

# Introduction & Orientation Class Chapter 1

## Technician Class Schedule

Chapter	Classroom Activity	Instructor	2020
T1	Welcome to Amateur Radio		Wednesday, January 15
T2	Radio Signals and Fundamentals		Wednesday, January 22
T3	Electricity, Components, and Circuits		Wednesday, January 29
T4	Propagation, Antennas, & Feed Lines		Wednesday, February 5
T5	Amateur Radio Equipment		Wednesday, February 12
T6 & T7	Communicating & Regulations		Wednesday, February 19
T8 & T9	Operating Regulations & Safety		Wednesday, February 26

### How will this class works?

- Individual reading of chapter prior to class
- Watch the Class Lecture Videos at home, courtesy of Dave Casler
- Work chapter sample problems prior to class
- Use the Class Notes to supplement your reading
- Class Review of assignment, discussion and help with problems
- Individual practice tests (online) at home between classes

### Text Book required for this course

ARRL Technician Class License Manual 4th Edition

ISBN: 978-1-62595-087-1 (for use July 1, 2018 to June 30, 2022).

### School supplies used in the course

- Calculator, just a simple add subtract, multiple, divide (NO Memory Functions)
- Notebook and pen, just a simple spiral bond pad

### General Class Exam Class Videos Online courtesy of Dave Casler KE0OG

- [Dave Casler Technician Exam Videos](#)

### On-Line Practice Tests

- <https://www.eham.net/exams/>
- <https://hamexam.org/>
- <https://hamstudy.org/>

### Guides to Amateur Radio Education

- [ARRL Licensing & Education](#)
- [eHAM Guide to Amateur Radio for New Hams](#)
- [HAM Radio for Dummies \(free PDF Book\)](#)
- [Operating Procedures for Amateur Radio \(free PDF Book\)](#)

# Radio and Signals Fundamentals Chapter 2

## Math Units

<b>MEGA</b> =	1,000,000	Million
<b>KILO</b> =	1,000	Thousand
<b>MILLI</b> =	0.001	1/1,000
<b>MICRO</b> =	0.000,001	1/1,000,000
<b>PICO</b> =	0.000,000,000,001	1/1,000,000,000,000

**Electromagnetic waves** carry radio signals

Radio waves travel at the **speed of light**.

**Electric and magnetic fields** are the two components of a **radio wave**.

**Velocity** of a radio wave as it travels through free space is **300,000,000 Meters per second**

**Frequency** is the number of **times per second** that an alternating current reverses direction

**Hertz** is the unit of **Frequency > Hz**

**Megahertz** is 1,000,000 Hz > **MHz**

**HF** > 3 MHz to 30 MHz

**VHF** > 30 MHz to 300 MHz

**UHF** > 300 MHz to 3000 MHz

**Wavelength** is the **distance** a radio wave travels during **one cycle**

**Wavelength is the inverse of frequency**

When the wavelength gets shorter the frequency increases

Higher in frequency the shorter the distance between each wave.

**Wavelength (Meters) = Freq (MHz) ÷ 300** > The formula for **converting frequency to wavelength** in meters is the wavelength in meters equals 300 divided by frequency in megahertz

**Frequency bands are the approximate Wavelength of the band: 2 meters; 20 meters; 40 meters, etc**

## Electrical Units

**Hertz** is the unit of **frequency**

**Capacitance** is the ability to store energy in an **electric field**

**Farad** is the basic unit of **capacitance**

**Inductance** is the ability to store energy in a **magnetic field**

The **Henry** is the basic unit of **inductance**

**RF** is the abbreviation that refers to **radio frequency** signals of all types

**Radio waves** is **electromagnetic waves** that travel through space

# Electricity, Components and Circuits Chapter 3

## Electrical Terms

**Voltage** is the electromotive force (EMF) that causes **electron flow**  
The **volt** is the basic unit of **electromotive force** (EMF)

Electrical **current** is measured in **Amperes**  
**Current** is the **flow of electrons** in an electric circuit

**Direct Current** flows only in **one direction**?

**Alternating Current** reverses **direction** on a regular basis

Electrical **power** is measured in **Watts**  
**Power** describes the rate at which electrical **energy** is used

**Copper** is a good electrical **conductor**

**Glass** is a good electrical **insulator**

A **mobile transceiver** usually requires **12 volts**

## Electrical components

**Resistor** is used to **oppose the flow** of current in a DC circuit

**Resistance** is controlled by a **potentiometer**

**Potentiometer** is used as an **adjustable** volume control

**Capacitor** stores energy in an **electric field**

**Capacitor** consists of two or more **conductive surfaces separated by an insulator**

**Capacitor** is used together **with an inductor** to make a **tuned circuit**

**Inductor** stores energy in a **magnetic field**

**Inductor** is usually composed of a **coil of wire**

**Switch** is used to **connect or disconnect** electrical circuits?

**Relay** is a **switch** controlled by an **electromagnet**

**Fuse** is used to protect other circuit components from **current overloads**

**1.2 volts** is the nominal voltage of a fully charged **nickel-cadmium** cell?

**Carbon-zinc** battery is **not rechargeable**

## Ohm's Law

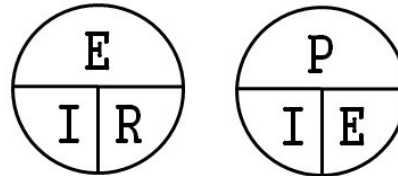
$E = I \times R$  Voltage = Current x Resistance

$I = E / R$  Current = Voltage / Resistance

$R = E / I$  Resistance = Voltage / Current

$P = E \times I$  Power = Voltage x Current

$I = P / E$  Current = Power / Voltage



## Semiconductors

**Transistors** is capable of using a voltage or current signal to **control current flow**

**Transistor** can be used as an electronic **switch or amplifier**

**Transistor** can **amplify** signals

**Gain** is a transistor's ability to **amplify a signal**

**Regulator** controls the amount of **voltage** from a power supply

**Bipolar junction transistor** is made of three **layers of semiconductor** material

**Bipolar transistor** has an **emitter** electrode

"**FET**" stands for **Field Effect Transistor**

**Field effect transistor** has a **gate** electrode

**Diode** allows current to flow in only **one direction**

**Diode's cathode** lead usually identified with a **stripe**

**Anode and cathode** are the names of the two **electrodes of a diode**

**Rectifier** changes an **alternating current** into a varying **direct current** signal

"**LED**" stands for **Light Emitting Diode**

**LED** is commonly used as a **visual indicator**

# Electricity, Components and Circuits Chapter 3

**Multi-Meters** > Volt-Ohm-Meter (VOM), Digital-Volt-Meter (DVM) Using a;

Volt-meter (measured in parallel)

Amp-meter (measured in series)

An **ohmmeter** is used to measure **resistance**

Using an Ohm-meter (measures resistance WITHOUT power DO NOT DAMAGE METER)

A **voltmeter** would you use to measure electric potential or **electromotive force**

**Voltage and resistance** measurements are commonly made using a **multimeter**

An **ohmmeter** shows low resistance then **increasing resistance** with time the circuit contains a **large capacitor**

## Schematic Circuit Diagrams

**Schematic symbols** are standardized **representations of components** in an electrical wiring diagram

The **symbols** on an electrical circuit schematic diagram **represent electrical components**

**Schematic diagrams** represent the way components are **interconnected**

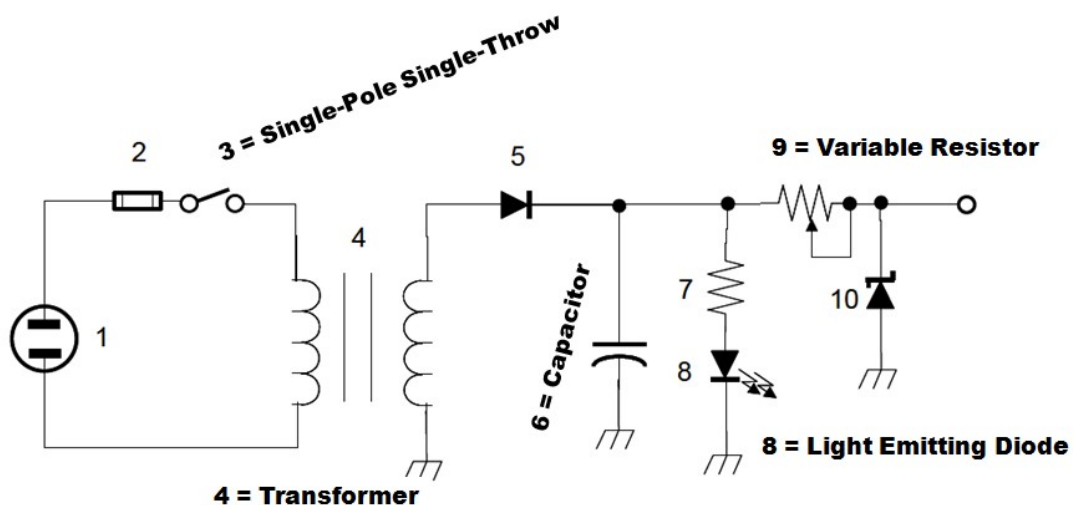
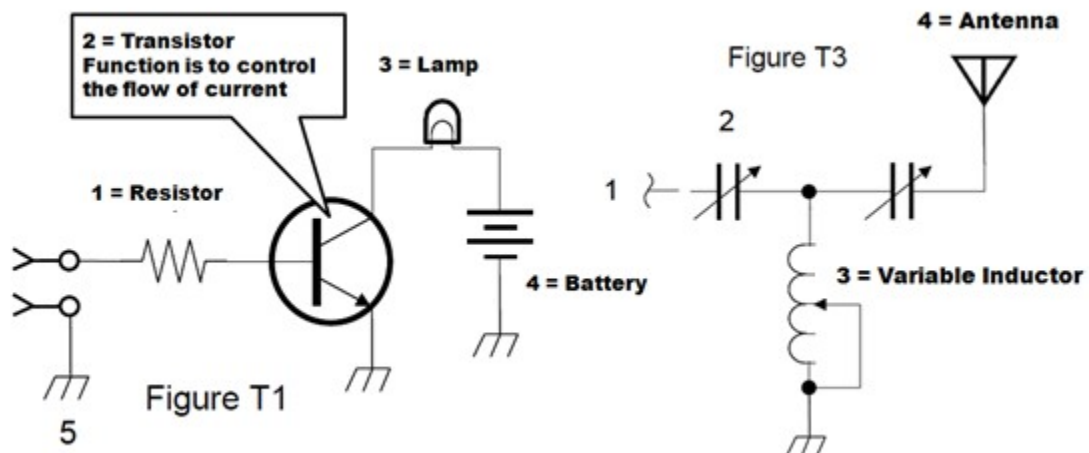


Figure T2

# Propagation, Antennas, and Feed Lines Chapter 4

## Radio Wave Propagation

Electromagnetic waves carry radio signals between transmitting and receiving stations

**RADIO HORIZON** is distance at which radio signals are **BLOCKED BY THE CURVATURE** of the Earth  
**EARTH SEEMS LESS CURVED TO RADIO WAVES** than light radio travel more than visual line of sight

**UHF** signals are **direct** (line of sight) **not reflected** by the ionosphere

**UHF** > penetrate the structure of buildings

**RF Bands** > approximately equal the Speed of Light / Frequency (300 Meters / F MHz)

**TEMPERATURE INVERSIONS** in the atmosphere causes "**TROPOSPHERIC DUCTING**"

Fog and light rain will have **little effect** on 10 and 6-meter bands

**DAYLIGHT HOURS** are generally the best time for long-distance **10 METER BAND PROPAGATION**

**Precipitation decrease** range at microwave frequencies

**Range of VHF and UHF signals be greater** in the winter due to **less absorption** by vegetation

## Multi-path Distortion > random reflections

**Random combining of signals** arriving via different paths cause of **irregular fading** of signals

**Irregular fading of signals** > random combining of signals arriving via **different paths**

**Picket fencing** > Rapid fluttering sound from mobile stations

**Data signals over multiple paths** > **Error rates** increase on VHF or UHF.

**Reflects signals** to the repeater using a **directional antenna**

2-meter signals are **become weak or distorted are multi-path** move a few feet or change direction

**"KNIFE-EDGE"** signals are **partially refracted** around solid objects exhibiting sharp edges

**The ionosphere** is the part of the atmosphere that enables the propagation of radio signals around the world.

**UHF** signals are usually **not reflected** by the ionosphere

The **ionosphere enables the propagation** of radio signals around the **world mostly on HF**

**Skip** > reflect off the **ionosphere**. Loud stations ++1000 miles every 30 sec fading weak to strong

**Long distances VHF** signals are being **refracted** from a **sporadic E layer**

**Sporadic E** propagation causes occasional **strong over-the-horizon** signals on **10, 6, & 2 M** bands

**6 & 10 M** provide long distance communications during the **peak of the sunspot cycle**

**Tropospheric Scatter** causes VHF & UHF communications **over-the-horizon** (~300 miles)

**6 meter band** is best suited to communicating via **meteor scatter**

**Auroral reflection VHF signals** exhibit **rapid fluctuations** of strength and often **sound distorted**

Decibel (dB)	+3 dB = 2X	-3 dB = X/2
	+6 dB = 4X	-6 dB = X/4
	+10dB = 10X	

## Antenna Characteristics

**Antenna Length** > Physical Length (**Shorter is Higher Frequency**)

1/4 Wave Antenna = Physical Length of **234 Ft.** / F MHz)

1/2 Wave Antenna = Physical Length of **468 Ft.** / F MHz)

1 Wave Antenna = Physical Length of **936 Ft.** / F MHz)

**1 / 4 Wave Antenna** > **Commonly used antenna (Flag Pole)**

**Rubber Duck** > Common Handheld Radio Antenna (1/4 Wave) NOT as effective as a full size antenna

**Dipole Antenna** > Two wire antenna (Rabbit Ears) **Radiates** to the **Broadside**

**Directional Antenna** > Beam, Quad, Yagi, Dish Concentrates signals in one direction

**Reference Antenna** > **Isotropic Antenna (equal signal in all directions)**

**Antenna Gain** > **Increased signal of a directional antenna compared to a reference antenna**

A **LOAD coil** is an inductor in the radiating portion of the antenna to make it **electrically longer**

**5/8 WL** antenna for VHF or UHF mobile has **more gain than a 1/4 WL** antenna

# Propagation, Antennas, and Feed Lines Chapter 4

## Antenna Polarization

**Vertical Antenna** > Electric Field is perpendicular to the earth (Flag Pole)

**Horizontal Antenna** > Electric Field is parallel to the earth (Cloths Line)

**Horizontal polarization** > long-distance CW/SSB on VHF and UHF

**Opposite polarization** > significantly weaker line of sight

**Skip** causes the **polarization** of the original signal to become **randomized**

## Antenna Feed Lines

**Antenna Tuner** > Matches the antenna impedance to the transceiver impedance

**Standing Wave Ratio (SWR)** > How well is the **LOAD (antenna) MATCHED** to the **Transmission Line**

**Voltage SWR (VSWR)** > Perfect 1:1, Transceiver limit 2:1, MIS-Matched 4:1 (Directional Watt Meter)

**Dummy Load** > Radio testing **WITHOUT** radiating RF

**Antenna Analyzer** > Checks antenna resonance

**Soldering** > Use ROSIN-Core only, COLD Joint is gray and dull

## Coaxial Cable > Connection between Antenna and Transceiver

**Coax** > **Damaged by Moisture, UV cracks & leaks water, AIR-CORE require dry-air, LOST RF = HEAT**

Easy to Use, Requires few special installation considerations Low SWR allows efficient transfer of power

Commonly **50 Ohms** Impedance,

**Loss increases with frequency**

RG-58 (smaller) more feedline loss used at HF

RG-8 (bigger) less feedline loss

Air-Core (Hard Line) lowest feedline loss

## Cable Connectors > loose connectors and water leaks most common problems

UHF (**PL-259** or **SO-239**) commonly used for HF

**N** most suitable for **above 400 MHz**

Seal connectors to prevent moisture leaks that cause feedline loss

**Loose** connectors might cause **erratic SWR**

# Amateur Radio Equipment Chapter 5

**Microphone** > connectors include push-to-talk and voltages for powering the microphone

**Headphones** > used in place of a regular speaker to help you copy signals in a noisy area

**Transmitter Filters** >

**Low Pass** filter is installed between the transmitter and the antenna to reduce **harmonic emissions**

**Band-Reject** filter is connected to a TV receiver as the first step in trying to prevent **RF overload** from a nearby 2 meter transmitter

**Sensitivity** is the ability of a receiver to detect the presence of a signal

**Selectivity** is the ability of a receiver to discriminate between multiple signals

**Power Supply** > use a regulated **12 V** power supply for communications equipment to **prevent voltage fluctuations** from reaching sensitive circuits. Allow for **TX Full Output** and Power Supply **regulation & Heat Dissipation**.

**Transverter** converts the RF input and output of a transceiver to another band

## Transceiver Controls

**PTT (push-to-talk) function switches between receive and transmit**

**VFO** > The keypad or VFO knob can be used to **enter** the operating **frequency** on a modern transceiver

**Microphone Gain** > If a transmitter microphone gain set **too high**, output signal becomes **distorted**

**Squelch** > The squelch control is used to **mute** receiver output **noise** when **no signal** is being received

**AGC** (automatic gain control) keeps received audio **relatively constant**

**Channel Memory** > A way to enable quick access to a **favorite frequency** on your transceiver

**Repeater Offset** > The difference between the repeater's **transmit and receive** frequencies

**Noise Blanker** > Turn on the noise blanker to reduce **ignition interference** to a receiver

**Receive Incremental Tuning** > **RIT** or clarifier is used if the **voice pitch** of a SSB signal seems too high or low

**Bandwidth Control** > permits noise or interference reduction by selecting a bandwidth matching the mode

**2400 Hz** is an appropriate receive filter to minimize noise and interference for **SSB** reception

**500 Hz** is an appropriate receive filter to minimize noise and interference for **CW** reception

## Audio Filters

**Ferrite choke** is used to reduce RF current flowing on the shield of an audio cable

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

A transceiver's power **negative connection** should be made at the **battery** or engine block ground

**Digital Communications** > Packet, PSK31, MFSK, WSJT (JT65, FT4, FT8) are digital communications

**PSK31** > A low rate data transmission mode (**Phase Shift Keying**)

**Parity Bit** > An extra code element used to detect errors in received data

**Packet** digital communications includes;

Check Sum for error detection and automatic repeat requests

The Header includes the call sign of the intended station

**WSJT** is used for Earth-Moon-Earth, Weak-signal propagation beacons and Meteor scatter

**FT8** Is a low signal-to-noise data mode that transmits on **15-second** intervals

## Computers

A **computer** is used for: **logging** contacts, **generating and decoding** digital including CW **signals**

A computer Microphone or **line input** is connected to a **transceiver's speaker** digital modes

**Computer sound card** provides audio to the radio's mic input and converts received **audio to digital**

**Receive audio, transmit audio, and push-to-talk (PTT)** are connected to a computer for digital modes

## Automatic Packet Reporting System > APRS

Uses a **Global Positioning System** receiver to report a radio location

Real-time map showing the **locations of stations**

Message **check sum** that permits error detection

Message **header contains the call sign** of the station to which the information is being sent

**ARQ** is an **Automatic repeat** request in case of error

**Packet Radio Station** > a transceiver and computer used for digital communications

**Terminal Node Controller** is connected between a transceiver and computer in a packet radio station

In digital communications the **computer sound card** provides audio to the microphone input and converts received audio to digital form



# Amateur Radio Equipment Chapter 5

**Broadband-Hamnet** is a high-speed multi data network using Wi-Fi gear with modified firmware

## Distorted Transmissions

High Pitched Whine > Car Alternator, Garbled > RF Feedback, Off Frequency, Location  
Bite Error Rate (BER) in Data is distortion

**Modulator** > Combines speech and RF into transmitted signal

**Over-Deviating** > Distortion from talking too loud (too CLOSE to Microphone)

**SSB** > Single Sideband is a form of Amplitude Modulated (AM) Signal

Most often used for weak signal VHF and UHF

The UPPER sideband is normally used for 10M, VHF and UHF SSB

SSB has a **narrower (3 KHz)** bandwidth than **FM**

**FM** > Frequency Modulation

Commonly used for VHF and UHF voice (phone) repeaters

Commonly used for VHF packet

FM has a **10 to 15 KHz** bandwidth

## FM Modulation & Deviation

What determines the amount of **deviation** of an FM signal >>> **amplitude of the modulating signal**

When the **deviation** of an FM transmitter is increased? >>> Its **signal occupies more bandwidth**

Your transmissions are causing **splatter or interference** on nearby frequencies?

Check your transmitter for **off-frequency operation or spurious emissions**

Action if your station's transmission unintentionally **interferes with another station?**

Properly **identify** your transmission and **move to a different frequency**

**CW** > Send Continuous Wave using; a Straight Key, an Electronic Keyer and a Computer Keyboards

**Morse Code** is used for CW

CW has the **narrowest** bandwidth (**150 Hz**)

**Fast Scan Images** > Uses **NTSC** format (like analog TVs), **6 MHz** bandwidth is used in the **70 cm** band



# Communicating With Other Hams Chapter 6

## Bands

What is a **band plan**, beyond the privileges established by the FCC?

A **voluntary guideline** for using different modes or activities within an amateur band

## Identifications and Call Signs

Call another station

**Say the station's call sign then identify with your call sign**

Example: W1ABC this is KK4XYZ

What is the meaning of the procedural signal "**CQ**"? **Calling any station**

How to indicate that you are listening on a repeater? **Say your call sign**

How to respond to a CQ? Say the **other station's call sign** followed by **your call sign**

FCC rules regarding power >>> amateur must **use the minimum transmitter power necessary**

Station identification is required at least **every ten minutes** during the test and **at the end**

On-air transmissions to **test antennas** >>> **Identify the transmitting station**

Method is encouraged by the FCC when identifying your station >>> Use of a **phonetic alphabet**

What is the "Q" Signal?

Indicates that you are receiving interference from other stations >>> **QRM**

Indicates that you are changing frequency >>> **QSY**

## 2 M Band >>>> 144 to 148 MHz

National calling frequency for FM simplex **146.520 MHz**

Most common repeater frequency offset **plus or minus 600 kHz**

## 70 cm Band >>>> 420 to 450 MHz

National calling frequency for FM simplex **446.000 MHz**

Most common repeater frequency offset **plus or minus 5 MHz**

## Simplex & Repeaters

Transmitting and receiving on the same frequency >>> **Simplex** communication

Sub-audible tone transmitted with normal voice audio to open the squelch of a receiver >>> **CTCSS**

**Carrier squelch** is muting of receiver audio controlled solely by the presence of an RF signal

Listening on a repeater's **input freq** is a use for "**reverse split**" function on VHF/UHF TxRx

Listening on a repeater's **input freq** if a weak station can't keep a repeater's **receiver squelch open**

**Linked repeater network** is signals received by one repeater are repeated by all the repeaters

I can hear but not access a repeater even when transmitting with the proper offset?

A. The repeater receiver requires **audio tone burst** for access

B. The repeater receiver requires a **CTCSS** tone for access

C. The repeater receiver may require a **DCS tone** sequence for access

**D. All of these choices are correct**

A "**talk group**" on a **DMR digital repeater** is a way for groups of users to share a channel without being heard by other users on the channel

## Satellites > Use amateur radio satellites to talk to operators in other countries on FM, SSB, CW, Data

Any amateur whose license privileges transmission on the satellite uplink frequency can be the operator

Always use the **minimum power** to complete the contact

**Too much power to may block** other users

**Correct power** means your signal strength on the downlink is about the **same as the beacon**

The **beacon** is a transmission from a space station that contains **Health and status of the satellite**

A **Satellite Tracking Program** gives times, freq shift, azimuth, and elevation for the satellite

**Keplerian** elements are inputs to a satellite tracking program

**Doppler Shift** is the frequency change caused by the motion of the transmitting station

**U/V Mode** is the satellite uplink is in the 70 cm band and the downlink is in the 2 meter band

**Spin Fade** is caused by the rotation of the satellite and its antennas

**LEO** stands for Low Earth Orbit

FM packet is commonly used for digital satellite communications

# Communicating With Other Hams Chapter 6

**Internet Radio Linking Project** > IRLP is radio VoIP via a radio GATEWAY

IRLP operators connect to repeaters via the internet using Voice Over Internet Protocol (VoIP)

Active IRLP Nodes can be found in a repeater directory

Voice Over Internet Protocol (VoIP) voice communications over the internet using digital techniques

Select a specific IRLP Node by using your keypad (**DTMF**) to transmit the IRLP Node ID

**Direction Finding** > A directional antenna is used to find noise interference or jamming (Fox Hunt)

**Contest** > Contacting as many stations as possible in a specific period of time

Send minimum information for station identification and contest exchange

**Grid Locator** > A letter-number designator assigned to a geographic location

**Special Event Call Signs** > A temporary 1 X 1 call sign operations in conjunction with an activity of special significance to the amateur community

**Radio Control** > RC is limited to 1 Watt and your call sign and address must be affixed to the transmitter

## Operating Rules

What rules applies to your station at the request of public service officials? >>> **Only FCC Rules**

**ARES** = Amateur Radio Emergency Service

Amateur radio organized to assist emergency public services sponsored by the ARRL

**RACES** = Radio Amateur Civil Emergency Service

Service using amateur stations for emergency management or civil defense communications

What do **RACES** and **ARES** have in common? >>> Both provide **communications during emergencies**

**Immediate attention** of net control to report an emergency? >>> **"Priority"** or **"Emergency"** & **call sign**

What should you do to minimize **disruptions to an emergency traffic net** once you have checked in?

**Do not transmit** on the net frequency **until asked** to do so by the **net control** station

Most important job of an amateur operator when **handling emergency traffic** messages?

**Passing messages exactly as written**, spoken or as received

**When normal communications systems are not available** an **amateur station** may **use any means** of radio communications at its disposal for essential communications in connection with immediate safety of **human life** and **protection of property**

## Formal Traffic Messages

What is the **preamble** in a formal traffic message?

**Information needed to track the message** through the amateur radio traffic handling system

**Net Control Station (NCS)** is s an operator responsible for controlling all radio traffic on a repeater or freq

**"TRAFFIC"** is formal messages exchanged by net stations

What is the term "**check**" in reference to a formal traffic message? >>> **count of the number of words**

When **checking into a net wait to TX** until asked to do so by the net control station

**Who must submit the request** to allow amateur to provide communications on behalf of their employers during a government sponsored disaster drill? >>> The **government agency sponsoring** the event

**When is it legal** for an amateur licensee to provide communications on **behalf of their employer** during a government sponsored disaster drill or exercise? >>> Only **FCC has granted a waiver**

# Licensing Regulations Chapter 7

## Amateur Radio Services

**Amateur Radio Service** is for advancing skills in the technical and communication phases of the radio art  
**Amateur Radio Service** is intended for persons **without pecuniary interest**  
**FCC regulates** and enforces the rules for the Amateur Radio Service  
**Part 97** of the FCC rules **govern** the Amateur Radio Service  
Amateur Radio **Station** is the **apparatus** for carrying on **radio communications**  
**Amateur space station** is more than **50 km above the Earth's** surface  
**Auxiliary station** transmits signals from a **remote receive site to a repeater** for retransmission  
**Frequency Coordinator** recommends T/R channels/parameters for **repeater stations**  
**Amateur operators** select a **Frequency Coordinator**  
**Harmful interference** degrades, obstructs, or interrupts a radio communication  
**Telecommand** is a one-way TX **to initiate, modify or terminate functions** at a distance  
**Telemetry** is a one-way TX of **measurements** at a distance  
The purposes of a **BEACON** is for observing propagation or related experimental activities

## Operator Classes and Station Call Signs

Current new **Operator Classes** are: Technician, General, Amateur Extra  
Only one operator/primary station license grants may be held by any one person  
You may **operate** from any **vessel in international waters** registered in the **US**  
FCC requires your **correct mailing address** > **Revocation** of license  
**Operate** as soon as your name and call sign appear in the **FCC's ULS database**  
**Ten years** is the normal term for an license  
**Two years** grace period following expiration license to renew  
You **cannot operate** during the **grace period** until renewed in the ULS database  
**A station and its records must be made available** for an FCC Representative  
A **foreign country** must authorize you to operate your amateur station  
**Stop operating** or take steps to eliminate the **harmful interference**  
Which is a valid **US amateur radio** call sign? KMA3505 **W3ABC** KDKA 11Q1176  
**K1XXX** is a valid call sign for a Technician class amateur radio station  
**Special event** call sign has a single letter in both the prefix and suffix i.e. **K4V**  
Any licensed amateur may request a desired call sign under the **vanity call sign** rules  
A club must have at least **four members** for a club license  
**International** Comm are for the **purposes of amateur service**

## Authorized Frequencies

The **ITU** United Nations agency for information and communication issues  
North American amateur stations are located in **ITU Region 2**  
**Technicians** have phone privileges on a subpart of 10M  
**50 to 54 MHz** is in the **6 M** band  
**144 to 148 MHz** is in the **2 M** band  
**Fixed digital message forwarding** on the frequencies 219 and 220 MHz  
**420 to 450 MHz** is in the **70 cm** band  
Amateur Radio Service is **secondary** in portions of the 70 cm Band  
**Only CW** permitted on **50.0 to 50.1 MHz** and **144.0 to 144.1 MHz**  
**Secondary basis** frequency band is available without causing interference  
**HF** Technician are limit to **200 Watts on HF Bands**  
Technician **HF** RTTY and data are only in **10 M**  
**DO NOT** transmit at the **edge of a band**

160 Meters = 1.8-2.0 MHz
80 Meters = 3.5-4.0 MHz
40 Meters = 7.0-7.3 MHz
30 Meters = 10.1-10.15 MHz
20 Meters = 14.0-14.35 MHz
17 Meters = 18.068-18.168 MHz
10 Meters = 28-29.7 MHz
15 Meters = 21-21.45 MHz
6 Meters = 50-54 MHz
2 Meters = 144-148 MHz
1.25 Meters = 222-225 MHz
70 Centimeters = 420-450 MHz
33 Centimeters = 902-928 MHz
23 Centimeters = 1240-1300 MHz

# Operating Regulations Chapter 8

## Control Operator

A station must have a **control operator** when **transmitting**  
A **license** appears in the **FCC database** is eligible to be the **control operator**  
**Control Operator** determines the transmitting privileges of an amateur station  
The station licensee **must designate** the station **control operator**  
**FCC presumes** the **station licensee** to be the control operator unless in logged differently  
The **control operator and station licensee are equally** responsible for the operation  
The station **control point** is the location at which the **control operator function** is performed  
**Local control** is being used when transmitting using a handheld radio  
**Remote control** is when the control operator can **indirectly manipulate a station (over internet)**  
**Automatic control** allows the control operator to be at a **different location**  
**Automatic control** is used for a repeater when the **control operator is not present**

## Station Identification & Misc

**English** is used for station ID use of a **phonetic alphabet is encouraged**  
A station required to **ID every 10 minutes**  
CW or phone ID is required for a station transmitting phone signals  
Call sign indicator appendix **must not conflict with (any FCC rules) or country prefix**  
**Acceptable Phone ID:** " KL7CC stroke W3" or " KL7CC slant W3" or "KL7CC slash W3"  
A station may **transmit without ID** when transmitting signals to control model craft  
**Tactical call** is used when identifying a station as "Race Headquarters"  
When using tactical identifiers, you must **ID your station every ten minutes** i.e. K4VRC  
A **Technician cannot be the control operator** in exclusive Extra Class segment bands  
Control operator of the **originating station is accountable for repeater TX violation**  
TX of **third party communications is authorize** to foreign stations permitted by that govt  
At least **4 persons** are required for a **club station license**  
**Repeater station** simultaneously retransmits the signal of another station  
Upon request the station licensee make the station / records available for **FCC inspection**

## Authorized and Prohibited Transmissions

**Operator** may receive compensation when incidental ... **A SCHOOL TEACHER**  
Stations may **sell or trade amateur equipment** but not on a regular basis  
Amateurs can TX **NEWS** related to **immediate** safety of human **life** or protection of **property**  
**One-way transmissions** for code practice or information bulletins are permitted  
**Music** maybe TX when incidental to retransmission of **manned spacecraft comm**  
**Automatically retransmit** signals from an **auxiliary, repeater, or space station**  
**Codes or Ciphers** allowed only controlling **space stations** or **radio control craft**  
**NO** one has absolute right to an amateur frequency  
During **Armed Forces Day** Test messages can be **exchanged** with a **U.S. military station**  
If a **country** objects (**notified the ITU**) you are **prohibited** from exchanging communications  
Transmissions that contain **obscene language is prohibited**  
**Willful interference is prohibited**  
Definition **Broadcasting** (FCC rules) is TX intended for the **general public** is prohibited

## Electrical Hazards

Electric current in the body causes tissue **heating, disrupts cell functions, involuntary contractions**  
**30 volts** is the lowest voltage that is a dangerous electric shock

**Electric shock** can occur from **capacitors in power supply** when it is turned **off**

**Electrical current flowing through your body** may cause;

- injury by heating tissue
- disrupt the electrical functions of cells
- cause involuntary muscle contractions

A **fuse interrupts power** in case of overload

Installing a 20-ampere fuse in the place of a 5-ampere fuse **could cause a fire**

A 120V AC "hot" conductor **fuse / circuit breaker** in should always be in home-built equipment

Safety ground is connected to the **green wire** in a three-wire electrical AC plug

Use **three-wire plugs, common safety ground, GFI** to guard against electrical shock

Ground to a **common plate / external ground for lightning protection** in a coaxial cable feed

Ensure **connections are short** when installing ground wires on a tower **for lightning protection**

A **12-volt storage battery hazard** is **explosive gas** is vented

**Shorting a 12-volt storage battery** can cause burns, fire, or an explosion

If **charged too quickly lead-acid battery** a could overheat /give off flammable gas / explode

**Emergency recharge** by connecting **12-volt lead-acid battery** to a car's battery and run the engine

## Antenna Tower Safety

A tower work team wear a **hard hat and safety glasses at all times**

Put on a **climbing harness and safety glasses** before climbing an antenna tower

**Always have an observer** or helper when climbing a tower

A **crank-up tower must never be climbed** unless it is in the fully retracted position

Use a **gin pole** to lift tower sections or antennas

**Safety wire** through a turnbuckle prevents loosening of the guy line from vibration

**Never attach an antenna to a utility pole** the antenna could contact high-voltage wires

**10 feet to the power wires is the min safe distance** from a power lines when installing an antenna

Look for and **stay clear of any overhead electrical wires** when putting up an antenna tower

Mount **lightning protectors on a metal plate** that is connected to a ground rod

Ground a tower with separate eight-foot long **ground rods for each tower leg**

**Bond ground rods** with heavy wire or conductive strap

**Sharp bends must be avoided in grounding** conductors used for lightning protection

**Local electrical code establishes grounding requirements** for an amateur radio tower or antenna

## Radio Frequency Radiation Exposure Hazard

VHF and UHF radio signals are **Non-ionizing radiation**

**RF radiation does NOT** have sufficient energy to cause genetic damage

50 MHz has a low **Maximum Permissible Exposure limit**

**More than 50 watts PEP** at the antenna **require an RF exposure evaluation** at VHF frequencies

**Frequency, RF Power, Distance & Radiation Pattern** of the antenna affect the RF exposure

**Human body absorbs more RF energy at some frequencies** than at others

**FCC OET Bul 65, computer model or field strength meter** determine complies with RF

A **painful RF burn** could happen if a person accidentally touched your antenna

**Relocating antennas** might prevent exposure to RF radiation in excess of FCC limits

**Re-evaluating the station whenever equipment is changed** to ensure RF safety

**Duty Cycle** affects the average exposure of people to radiation **over 6 Minute Average**

**Duty Cycle** is the ratio of on-air time to total operating time of a transmitted signal

# Safety / RFI Chapter 9

## Radio Frequency Interference

When a receiver is unable to reject strong signals outside the AM or FM band it may receive amateur radio transmissions unintentionally

If a neighbor tells you that your station's transmissions are interfering make sure that your station is functioning properly and that it does not cause interference to your own radio or television

Cable TV interference from your Tx maybe caused by loose TV coaxial connectors

Part 15 device is an unlicensed device that may emit low-powered radio signals

The following can cause radio frequency interference;

- Fundamental overload
- Harmonics
- Spurious emissions

Overload of a non-amateur receiver with a filter at the antenna input of the affected receiver

An RF filter on the telephone is a way to reduce interference from an amateur transmitter

Band-reject filter can reduce overload to a VHF transceiver from a nearby FM broadcast station

If something in a neighbor's home is causing harmful interference;

- Work with your neighbor to identify the offending device
- Check your station and make sure it meets the standards of good amateur practice
- Inform your neighbor rules that prohibit the use of devices that cause interference

Reports of garbled, distorted, or unintelligible voice transmissions maybe RF feedback