

## RADIO CLASS MASTER

1. Explain what radio is.

**Radio is the technology of signaling and communicating using radio waves. Radio waves are electromagnetic waves of frequency between 30 hertz (cycles per second) and 300 giga hertz.**

**Radio is a way to electronically communicate without wires. Radio sends information from one location to another location using electromagnetic waves. The information could be Morse code, your voice, music, or data. Electromagnetic waves are created when we get an electrical circuit to vibrate electrons back and forth thousands or millions a time per second. (Music is not allowed on ham frequencies.)**

Then discuss the following:

- a. The differences between broadcast radio and hobby radio.

**Broadcast radio is one-way radio, meant for commercial purposes. Hobby radio is non-commercial two-way radio used to transmit a message to another radio. Hobby radio, which is referred to as Personal Radio Service by the Federal Communications Commission (FCC), includes Citizens Band Radio Service (CB), General Mobile Radio Service (GMRS), Family Radio Service (FRS), Multi-Use Radio Service (MURS) and Amateur (ham) Radio Service.**

**You probably already know broadcast radio, but radar, wireless networks, remote car locks, cell phones, microwave ovens, communications satellites, television, satellite navigation systems, EZ-Pass toll systems and those security tags in stores are all radio too!**

- b. The differences between broadcasting and two-way communications.

**Broadcasting is a one way transmission to many receivers at the same time such as a local music station or television station. Two way communications are back and forth conversations between two stations. Both stations then take turns transmitting and receiving.**

**Two-way radio is used by police, fire, ambulances, planes, trains, ships, astronauts.**

- c. Radio call signs and how they are used in broadcast radio and amateur radio.

**All radio transmitters must use call signs to prove they have been licensed. Amateur Radio call signs are like, KF5FWK or W5KY, with a number in them.**

**The items below are optional.**

**A general aviation tail number generally begin with the letter N and is their FCC call sign.**

**Generally the call sign of a commercial radio or TV station east of the Mississippi river begins with the letter W and west of the Mississippi river begins with the letter K.**

**Sometimes the commercial call sign have a meaning but not always obvious. TV channel 11 KTVT is "Television for Texas." TV channel 21 KTXA is "Texas." TV channel 13 KERA is "A new ERA in broadcasting." FM Radio station 88.5 KEOM is "Education of Mesquite."**

- d. The phonetic alphabet and how it is used to communicate clearly.

**Because some letters such as "C" and "E" might sound alike when transmissions are noisy, standard Phonetic Alphabet words are often used to make things understood.**

**The standard phonetics are in the attachment.**

**For example, you might say "My name is John, It is spelled Juliet Oscar Hotel November."**

## RADIO CLASS MASTER

2. Do the following:

- a. Sketch a diagram showing how radio waves travel locally and around the world.

**Locally: Radio waves travel in line-of-sight and slowly dissipate. Higher frequencies dissipate faster.**

**Globally: Radio waves bounce off the atmosphere and off the ground repeatedly until they circle the globe.**

- b. Explain how the broadcast radio stations, WWV and WWVH can be used to help determine what you will hear when you listen to a shortwave radio?

**They also provide information on how well the ionosphere is bouncing radio signals today. They also can be used to set your clock, to calibrate your receiver and transmitter, and to see how well radio signals can travel to and from Colorado and Hawaii.**

- c. Explain the difference between a distant (DX) and a local station.

DX

**DX stands for Distance. Usually a DX station is in another country though sometimes it can be another state.**

Local

**A local station is usually within 100 miles of you.**

- d. Discuss what the Federal Communication Commission (FCC) does and how it is different from the International Telecommunication Union.

FCC, NTIA, ITU:

**The Federal Communications Commission (FCC) is a United States government agency that control licensing of non-government transmitters. Non-government transmitters would be places like Radio & TV transmitters, Trains, Planes, Airplanes, Boats, Amateur transmitters, and others.**

**The National Telecommunications and Information Administration (NTIA) control licensing of government agencies like the FBI and US military.**

**The International Telecommunications Union (ITU) is a United Nations agency that establishes international standards for radio.**

**All three agencies also regulate transmitters in space.**

## RADIO CLASS MASTER

4. Explain how radio waves carry information.

**A radio frequency transmitter sends out a radio frequency transmission. Just like this it is called a continuous wave signal and it has no information. Once you modulate the signal it then contains information. Some of the ways to modulate the continuous wave to produce information is to: switch it on and off – Morse Code; change its amplitude – Amplitude Modulation (AM); change its frequency – Frequency Modulation (FM); or change its phase – Digital Modulation.**

Include in your explanation: transceiver, transmitter, receiver, amplifier, and antenna.

Transceiver:	<b>A box containing both a transmitter and a receiver.</b>
Transmitter:	<b>A device for sending a modulated RF signal.</b>
Receiver:	<b>A device for receiving and un-modulating a RF signal.</b>
Amplifier:	<b>A device for increasing the amplitude of an RF signal. This can be for the transmitter and /or receiver.</b>
Antenna:	<b>A metallic devise used for sending and/or receiving an RF signal. It can be as simple as a length of wire.</b>

## RADIO CLASS MASTER

5. Do the following:

- a. Explain the differences between a block diagram and a schematic diagram.

Block diagram:	<b>A block diagram shows how major units are hooked together. Major units in radio would be things like a Microphone, a Transceiver, an Amplifier, and an antenna.</b>
Schematic diagram:	<b>A schematic shows the components of a major unit and how they are interconnected. For an amplifier it could show how Transistors, Resistors, Capacitors, and Coils are wired together.</b>

- b. Draw a block diagram for a radio station that includes a transceiver, amplifier, microphone, antenna, and feed line.

**See attachment.**

- c. Discuss how information is sent when using amplitude modulation (AM), frequency modulation (FM), continuous wave (CW) Morse code transmission, single sideband (SSB) transmission, and digital transmission.

Amplitude modulation (AM):	<b>Changes the amplitude of the continuous wave.</b>
Frequency modulation (FM),	<b>Changes the frequency of the continuous wave.</b>
Continuous wave (CW) Morse Code transmission	<b>Turns the continuous wave off and on to produce the dits and dahs of Morse code.</b>
Single sideband (SSB) transmission	<b>In reality AM modulated signals are complex signals with a lot of duplicated and un-necessary information. A SSB transmitter eliminates the duplicated and un-necessary information. This greatly increases efficiency of the transmitted signal.</b>
Digital transmission.	<b>There are two ways to produce the Ones and Zeros of digital communications. One way is to changes the phase of the continuous wave. Another way is to transmit on two different frequencies – one for zeros and one for ones.</b>

- d. Explain how NOAA Weather Radio (NWR) can alert you to danger.

**NOAA Weather Radio (NWR) is a series of transmitters operating near 162 MHz across the country sending weather information direct from the National Weather Service. Many Amateur Radio handheld transceivers can receive these broadcasts, making them doubly useful on camping trips. In addition, special NWR receivers can silently monitor the broadcasts and turn themselves on when urgent weather danger threatens.**

- d. Explain how cellular telephones work. Identify their benefits and limitations in an emergency.

**Cellular telephones are radios. They transmit radio signals back and forth to a cell site to make phone calls, send text messages, or data for applications. As you change location, your radio is transferred to another cell site along your way of travel. For the system to work, the cell sites are connected by landline cables. This makes them vulnerable in disasters, as these landlines can fail and power can be lost. In emergencies the government can turn off cell towers.**

## RADIO CLASS MASTER

Here we are supposed to discuss section 7 and section 9a of the Radio Merit Badge Workbook.

7. Visit a radio installation (an amateur radio station, broadcast station, or public communications center, for example) approved in advance by your counselor.

Discuss what types of equipment you saw in use, how it was used, what types of licenses are required to operate and maintain the equipment, and the purpose of the station.

Equipment:	<b>Equipment at the Garland Amateur Radio Club's Communications Center includes antennas on towers outside, and coax cables connecting the outside antennas to the radios inside, plus High Frequency radios and Very High Frequency radios on the inside.</b>
Licenses:	<b>You need a General or Extra amateur license to transmit on the High Frequency radios. Any amateur license, including the Technician license is needed to transmit on the Very High Frequency radios.</b>
Purpose:	<b>We gather here to socialize, for training, for community activities and for emergency operations.</b>

9. Do ONE of the following: (a OR b OR c OR d )

a. **Amateur Radio**

1. Tell why the FCC has an amateur radio service.

**The Federal Communications Commission (FCC) authorizes the Amateur Radio Service. One of the reasons for the Amateur Radio Service is because it is a hobby where people help others learn about amateur radio and have fun. It's called Amateur Radio because the frequencies can't be used for commercial or money-making purposes. The Amateur Radio Service is also called "Ham Radio."**

Describe some of the activities that amateur radio operators can do on the air, once they have earned an amateur radio license.

**Some of the activities that amateur radio operators can do on the air are:**

**Scouts Jamboree On The Air (JOTA) is the third weekend every October when scouts from all over the world talk to each other on ham radio.**

**Long Distance Radio Reception otherwise known as DX allows hams to talk to other hams around the world and collect postcards called QSL cards to prove that they did make the contact. It's a great way to have fun and learn about geography.**

**Contests are held many weekends. Contests are when you try to contact as many people from a certain place or in a certain way. For example, to get a Worked All States Award you need to contact another ham in each of the fifty states.**

**Public Service at parades and special events is one place where Hams excel. Ham radio operators are often the best people to help with communication at large community events, from small Rodeos and Stock Shows all the way up to the Dallas Marathon. Last December we had eighty Hams assisting at the Dallas Marathon with Ham Radios at water stops and aid stations.**

**Disasters like fires, floods and earthquakes are times when Hams are often called on to help by providing communications assistance. At these times, telephone lines and cell phone sites are often damaged or overloaded, and ham radio is the only reliable communications. During emergencies cell phone towers can be restricted to emergency use only.**

## RADIO CLASS MASTER

**Skywarn** training classes are provided by the National Weather Service around the nation in the months of January and February. The National Weather Service uses Hams to report severe weather conditions directly to a weather center via Ham radio. Listen to the Weather Radio (162.440 MHz for Dallas) and they will tell you if Spotter Activation is currently required.

**Digital Communications** are when communications are sent by digital means as ones and zeros instead of by voice. Some hams hook their computers to their radios so they can send electronic messages. One example is wireless e-mail. We have two radios right here in the GARCC that are used for e-mail over the radio, no internet is required. When the real internet is down Hams still have their own internet over the radio. Our internet antenna is on top of the utility pole outside and it is pointing to Richardson. This internet operates over Ham frequencies so only Hams can access it.

**Camping** communications with Ham radio are easy even in the backcountry. Use Ham radio when you need to get help or just let the folks back home know how things are going.

**Hobbies** include operating model planes, trains, boats, and airplanes via amateur radio frequencies with an amateur radio license. Sometimes operating the video equipment on drones requires an amateur radio license.

2. Explain differences between the Technician, General, and Extra Class license requirements and privileges..

Technician:	<b>The Technician Class license is the entry level Amateur Radio license. This license gives use of Very High Frequency bands and above so you can communicate around town and it gives you the use of repeaters.</b>
General:	<b>The General Class license is the mid level Amateur Radio license. This license adds most High Frequency band privileges used for world-wide communications to the Very High Frequency privileges previously earned by the Technician license.</b>
Extra Class:	<b>The Extra Class license is the highest level Amateur Radio license. This license adds all privileges on all amateur bands.</b>

Explain who administers amateur radio exams.

**The exams are given by local Volunteer Examiners know as VEs. These VEs are hams with a General or Extra class amateur licenses.**

3. Explain at least five Q signals or amateur radio terms.

**See the attachment. (Popular: QRZ, QSL, QSO, QSY, QTH)**

**(Who is calling me, Acknowledge, Conservation, Change Frequency, Location)**

4. Explain how you would make an emergency call on voice or Morse code.

**If you see a true emergency you are allowed to report that emergency by any means available. A true emergency is things like a boat overturned in the lake, a house on fire, a tornado on the ground. During a true emergency and if your cell phone and/or land lines are not functioning or available then you are allowed to transmit over any radio available. Say that you are a Boy Scout with at true emergency. Then when asked, give any details required. Most radio dispatchers know that you are allowed to use any radio available in a true emergency.**

## RADIO CLASS MASTER

### **IF YOU OBSERVE A TRUE EMERGENCY:**

If you observe a true emergency and you want to report that emergency on the Ham bands wait for an opening in the conversation if a conversation is in progress. Of course, if there is silence, that means there is an opening. Say the word Emergency. Repeat the word Emergency if necessary. When asked, say that you are a Boy Scout with a true emergency. Then when asked, give any details required.

### **IF YOU ARE INVOLVED WITH A TRUE EMERGENCY:**

Of course, protect life and limb first.

You make an emergency call using voice by saying:

- The word "Mayday" three times
- Your call-sign
- Your location
- A message explaining what help you need
- The word "Over"

You make an emergency call using Morse Code by sending:

- The letters "SOS" three times
- Your call-sign
- Your location
- A message explaining what help you need

5. Explain the differences between handheld transceivers and home "base" transceivers. Explain the uses of mobile amateur radio transceivers and amateur radio repeaters.

Transceivers:	<b>Handheld Transceivers are complete units that are small enough to be held by one hand. A mobile station in a vehicle or a permanent station in your home is generally larger than a Handheld Transceiver and it has more transmitter power and more features.</b>
Repeaters:	<b>Repeaters are automatically controlled transceivers that relay signals. Repeaters are located on high points like mountains, tall buildings, satellites, and the International Space Station. International governments help amateurs launch their own satellites. See <a href="http://amsat.org">amsat.org</a> if you are interested.</b>

6. Using proper call signs, Q signals, and abbreviations, carry on a 10-minute real or simulated amateur radio contact using voice, Morse code, or digital mode. (Licensed amateur radio operators may substitute five QSL cards as evidence of contacts with five amateur radio operators. Properly log the real or simulated ham radio contact, and record the signal report.)