

Chapter 1 Introduction

Technician Class License Manual July 2018 – June 2022

Technician Class Exam Preparation Schedule available at <http://www.k4vrc.com/>

How will this class work?

- 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

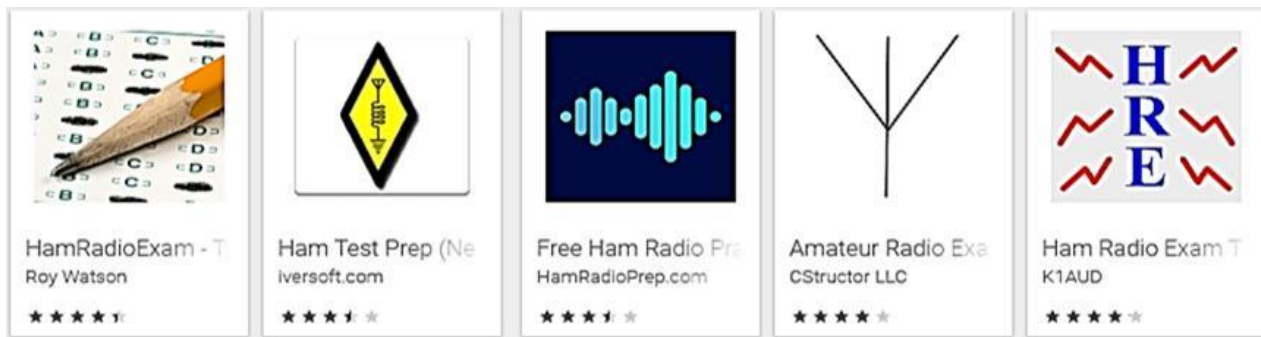
Text Book used in the course

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

Practice Tests Apps for all License levels



<https://play.google.com/store/apps> and <https://www.apple.com/ios/app-store/>

On-Line Practice Tests

<http://arrlexamreview.appspot.com/>
<https://hamexam.org/>
<https://hamstudy.org/>
<https://www.qrz.com/hamtest/>

KE0OG Dave Casler / Technician Class Exam Videos > <http://dcasler.com/ham-radio/training/>

Guides to Amateur Radio

[Ham Radio for Dummies free PDF book](#)
<http://www.arrl.org/licensing-education-training>
[Ethics and Operating Procedures for the Radio Amateur free PDF book](#)

Radio and Signals Fundamentals Chapter 2

Technician Class License Manual July 2018 – June 2022

Math Units

| | | |
|----------------|-------------------|---------------------|
| MEGA = | 1,000,000 | Million |
| KILO = | 1,000 | Thousand |
| MILLI = | 0.001 | 1/1,000 |
| MICRO = | 0.000,001 | 1/1,000,000 |
| PICO = | 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

Technician Class License Manual July 2018 – June 2022

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

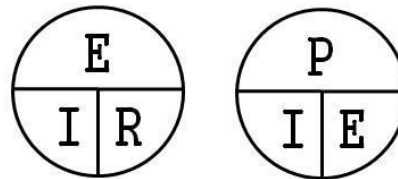
$E = I \times R$ Voltage = Current x Resistance

$I = E / R$ 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

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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**

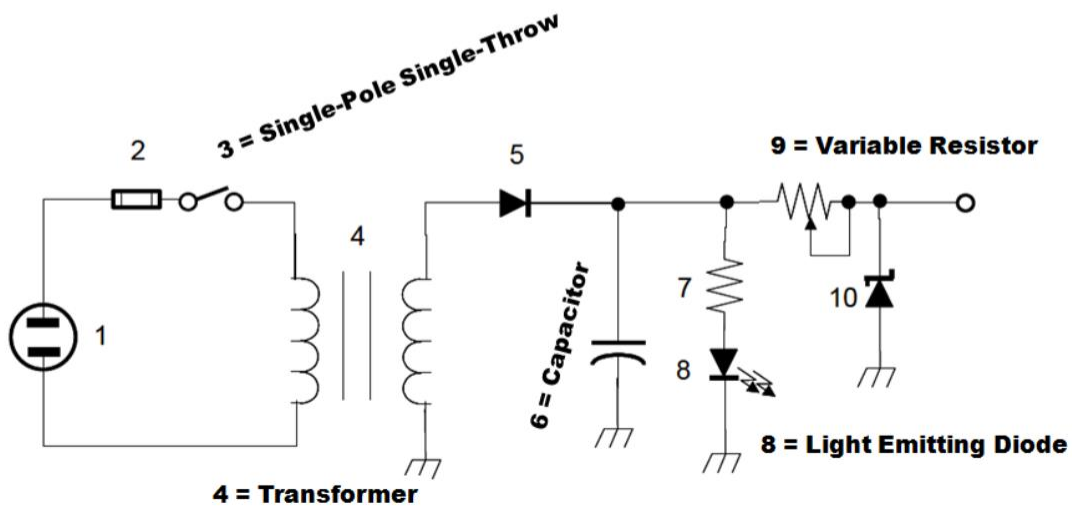
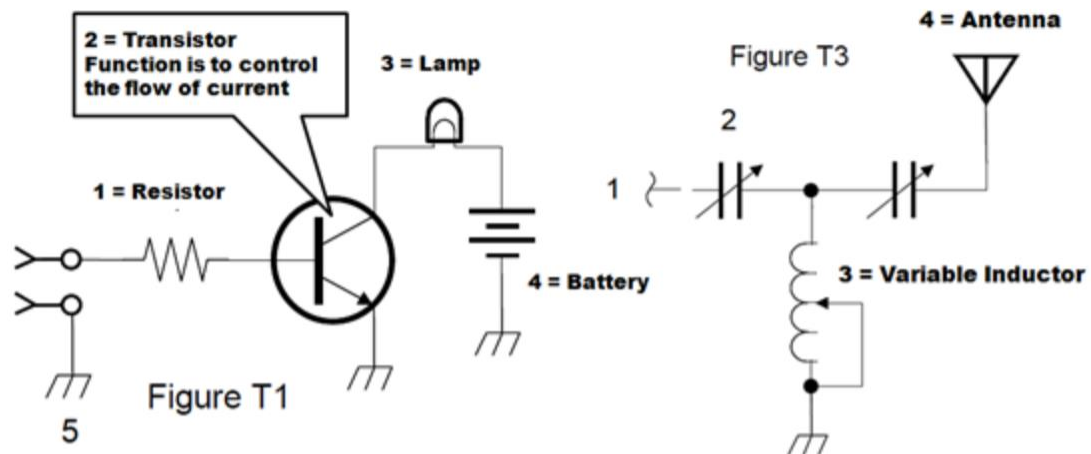


Figure T2

Propagation, Antennas, and Feed Lines Chapter 4

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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

Technician Class License Manual July 2018 – June 2022

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

Technician Class License Manual July 2018 – June 2022

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

Technician Class License Manual July 2018 – June 2022

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

Technician Class License Manual July 2018 – June 2022

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

Technician Class License Manual July 2018 – June 2022

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

Technician Class License Manual July 2018 – June 2022

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

Technician Class License Manual July 2018 – June 2022

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

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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

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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