Licensing Authority

• Federal Communications Commission
  – Located in Gettysburg, PA.
  – Use Part 97 for short
Why is There Ham Radio?

1. Providing emergency communication capability.
2. Advancement of the art and science of radio.
3. Advance communication and technical skills of radio.
4. Provide a trained reservoir of operators, technicians, and electronics experts.
5. Promote and enhance international goodwill.
Some Definitions

• Amateur Service – no pecuniary interest (private and personal, non commercial).
• Amateur Operator – the person holding authorization (license) to operate an Amateur Radio station.
• Amateur Station – equipment capable of transmitting on frequencies authorized for Amateur Service.
The Amateur License

• No age limit or citizenship restrictions.
  – One exception – foreign representatives.

• License actually contains two parts.
  – Operator License.
  – Station License (the Call Sign).

• Three levels of operator privileges: Technician, General, Amateur Extra.
Examinations

• Preparation
  – Study the content.
  – Question Pool.

• Taking the exam
  – Proctored exam.
  – Multiple choice.
  – What the fee pays for.

• Volunteer Examiners (VEs).

• Volunteer Examiner Coordinators (VECs).
License Term and Renewal

• The license is free and good for 10 years.
  – Renewable within 90 days of the expiration date.

• Some personal identification information is required.
  – Tax ID (Social Security number).
  – Current Mailing Address.
  – Federal Registration Number (FRN).
Responsibilities of Licensure

- Prevent unauthorized operation of your station.
- Provide personal information as required – keep a current mailing address on file.
- Make your station available for FCC inspection upon request.
FCC ULS Web Site

- www.wireless.fcc.gov/uls
  - Register for on-line access to your license information.
  - Make changes to your address and other information.
  - Renew your license.
  - Search for other station information.
What can you do with a Technician Class License?

- Frequency Privileges:
  - Band versus frequency
  - Everything 50Mhz and up.

\[
\text{Band} = \frac{300}{Freq(MHz)}
\]
What can you do with a Technician Class License?

- Emission Privileges:

<table>
<thead>
<tr>
<th>Table 5-4</th>
<th>Amateur Emission Types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emission</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>CW</td>
<td>Morse code telegraphy</td>
</tr>
<tr>
<td>Data</td>
<td>Computer-to-computer communication modes, usually called <em>digital modes</em></td>
</tr>
<tr>
<td>Image</td>
<td>Television (fast-scan and slow-scan) and facsimile or fax</td>
</tr>
<tr>
<td>MCW</td>
<td>Tone-modulated CW, Morse code generated by keying an audio tone</td>
</tr>
<tr>
<td>Phone</td>
<td>Speech or voice communications</td>
</tr>
<tr>
<td>Pulse</td>
<td>Communications using a sequence of pulses whose characteristics are modulated in order to carry information.</td>
</tr>
<tr>
<td>RTTY</td>
<td>Narrow-band, direct-printing telegraphy received by automatic equipment, such as a computer or teleprinter.</td>
</tr>
<tr>
<td>SS</td>
<td>Spread-spectrum communications in which the signal is spread out over a wide band of frequencies</td>
</tr>
<tr>
<td>Test</td>
<td>Transmissions containing no information</td>
</tr>
</tbody>
</table>
What can you do with a Technician Class License?

- Power limits.
- Use the minimum power required to get the job done. (QRP = low power)
- Up to 1500 watts peak envelope power (PEP).
  - Will generally require an external amplifier to achieve these power levels.
- Some special cases where power is restricted.
Primary and Secondary Allocations

• Some authorized amateur frequencies are shared.
  – Primary Users.
  – Secondary Users (we must yield to them).
Amateur Radio - Internationally

• International Telecommunication Union (ITU).
  – Regions 1, 2 and 3.
• CONUS hams are in Region 2.
• Reciprocal operating authorizations.
• There are times when there are restrictions on certain countries that we can contact.
• US call signs begin with: K, N, W, and A.
• US call sign districts: 0-9
• First license uses your address given
Call Signs

• Portable – operating away from primary station location.

• If in the different call sign district add:
  – “portable 6” if voice.
  – /6 if Morse code or digital.
  – Not required, just nice to do.

• If recent upgrade add “AG” or “AE.” (upgrades don’t have to wait to be in the FCC database but new licenses do!)
Special Call Signs

• Club and special event call signs.
• Vanity call signs. ($14 fee, renewable)
• Some signs reserved for General and Extra class (1x2, 2x1)
Most Important Information

• Control operator responsibilities.
  – The FCC’s primary concern is that transmissions are made only under the control of a licensed operator.

• Control operator – the licensed amateur responsible for making sure transmissions comply with FCC rules.
Control Operator

- Must have a valid FCC issued Amateur Radio license.
- Station must operate within the authorization of the control operator’s license.
- Control operator must be present at the control point of the station (the on-off switch) or remotely connected by a control link.
Guest Operations

• Non-licensed people can use a ham radio but only when a control operator is present.
  – The control operator is solely responsible for station operation.

• Licensed guests can use the ham radio.
  – In this case, both the control operator and the guest ham are responsible for station operation.
Station Identification (ID)

• Normal ID.
  – Say your call sign every ten minutes during and at the end of the contact (QSO).

• Use of Tactical Call Signs.
  – Does not substitute for proper station ID.

• Ham Guests.
ID Rules Apply

• Repeaters must also ID using the same 10 minute rule.
  – Can be voice or CW (at 20 WPM or less).
  – (can be pictures if sending images)
• Satellites and ISS have special rules.
• Special event calls.
  – Normal club call or control operator call given once per hour.
Interference

• **QRN**
  – Natural interference (thunderstorms).
  – Man-made (appliances and power lines).

• **QRM**
  – Interference from nearby signals.
  – Other hams or other users of the frequencies.

• Control operators should prevent interfering with other users of the frequencies.
Preventing Interference

• Use common sense and courtesy.
• Keep equipment in proper operating order.
• No one owns a frequency; be a good neighbor and share.
• Yield to special operations and special circumstances.
Interference

- **Harmful**
  - Interference that is disruptive but not intentional.
  - Deal with it as best you can and help others avoid harmful interference.
  - Might happen if you are secondary user

- **Willful**
  - Intentionally causing interference.
  - This becomes a legal and law enforcement issue.
  - This is rare and there are procedures to deal with this (ARRL Official Observers can help).
Third-Party Communications

• Third-party means that a non-ham is involved in communication via ham radio.
  – Could be actually speaking on the air.
  – Could be passing a message on behalf of the non-ham.

• Two situations – different rules.
  – Within the US.
  – Communication that crosses international borders.
Third-Party within US

- No special rules.
- Just make sure the message is non-commercial in nature.
Third-Party Across Borders

• Make sure that third-party agreement exists.
  – Check for current third-party agreements from FCC sources if in doubt.
  – You might be surprised at the countries that we do not have third-party agreements with.

• During station identification say both stations’ call signs.
Remote and Automatic Control

- Some stations, repeaters and beacons operate without the control operator physically present at the control point.
- These stations must still comply with control operator stipulations.
  - Local.
  - Remote.
  - Automatic.
Prohibited Transmissions

- Unidentified transmissions.
  - (not giving your call sign)
- False or deceptive signals.
  - (using someone else’s call sign)
- False distress or emergency signals.
  - (fake calls for help)
- Obscene or indecent speech.
  - (up to interpretation)
- Music.
No Business Communications

- You cannot make a profit through the use of transmissions made via ham radio.
- The exception is teachers using ham radio in their classrooms.
- (ok to mention briefly, e.g. that you put a rig on sale and give a link… but not run a business)
No Encrypted Transmissions

• Encryption involves encoding information for transmission that must be decoded upon reception to interpret the information.

• This is okay if:
  – Coding is open source.
  – Intention is not to hide the message or deceive.
No Broadcasting

• Broadcasting is sending one-way transmissions with no expectation of getting a response.
  – News
  – Music

• Exceptions:
  – Code practice.
  – Ham radio related bulletins.
  – Re-transmission of shuttle communications.
Special Circumstances

- Ham communication is generally intended for hams.
- Emergencies and critical situations create special circumstances.
- Special commemorative events may qualify as special circumstances.
- Normal rules return when the situation returns to normal.
Technician License Course
Chapter 7
Electrical and RF Safety
Electrical Safety

• Avoiding contact is the most effective way of practicing electrical safety. ("one hand in your pocket" makes sure you don’t close a circuit across your heart!)

• Most modern radio equipment uses currents that are not as dangerous as older equipment but precautions still must be taken.
Electrical Injuries

- Shocks.
- Burns.
- Even small currents can cause problems.
- (defibrillator: \( \sim 200 \text{ J}, 4 \text{ kW}, 50 \text{ ms} \))

<table>
<thead>
<tr>
<th>Current (1 Second Contact)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mA</td>
<td>Just Perceptible.</td>
</tr>
<tr>
<td>5 mA</td>
<td>Maximum harmless current.</td>
</tr>
<tr>
<td>10 - 20 mA</td>
<td>Lower limit for sustained muscular contractions.</td>
</tr>
<tr>
<td>30 - 50 mA</td>
<td>Pain</td>
</tr>
<tr>
<td>50 mA</td>
<td>Pain, possible fainting. “Can’t let go” current.</td>
</tr>
<tr>
<td>100 - 300 mA</td>
<td>Normal heart rhythm disrupted. Electrocution if sustained current.</td>
</tr>
<tr>
<td>6 A</td>
<td>Sustained heart contractions. Burns if current density is high.</td>
</tr>
</tbody>
</table>
Mitigating Electrical Hazards

• TURN OFF POWER WHEN WORKING INSIDE EQUIPMENT!!!!!!
• MAKE SURE EQUIPMENT IS PROPERLY GROUNDED AND CIRCUIT PROTECTED!!!!!!
• If power is required:
  – Remove jewelry.
  – Avoid unintentional touching of circuitry.
  – Never bypass safety interlocks.
  – Capacitors hold a charge even when power is off.
  – Storage batteries are dangerous when shorted.
Responding to Electrical Injury

• **REMOVE POWER!**
  – Have ON/OFF switches and circuit breakers clearly marked.
  – Push people off live circuits with a broom or other nonconductor

• Call for help.

• Learn CPR and first aid.

• (Rice CPR includes training on AED’s which can restart hearts that have stopped)
Electrical 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. (no “cheaters”!)
  – 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.
Electrical Grounding and Circuit Protection (in the car)

• 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 where the battery ground connection is made – prevents “ground loops”.
  – Use grommets or protective sleeves to prevent wire chafing.
  – Don’t assume all metal in the car is grounded; modern cars are as much plastic as metal.
RF Safety

• Proper Grounding.
• Important not only for protection of equipment and people, any wires connected to the radio potentially becomes part of the antenna and can radiate RF where it is not intended.
Lightning Safety

• Antennas are not struck any more frequently than trees or tall structures.
• Ground all antennas.
• Use lightning arrestors.
• Disconnect antenna cables and power cords during storms.
• Disconnect telephone lines from computer modems.
RF Exposure

• Exposure to high levels of RF can cause problems.

• If equipment is operated properly, RF exposure is minimal and not dangerous.

• Problem is RF energy can heat body tissues.
  – Heating depends on the RF intensity and frequency.
  – Cooking eyes can be very fast
RF Intensity

• Power Density
  – Actual transmitter power.
    • Higher power, higher risk.
  – Antenna gain and proximity.
    • Beam antennas focus available energy.
    • Being physically close or standing in the beam direction increases risk.
  – Mode duty cycle.
    • The more time the power output is at high level, the higher the risk.
Antenna Proximity

• Controlled Environment.
  – You know where people are standing in relation to your antenna and you can do something about it.
  – More power is allowed because you can make adjustments if needed.

• Uncontrolled Environment.
  – You have no idea, or have no control of people near your antenna.
  – Less power is allowed because you have to assume the worse case scenario.
### Mode Duty Cycle

- The more time the transmitted power is at high levels, the greater the duty cycle, and the greater the exposure risk.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Duty Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversational SSB</td>
<td>20%</td>
</tr>
<tr>
<td>Conversational SSB</td>
<td>40%</td>
</tr>
<tr>
<td>SSB AFSK</td>
<td>100%</td>
</tr>
<tr>
<td>SSB SSTV</td>
<td>100%</td>
</tr>
<tr>
<td>Voice AM, 50% modulation</td>
<td>50%</td>
</tr>
<tr>
<td>Voice AM, 100% modulation</td>
<td>25%</td>
</tr>
<tr>
<td>Voice AM, no modulation</td>
<td>100%</td>
</tr>
<tr>
<td>Voice FM</td>
<td>100%</td>
</tr>
<tr>
<td>Digital FM</td>
<td>100%</td>
</tr>
<tr>
<td>ATV, video portion, image</td>
<td>60%</td>
</tr>
<tr>
<td>ATV, video portion, black screen</td>
<td>80%</td>
</tr>
<tr>
<td>Conversational CW</td>
<td>40%</td>
</tr>
<tr>
<td>Carrier</td>
<td>100%</td>
</tr>
</tbody>
</table>
RF Exposure and Frequency

• When body parts act like antennas, those parts absorb RF energy at certain frequencies (wavelengths) more efficiently and increase risk.

• RF exposure risk varies with frequency.
  – More caution is dictated at some frequencies more than other frequencies.
RF Exposure and Frequency (allowed levels – don’t put HT up to ear!)
Physical Safety

• Mobile Installations.
  – Secure all equipment.
  – Location, location, location.

• Antenna installation.
  – Clear of trees and power lines.
  – If it falls it won’t hit anyone or cross power lines.

• Tower climbing considerations.
  – Use a climbing belt with chest strap.