

Comments on RM-11829

James K. Rinehart
1455 Shannon Ave
Indianapolis, In 46201

Comments:

There has been a lot of discussion about the need for an entry class license, but what is presented in this petition is not what is needed.

The Novice license died out as most opted for Technician License and with the additional HF privileges proposed in Petition RM-11828 it is even more attractive as an entry class license.

I reviewed the results for my VE test sessions for the last year and I had an 80% pass rate for the Technician exams and many also passed the General exam.

A new entry class license should work within the present structure of amateur radio and allow the licensee to experience the entire scope of amateur radio.

Amateur radio has a lot to offer; experimentation, emergency communication satellite communications, working DX with different modes and types of propagation, etc.

I do agree that for younger people getting a ham license might be a challenge.

If you read through this petition it is not an entry level amateur radio license but it is trying to establish a new personal radio service modeled around the GMRS service that within the amateur radio bands.

The Tryo license class has:

1. Its own repeater coordination and license committee that coordinates and dictates who can have a repeater, where is it located, and how it can be used.
2. Tryos and all amateur licensees can use the 99, 2.5 KHz deviation, 12.5 KHz spaced analog FM repeater/simplex channels with CTCSS. CTCSS low speed data and data as specified in the Tyro rules.
3. Online license application with a few simple questions very similar to applying for a GMRS license.
5. A commitment or promise for an amateur to mentor the Tryo licensee with no requirement for either the amateur or the Tryo licensee to complete it or any definition of what is required for the mentor to complete in the process.

6. Cross-banding under the supervision or managed by a higher class licensee is a feature of the Tyro class license.

Tyro traffic may be retransmitted beyond the Tyro sub band (cross band linking) exceeding the Tyro control operator privileges, but limited to frequencies and modes permitted by the repeater or station license.

This extends the scope of the Tyro traffic without their being technical or personally responsible.

7. The age limit is 11 years old to apply for a license.

8. Digital transmission must use Open Architecture coding techniques, specifically: public domain specifications, no required agreements, no royalties or licensing.

9. Tyro radio and repeaters must meet the specs and be type accepted for Tyro operation.

The Tyro is based on the GMRS model channelized model and will not be able to adapt as ham radio changes. Many of the repeaters and channels are limited to FM, but a few available for limited experimentation within the Tyro rules.

Amateur radio is not channelized. Amateur Radio uses band plans developed by amateurs and to meet the regional frequency, terrain and population needs.

This has allowed amateur to evolve and adapt to new technologies and frequencies demands in different areas of the country.

Amateur Radio allows for experimentation with different modes and technologies. They can be wide or narrow bandwidth; TV both analog and digital, (image), propagation beacons, meteor scatter, moon bounce (EME), analog voice (SSB/FM), digital voice and data and spread spectrum.

Amateur Radio is switching from FM to digital; DMR, Yaesu Fusion, D-Star and other digital modes.

There are amateur radio HTs, mobiles and repeaters that are available for mixed mode digital voice/data and FM operations.

Motorola, Kenwood digital repeater are showing up on the used/surplus market. They are being re-proposing as ham radio repeaters and use technology that may require a license to manufacture., but the technology has been proven with the commercial use.

He talks about using surplus radios like Motorola or GE Master II but then wants type accepted radio for the Tyro radios.

Amateur radio is switching from these radios to the next generation of digital used equipment available.

Yaesu offered a special deal for amateur club buying a mixed mode Fusion Digital / FM repeater.

Amateur radio offers a wide range of modes: SSB, CW, FM, Digital Voice and Data, ATV, RTTY, TV, PSK31, packet, FT8 and many other digital modes. SSB and CW offer a lot of advantages with weak signal and DX operations

FT8 is one of the latest digital modes and came out about the time this petition was written in 2017. Now it represents 30% of the contacts being made on HF and 6 meters. WSJT-X has more digital modes used for moonbounce (EME) and meteor scatter.

The FCC will need to constantly step in and revise the rules for Tryo channelized for it to adapt to new technologies.

I don't think we should put an age limit on getting an entry class amateur radio license.

I am VE and we have an eight and nine year olds pass the tech license this year. The eight year old only missed the general by two questions and he has taken a code class at a Contest Academy and is on the air on the HF CW tech bands.

The 8 year old's enthusiasm for ham radio is catching. He brings his electronic keyer to the club meeting and talks to everyone about ham radio.

We had two 13 year old girls and one 13 year boy operate the W9IMS Special Event Station that held extra class license.

I do agree that the younger kids have usually not been exposed to algebra and engineering notation, but that can be taught.

The Scouts (Boy Scouts) have a club station at Camp Belzer in Indianapolis, with classes and free license testing quarterly.

Scouts with ham licenses have stopped by and operated Field Day with us.

Why use 70cm?

a) He makes the best point for not using 70 cm with the wind profile in Denver and other interference sources materializing are causing problems for repeater in Denver. If the interference is such a big problem why would you want to subject new hams to a problem that could be a real turn off.

b) The 70 Centimeter band is the backbone of the VHF/UHF amateur radio bands. I don't think the petitioner has looked at it from an amateur radio standpoint. Below is the ARRL band plan, you can see the band is pretty well utilized.

c) It is the first band where amateur can experiment analog or digital TV and that is in the

420–426 MHz part of the band.

d) 420–426 MHz is also used for repeater linking. Out west it is used for mountain top to mountain top linking. Examples are the Upper Rio FM Society linking system covering most of New Mexico and The Cactus Intertie linked system covering large portions of California, Arizona, New Mexico, Nevada, Utah, Colorado and Texas.

e) These are duplex links with 5 MHz separation and are in the lower part of the 70 cm band.

f) The 70 Centimeter band is low enough in frequency that you can still build RF circuits, but 1.2 GHz and above are not practical for most amateurs to experiment with. We need some bandwidth set aside for experimentation with new technologies and modes.

g) He says the 99 channels Tryo would only occupy only 2.25 MHz, 1 MHz of the bottom of the band, 420 MHz to 421 MHz (these frequencies are used for repeater linking) and 1.25 MHz from the top of the band 448.75 MHz to 450 MHz are repeater inputs.

h) The low end of 70 centimeter bands is used differently in different areas of the US. Common use is for links both one way and duplex links with 5 MHz separation between transmit and receive links.

i) There are packet duplex links and ATV in this section of the band.

j) 440 MHz repeater frequencies are always in high demand especially with more digital repeaters coming on line.

k) Each state or region has adapted the band to their needs and interests. California and the east coast have large populations, New Mexico, Arizona and Texas and have large area with mountains and low populations. See the bandplans below.

l) The 2.25 MHz requested would decimate the current bandplan. It would be easier to accommodate a new entry-level class within the existing bandplan repeater coordination structure.

m) The repeater coordination and license committee proposed in the petition are a new separate coordinating body for the TRYO sub band and there is no requirement that they work with the amateur radio recognized amateur coordinators.

n) The 70 cm band is shared with other services and there is a Part 15 section around 434 MHz so you expect some interference

o) The petitioner could have included data on the impact to the present amateur radio repeaters and how many would be displaced by reallocating part of the 70 Centimeter amateur radio band to the Tryo Sub Band.

70 Centimeters (420-450 MHz) ARRL Bandplan

420.00-426.00	ATV repeater or simplex with 421.25 MHz video carrier control links and experimental
426.00-432.00	ATV simplex with 427.250-MHz video carrier frequency
432.00-432.07	EME (Earth-Moon-Earth)
432.07-432.10	Weak-signal CW
432.10	70-cm calling frequency
432.10-432.30	Mixed-mode and weak-signal work
432.30-432.40	Propagation beacons
432.40-433.00	Mixed-mode and weak-signal work
433.00-435.00	Auxiliary/repeater links (Shared with Part 15 Digital)
435.00-438.00	Satellite only (internationally)
438.00-444.00	ATV repeater input with 439.250-MHz video carrier frequency and repeater links
442.00-445.00	Repeater inputs and outputs (local option)
445.00-447.00	Shared by auxiliary and control links, repeaters and simplex (local option)
446.00	National simplex frequency
447.00-450.00	Repeater inputs and outputs (local option)

SERA is the largest Amateur Radio Repeater Coordinating organization in the United States. SERA, P.O. Box 25, Hillsville, VA 24343

SERA FREQUENCY UTILIZATION PLAN for 420-450 MHz

420.0000 - 420.2000 Repeater Links
420.0000 - 426.0000 ATV Repeater Output 421.250 Video - 425.750 Audio
426.0000 - 432.0000 ATV Simplex 427.250 Video - 431.750 Audio
432.0000 - 433.0000 SSB & Weak Signal 432.100 National SSB Calling Frequency
433.0125 - 433.2000 Repeater Links
433.0000 - 439.0000 ATV Simplex Only 434.000 Video - 438.500 Audio
438.7750 - 439.5875 Repeater Links
439.6000 - 440.4750 FM Digital/Packet Operation
440.5125 - 440.7250 Narrow Band Digital Repeater Outputs/Duplex Backbones/Link
440.7375 - 440.9000 Simplex Cross Band Voice - Base
440.9125 - 441.1750 Simplex Digital
441.1875 - 441.4875 Links, Control Frequencies
441.5000 Simplex Digital 441.000 National Digital Calling Frequency
441.5250 - 441.7750 Duplex Link Repeaters
441.8000 - 444.9750 FM, APCO P25, DMR, Fusion and D-Star Repeater Outputs

445.0250 - 445.4750 Digital
445.5125 - 445.7250 Digital Repeater Inputs
445.7375 - 445.9000 Simplex Cross Band Voice - Mobile
445.9125 - 446.1750 FM Simplex 446.000 National FM Calling Frequency
446.1875 - 446.4875 Links, Control Frequencies
446.5000 Simplex Digital
446.5250 - 446.7750 Duplex Link Repeaters
446.8000 - 449.9750 FM, APCO P25, DMR, Fusion and D-Star Repeater Inputs, wideband/mixed mode digital

Western Washington Amateur Relay Association 70cm Band Plan

420.000 - 426.000 ATV repeater, control links and experimental operation 421.250 Video carrier for ATV3
426.000 - 432.000 ATV simplex, control links special mode and experimental operation
427.250 Video carrier for ATV3
430.800 - 431.000 Packet radio
432.000 - 433.000 Weak signal activities - NO FM ALLOWED
432.100 National SSB calling 433.000 - 435.000 ATV repeater, auxiliary links and repeater links
434.000 Video carrier for ATV3
435.000 - 438.000 Satellite only by international treaty
438.000 - 440.000 Control links, special modes and experimental operation
439.800 - 439.975 Packet Radio
440.000 - 445.000 Repeater outputs, links and simplex
440.000 Shared Non-Protected Pair (SNP) #1 output
440.025 Cross band operation
440.700 - 440.775 Packet repeater outputs
440.800 - 440.900 Packet simplex
441.000 National Packet simplex frequency
443.000 Shared Non-Protected Pair (SNP) #2 output
445.000 - 450.000 Repeater inputs, links and simplex
445.000 Shared Non-Protected Pair (SNP) #1 input
445.700 - 445.775 Packet repeater inputs
445.800 - 445.900 Voice simplex only
445.825 Shared Public Service simplex. Other frequencies will be added for this use as they become available
445.975 - 446.025 Voice simplex only
446.000 National FM simplex calling 448.000 Shared Non-Protected Pair (SNP) #2 input

Open repeater for TRYO

As a repeater owner and control operator I feel I have the right to say who can use it. After all the repeater is an extension of my station and my license.

A repeater cost around \$1500, cavities \$1500, antenna \$500, controller \$600, 7/8" Heliax about \$5 foot new (can find some used or salvage for less).

Tower space is getting harder to find and they want to charge for it.

You will have to pay someone to climb the tower and put up the antenna and feedline.

Depending on where it is located you may have to do an environmental impact study, noise floor for the site and RF exposure.

Ongoing operating cost: power \$60 a month, internet \$60 a month, Liability insurance \$350 a year, maintenance \$350.

I think it is only right that the licensee and those paying for the repeater would have the right to control how and who can use the repeater not Tryo repeater coordinator and license committee. If Tryo is like a person personal communication service, I should be able to bill the users for the cost of the operation.

Online Licensing and a Promise to be Mentor

The online licensing has problem with a few basic questions and an amateur to promise to be a mentor. He compares it to getting a GMRS license.

If you were looking to get a radio license for personal use and you had a choice between getting a GMRS license and paying \$65 and a TRYO ham license for free only with only a simple test a ham to sign up to promise or makes a commitment to be a mentor.

The words “Promise” and “Commitment” to be a mentor are used in the petition. This is pretty vague.

There is no definition of what is expected of the mentor and even that the Tryo licensee has to cooperate with the mentor after getting the license.

Is mentoring as simple as just showing the new Tyro licensee how to turn on the HT, the squelch, volume control and PTT button are located and what repeaters are on the air? Maybe making one contact.

The idea lacks accountability and with no requirements, no workbook or checklist to be used by the Mentor and the Tyro licensee to ensure mentoring works.

A workbook should be developed so that the mentoring has structured plan to follow. The mentoring should start before taking the exam and the workbook required to complete before the exam and a requirement to before taking the exam. This would be the study guide for the exam and could be done online so the mentor to follow the progress and help if needed.

The Mentor will sign the tyro license and will be responsible for the Tryo licensee until he upgrades to Technician or higher class license.

He can also request that the FCC suspended the license if he feels the Tryo licensee did not

complete the mentoring or for illegal or improper operations.

I am concerned with the cross-band linking he mentions in the petition.

This is covered in Part 97 already, but as it is used in the petition as a feature of the Tryo license and it sounds like he is trying to circumvent the rules to add this as a privilege for the Tryo license.

He uses terms like managed by or supervised by and then mention cross banding to 14.160 MHz. He does not say a control operator is required.

Part 97 does allow for 3rd parties to speak over an amateur radio station under the control of a license operate or control operator.

I don't think cross-band linking was intended to allow the Tryo class operator to operate on frequencies that exceeds the control operator privileges of on a regular basis.

I don't think that cross-band linking should be allowed or promoted as a feature of the Tryo license.

The Novice License (no longer issued) would be a better starting point for an entry class license

A. Offering the Novice licenses again would not require creating new infrastructure within amateur radio.

It does not require any new sub bands like needed for the proposed Tryo License class

There is a recognized bandplan and amateur radio repeater coordination.

It has 1.25 meter and 23 centimeter allocations.

There are 1.25M repeaters on the air as well as CW and SSB operation.

B. The 1.25M HTs are about the same cost. Examples are the Baofeng 5RX3 and the UV82X.

Kenwood has released the TH74A triband D-Star HT. It is more expensive but not compared to other hi-end HTs from major manufacturers for 2M and 70CM.

Bridgecom has also introduced BCR-220 a dual mode FM/Digital digital repeater.

Novice allocations in the 1.25 meter band (222 – 225 MHz) Power 25W

The 1.25 MHz novice band many modes of operation: FM, SSB, digital voice and data, image, RTTY, packet, PSK31, FT8 and other data privileges.

The range would be better for the same power compared to 70 Centimeters.

Novice allocation - 23 Centimeter band (1270 – 1295 MHz) Power 5W

No HTs are currently available, but there have been a few in the past.

There are radios intended for satellite use like the IC-9700 or IC-9100 and the FT736, but the output power is too high.

New allocation

2.4 GHz Allocation - Mesh Network (2300-2310 GHz & 2390-2450 GHz) Broadband Hamnet and RC Drones

Mesh Networks are still new, but it could be with an app on a cellphone allow access that could use reprogram WiFi routers that connect to the internet, maybe link to digital repeaters.

Allow Novices to used 2 meter and 70 Centimeter link to 222 MHz and 23 CM repeaters.

Many 222 MHz repeaters already have cross-band linked to 2m or 70CM provided the linking is under the control of the control operator. They as long as they did not initiate or control the link. This would be limited to 2M and 70CM.

I said I did not like the cross-band linking in the Tryo license, but the Novice License is a more advanced class of license allow more modes of operation with a real test.

I don't think that the Novice license should be added as a license step and carries no credit for the Technician license.

The Technician License would still be the first in the series in the required license steps; Technician, General and Extra.

The online test with mentoring has merit and could be considered for the Novice exam also.

If the FCC decides to go ahead the Tryo license class. This is how getting a Tryo license it might end up working.

1. You look on line for a radio that you could use for talking to your buddies while hunting, fishing or hiking. Maybe you are a rancher or farmer looking for a radio to use to talk with hands while fixing fence or to talk to other farmers about grain prices or where they can get a part they need for their combine.

On the internet you find there is:

FRS which is free but limited range.

GMRS which offer greater range, 50W power and has repeaters to increase the range, but the license cost \$65.

Tyro amateur radio license which is free, 20W power, 99 channels, simple online test, requires a mentor to help understand amateur radio requirements.

Drop downs on the side of the showing sites and ads selling the Tyro radios.

Tyro Ht \$65, no need to take an exam for a license, simple online test. 50 miles ranges great with repeaters for hunters, fisherman, hiker and great to have in an emergency to talk to other ham radio operators. Call for price and details.

2. You see there is a CB /Two Way Radio Shop that is selling them near you so you go over to check it out.

He shows you the HT and says getting the license is simply fill out an application and take the test online. just answer a few basic questions about amateur radio.

He has an amateur radio license and can sign off as the proctor for the exam and your mentor. There is a short youtube video to watch going over ham radio you have to watch before taking the exam.

3. You decided you want to check the prices out the internet to see if they have a better deal.

The sales person you talk to says it simple. It requires you to complete the license application and take test on line with a few simple questions about ham radio.. You will need to watch short youtube video about ham radio before taking the exam.

They have an youtube Mentoring video that shows you how to unpack and use your Tryo radio. It also covers key point about Part 97 and RF safety.

The salesperson says if you buy the radio he can help you complete the license application and be the online proctor for the test and your mentor.

You agree and you and the salesperson complete the application form, watch the video and complete the exam.

Passing the exam you can print out your license from the FCC ULS site.

The application should include:

1. Proctor's statement the exam was administered as specified in Part 97.

Proctor's Name, call sign, license class and FRN
Electronic signature, call and date

2. Mentor's statement that he accepts responsibility for the Tryo and will monitor his operation and as the mentor has the right to request that the FCC suspend Tryo license if found breaking rules set forth in Part 97.

3. the applicant would need to apply for and receive a FRN on the FCC ULS / CORES site.

The Exam:

The exam would be made up of 25 questions selected from a 250 question pool. 19 correct to pass. – See the Appendix for suggested material to be covered by the question pool.

If the applicant the exam he will receive a FRN but can not be retaken for 30 days to allow time for the mentor to review the material with the Tyro applicant.

The test could be generated similar to ARRL VEC test generator. This does allow each applicant to get a different test adding some integrity to the exam.

Note: This is an amateur radio license so Tryo should demonstrate that he understands the basic requirements, rules and operation procedures of amateur radio.

GMRS has no operating procedures or requirements to even read the rules, you just get a license on get on the air.

1. IF the applicant fails he will receive an FRN but will need to wait 30 days before taking the test again. This will give the Mentor time to review the material with him.
2. Now if you pass the exam, you can print out your license, the store will ship you a radio. All that is left for you to do is to set back and watch the Mentor video on youtube video and you are ready to go on the air when you receive your radio.
3. Tryo license is an entry level license but has no credit for the technician license and is not one of the required steps in the amateur radio license system, Technician, General and Extra.
4. The test would be a 25 question test 19 correct needed to pass generated from a 250 question pool.

Another approach for the exam would be a teaching exam with the material covered in a video followed by questions randomly selected from the question pool for that section. This would be done one section at a time.

The mentoring will be done before taking the exam and the mentor will state it was completed on the application.

The mentor will give an overview of the amateur radio Part 97 regulations and operating practices. Explain the different call signs available for the different license classes and the vanity call signs.

The mentor would be required to demonstrate how to program and use an HT, what is the purpose of: PTT squelch, memory and VFO operation as well as simplex and repeater

operation.

The Mentor would demonstrate the proper way to make call on the repeater and supervise the applicant while making 5 contacts. If possible, check into a net and make a contact on the HF bands.

The Proctor could enter his call sign plus a code you would get when requesting the exam online.

This is a teaching exam and would consist of a video going over the material that could be repeated as many times as the applicant wanted but once you take the exam you can't go back but would proceed to the next section and repeat the process until the exam is completed.

The applicant would see the questions they missed along with the correct answer for each section and get a report at the end of the test showing how many questions were missed in each section.

The exam can be taken twice. If failed, the applicant will have to wait 24 hours before taking the exam again. The will give the applicant and the mentor time to go over the material before taking the exam again.

Suggested material for the Tryo class license question pool:

The question pool would be created and maintained by the NCVEC

- a) FCC Rules, descriptions, and definitions for the Amateur Radio Service, operator and station license responsibilities.
- b) Authorized frequencies: frequency allocations; ITU; emission modes; restricted sub-bands; spectrum sharing; transmissions near band edges.
- c) Operator licensing: operator classes; sequential and vanity call sign systems; International communications; reciprocal operation; places where the Amateur Radio Service is regulated by the FCC; name and address on the FCC license database; license term; renewal; grace period.
- d) Authorized and prohibited transmission: communications with other countries; music; exchange of information with other services; indecent language; compensation for use of station; retransmission of other amateur signals; codes and ciphers; sale of equipment; unidentified transmissions; one-way transmission.
- e) Control operator and control types: control operator required; eligibility; designation of control operator; privileges and duties; control point; local, automatic and remote control; location of control operator.

- f) Station identification; repeaters; third-party communications; club stations; FCC inspection.
- g) Station operation: choosing an operating frequency; calling another station; test transmissions; procedural signs; use of minimum power; choosing an operating frequency; band plans; calling frequencies; repeater offsets.
- h) VHF/UHF operating practices; FM repeater; simplex; splits and shifts; CTCSS; DTMF; tone squelch; carrier squelch; phonetics; operational problem resolution; Q signals.
- i) Public service: emergency and non-emergency operations; applicability of FCC rules; RACES and ARES; net and traffic procedures; operating restrictions during emergencies.
- k) Radio wave characteristics: properties of radio waves; propagation modes.
- l) Amateur Radio practices and station set-up.
- j) Electrical principles, units, and terms: current and voltage; conductors and insulators; alternating and direct current.
- o) Basic electronic components; switches, diodes, transistors, FET, IC, resistor, capacitors and inductors.
- p) Station equipment: common transmitter and receiver problems; antenna measurements; troubleshooting; basic repair and testing.
- q) Station equipment: receivers; transmitters; transceivers; modulation; transmit and receive amplifiers.
- r) Common transmitter and receiver problems: symptoms of overload and overdrive; distortion; causes of interference; interference and consumer electronics; part 15 devices; over-modulation; RF feedback; off frequency signals.
- s) Antenna measurements and troubleshooting: measuring SWR; dummy loads; coaxial cables; causes of feed line failures.
- t) Antennas and feed lines – Antennas: vertical and horizontal polarization; concept of gain; common portable and mobile antennas; concept of vertical, dipole and beam antennas.
- u) Electrical safety: AC and DC power circuits; antenna installation; RF hazards Power circuits and hazards: hazardous voltages; fuses and circuit breakers; grounding; lightning protection; battery safety; electrical code compliance.

The petitioner mentioned the Boy Scout Merit Badge.

We had experience working with the scout's JOTA.

One JOTA was a pitch-in dinner with the parents along with the JOTA operation. The parents

operated as well as the kids and two kids and two parents ended up getting their license.

Another ham radio event was a scout masters idea was a ham radio / astronomy operation. This was when Mars has close to the earth.

We arranged to be contact with W6VIO so the scout's could talk with ham at NASA. We also had a telescope setup so the could view Mars. We had three scout troops visit the club station.

This was a big success for both the scouts and our club.

Boy Scout Merit Badge requirements.

- 1) Explain what radio is. Then discuss the following:
 - a) The differences between broadcast radio and hobby radio
 - b) The differences between broadcasting and two-way communications
 - c) Radio call signs and how they are used in broadcast radio and amateur radio
 - d) The phonetic alphabet and how it is used to communicate clearly
- 2) Do the following:
 - a) Sketch a diagram showing how radio waves travel locally and around the world.
 - 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.
 - c) Explain the difference between a distant (DX) and a local station.
 - d) Discuss what the Federal Communications Commission (FCC) does and how it is different from the International Telecommunication Union.
- 3) Do the following:
 - a) Draw a chart of the electromagnetic spectrum covering 300 kilohertz (kHz) to 3,000 megahertz (MHz).
 - b) Label the MF, HF, VHF, UHF, and microwave portions of the spectrum on your diagram.
 - c) Locate on your chart at least eight radio services such as AM and FM commercial broadcast, citizens band (CB), television, amateur radio (at least four amateur radio bands), and public service (police and fire).
 - d) Explain how radio waves carry information. Include in your explanation: transceiver, transmitter, receiver, amplifier, and antenna.
- 4) Do the following:
 - a) Explain the differences between a block diagram and a schematic diagram.
 - b) Draw a block diagram for a radio station that includes a transceiver, amplifier, microphone, antenna, and feed line.
 - 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.
 - d) Explain how NOAA Weather Radio (NWR) can alert you to danger.

- e) Explain how cellular telephones work. Identify their benefits and limitations in an emergency.
- 5) Explain the safety precautions for working with radio gear, including the concept of grounding for direct current circuits, power outlets, and antenna systems.
- 6) 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.
- 7) Find out about three career opportunities in radio. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.
- 8) Do ONE of the following: (9 OR 10 OR 11 OR 12)

9) Amateur Radio

- a) Tell why the FCC has an amateur radio service. Describe some of the activities that amateur radio operators can do on the air, once they have earned an amateur radio license.
- b) Explain the differences between the Technician, General, and Extra Class license requirements and privileges. Explain who administers amateur radio exams.
- c) Explain at least five Q signals or amateur radio terms.
- d) Explain how you would make an emergency call on voice or Morse code.
- e) Explain the differences between handheld transceivers and home "base" transceivers. Explain the uses of mobile amateur radio transceivers and amateur radio repeaters.
- f) 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.

10) Radio Broadcasting

- a) Discuss with your counselor FCC broadcast regulations. Include power levels, frequencies, and the regulations for low-power stations.
- b) Prepare a program schedule for radio station "KBSA" of exactly one-half hour, including music, news, commercials, and proper station identification. Record your program on audiotape or in a digital audio format using proper techniques.
- c) Listen to and properly log 15 broadcast stations. Determine the program format and target audience for five of these stations.
- d) Explain to your counselor at least eight terms used in commercial broadcasting, such as segue, cut, fade, continuity, remote, Emergency Alert System, network, cue, dead air, PSA, and play list.

- e) Discuss with your counselor alternative radio platforms such as internet streaming, satellite radio, and podcasts.

11)Shortwave and Medium-Wave Listening

- a) Listen across several shortwave bands for four one-hour periods - at least one period during daylight hours and at least one period at night. Log the stations properly and locate them geographically on a map, globe, or web-based mapping service.
- b) Listen to several medium-wave stations for two one-hour periods, one period during daylight hours and one period at night. Log the stations properly and locate them on a map, globe, or web-based mapping service.
- c) Compare your daytime and nighttime shortwave logs; note the frequencies on which your selected stations were loudest during each session. Explain the differences in the signal strength from one period to the next.
- d) Compare your medium-wave broadcast station logs and explain why some distant stations are heard at your location only during the night.
- e) Demonstrate listening to a radio broadcast using a smartphone/cell phone. Include international broadcasts in your demonstration.

12)Amateur Radio Direction Finding

- a) Describe amateur radio direction finding and explain why direction finding is important as both an activity and in competition.
- b) Describe what frequencies and equipment are used for ARDF or fox hunting.
- c) Build a simple directional antenna for either of the two frequencies used in ARDF.
- d) Participate in a simple fox hunt using your antenna along with a provided receiver.
- e) Show, on a map, how you located the "fox" using your receiver.