphone) from a voice and adds that to the radio waves (“modulation”).

● **Receiver**

- Receives radio signals of all frequencies.
- Amplifies the radio waves of a desired frequency (tuning).
- Converts the information in the waves to audio frequencies: output through a speaker.

● **Transceiver:** Transmitter and Receiver in one unit.

A Radio Station

12-13

● **Amplifier**

- Greatly increases the voltage (the strength) of the electric waves coming out of the transmitter.
- This generally helps your signal reach farther (up to a point).

● **Antenna**

- When **transmitting**: acts like a megaphone, lets the electric waves spread out in the desired direction.
- When **receiving**: acts like a “big ear” that collects the electric wave energy.
- To be most efficient, antennas must be “**tuned**” to the radio frequency, just like the transmitter and receiver are tuned.

Antennas of all shapes!

12-13



Safety First!

- Working on radios can be dangerous!
 - They use electricity: often **very high voltages!**
 - Radio waves themselves can cause burns!
 - So, don't touch an antenna when someone is transmitting!
- **PLEASE: DON'T DO ANY WORK ON ELECTRONIC EQUIPMENT YOURSELF** until you have learned from an experienced worker.
- And, did you know? It is **illegal** to work on radio transmitters without a license!



Safety First!

- Electrical shock can **hurt or kill you!** Make sure the power is disconnected before working.
- Even with the power off, some parts inside the radio can hold a dangerous electrical charge.
- If you aren't sure what you are doing: **GET HELP!**



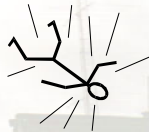
Safety First!

- Radio Frequency (RF) energy can burn you badly. Keep antennas out of reach of people and animals.
- RF radiation can be unhealthy. Don't use a radio when it is not completely assembled. The case keeps the RF radiation contained.
- Make sure the antennas can't touch any power lines, or you could be **electrocuted** when using the radio.



Safety First!

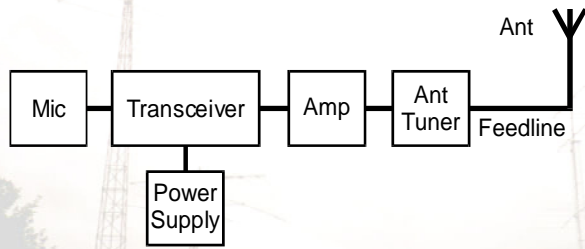
- Lightning can hit your antenna and travel down your lines to the radio. Make sure your antenna and radio are grounded to a good "earth ground."
- Be very careful working on towers and roofs.
 - A fall will surely hurt you, and **might even KILL you!**
 - Falling tools or other objects can hurt people below.



Block Diagram vs. Schematic Diagram

- **Block diagram**
 - Shows parts of radio station.
- **Schematic diagram**
 - Shows how the electrical circuit works.
 - It uses *schematic symbols* to show the path of a circuit—similar to the way a map uses "map symbols" to show the path of travel on a hiking trail.

Block Diagram of Radio



Circuits

- An electrical circuit is made up of wires and various electrical components
- Together they make up the electronic part of your electrical appliance, in this case: a radio.

Kinds of Circuits

- **Open circuit:** No current. No electrical contact. For example, when a light switch is “off.”
- **Closed circuit:** Electricity flows correctly along the proper path. For example, when a light switch is “on.”
- **Short circuit:** Electricity flows incorrectly, from the source to the other side of the circuit, usually causing serious damage. For example, a frayed lamp cord, where the wire insulation is worn so the two wires can touch each other. ***Pow! Very dangerous!***

Schematic Symbols

- A picture that represents an electronic part in a circuit.
- Let's learn some of the more common symbols.
- You will have to identify three actual parts for this merit badge.

Schematic Symbols



Fuse



Battery



Resistor



Variable Resistor

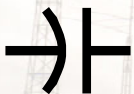
Schematic Symbols



Earth Ground



Inductor (coil)



Capacitor



Variable Capacitor

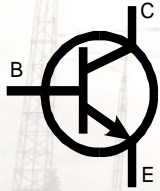
Schematic Symbols



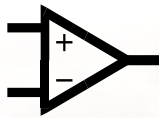
Diode



Light-Emitting Diode

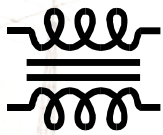


Transistor (NPN)



Op-Amp

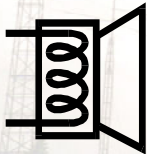
Schematic Symbols



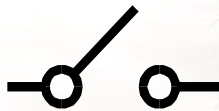
Transformer



Antenna



Speaker



Switch

What Can Amateur Radio Operators Do on the Air?

- **Jamboree On The Air (JOTA)** is the third weekend every October when Scouts all over the world talk to each other on ham radio.
- **DX!** Lots of hams like to talk to other hams around the world and collect postcards called QSL cards to prove they did it. It's a great way to have fun and learn about geography.

What Can Amateur Radio Operators Do on the Air?

- **Contests** are held many weekends. For example, you try to contact as many people from a certain place or in a certain way.
- **Service** at parades & special events. Ham radio operators are often the best people to help with communication at community events, from small carnivals to large parades and “runs.”

What Can Amateur Radio Operators Do on the Air?

- **Disasters:** Hams are often called to help during fires, floods, earthquakes, and other disasters. At these times, telephone and cellular phone systems are often damaged or overloaded, and ham radio is the only reliable communication.
- **Skywarn:** Amateur radio operators help the National Weather Service by reporting severe weather conditions.

What Can Amateur Radio Operators Do on the Air?

- **Digital Communications:** Hams can connect their computers to their radios. Then they can send electronic messages and pictures—wireless e-mail!
- **Portable Radio Operations:** Amateur radio is great fun when done away from home! On a campout, using solar power and a wire antenna suspended by trees: imagine chatting with someone in another country, or just letting the folks back home know how things are going.

Q Signals

- Q-signals are short, three letter codes mainly used in a Morse code **QSO**—that is, a Morse code **radio contact**.
- Sometimes, we also use these codes for voice communication. But in a “phone” QSO, it’s usually better to just say what you mean.
 - “I live in Waco, Texas”
 - Not “My **QTH** is Waco, Texas”

Q Signals (used with Morse code)

- **QTH:** Your location
Example: My QTH is Waco, TX.
- **QRM:** Man-made interference
Example: I am experiencing QRM.
- **QRN:** Static interference
Example: I am experiencing QRM.
- **QRP:** Low power (5 watts or less)
Example: I am transmitting QRP.

Q Signals (used with Morse code)

- **QSB:** Signal fading
Example: I am experiencing QSB.
- **QSL:** Confirmation of contact information
Example: QSL on the brand of your radio there.
- **QSO:** A radio contact
Example: I had a QSO with Japan today.
- **QSY:** Change of frequency
Example: Let’s QSY to 7010.

Technician Class

- The **Technician Class** license is the entry level license: the “Tenderfoot” of ham radio.
- Simply pass a **35-question multiple choice test** covering radio basics, rules, and procedures.
- **No longer required to learn Morse code.**
- **Full privileges on the VHF bands**, so you can use repeaters and hand-held radios around town.
- **Not allowed to use the HF bands** (except a little of the 10m band).
- **Surprise!** All the **questions and answers are available** for study (in books and on the Internet).
- Tests are given by other licensed amateurs who are called “volunteer examiners,” or “VEs.”

Emergency Calls

- Speak clearly and **give complete information**, just like when you make a **911** telephone call.
- Remember to give your **complete location**, because the person on the radio may be in another state—or even another country!
- **“MAYDAY”** is the international word for requesting help by radio. However, it is probably easier and less confusing to just say **“EMERGENCY.”**

Emergency Calls

- If no one hears you: might have to get higher—up a hill or tall building, for example.
- If using Morse code, send SOS

S O S

 until you make contact. Then send your information.
- Give your info slow enough for the other person to understand and write it down.

FCC and the Amateur Radio Service

- It's a **PRIVILEGE** to use radios! So, in return...
- **Service:** Amateur operators (hams) are volunteers, serving the community—just like the Scouts.
- **Experimentation:** Hams are allowed to build their own radio equipment.
- **Communication skills:** Hams practice, and learn how to **listen** and **talk** on the radio.
- **Self-training:** Ham's learn by doing, and by asking for help, and by helping each other.
- **International goodwill:** Because signals can travel worldwide, you can represent America.

Small and Big Radios

- **Handheld radios (HT):** Small, light, portable, but not much power (3 watts). Some can fit in your pocket. With repeaters they can be quite useful. Great for hikes and bike rides.
- **Mobile radios:** Operate on 12 volts from car. More power (50 watts). Requires outside antenna.
- **Base radios:** Operate on 12 volts from home power supply. Lots of power (100 watts or more). Easier to use, with many nice features.
- **Repeaters:** Located high up (mountains, tall buildings, towers). Relay signals with high power and big antennas.

Choosing Your Radio

- **Cost**
 - Small, low-power radios cost less (\$100-\$200).
 - Larger radios with more features cost more.
 - Used radios cost less at "hamfests" (as little as \$50)
- **Power**
 - Low-power radios work well for short distances or with repeaters, and can operate with batteries.
 - High-powered radios can talk longer distances, but require more electricity.
- **Intended Purpose**
 - Small radios are ideal for backpacking and camping.
 - Medium-power radios work well in cars and trucks.
 - High-powered radios are good for home "base" stations.

Requirement 7, Option A: Simulated Radio Contact

Give **and** Receive (and log it)! Use **Q**-signals where indicated.

- Call any station: **CQ CQ CQ, This is <your station ID>**.
- Station IDs (give yours, record theirs).
Use your initials and age, for example: **JDC12**
- Q Your location (city, state)
- Q Tell the other station that you “copied correctly”
- Type of radio you are using (brand, etc.)
- Q You are transmitting with low power
- Q Coordinate a change to another frequency
- Q Are you having any difficulties, like static or interference? Yes, let’s pretend (pick one).
- Q Thank the other station for “the contact”
- Sign off, giving the other station ID **and** your station ID.