Discovering your Technician Privileges

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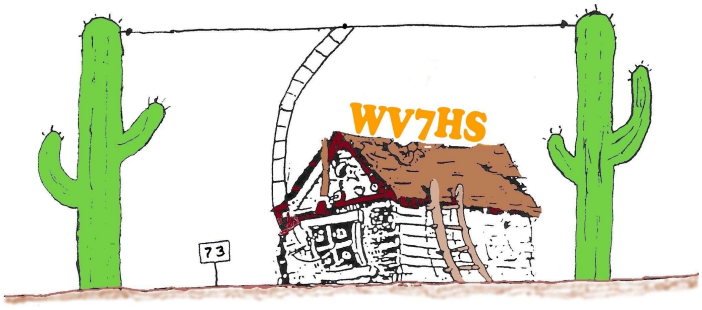


Topics

Now that you have you Technician license do you know what you can do with it? You can still talk all over the country, or even all over the world with the right gear and tools. In this class, we will help you get the most out of your technician license. This class is perfect for new Hams or even hams who have had their technician license for years but haven't ventured out beyond the local repeater.

- What frequencies can you operate? (Pat)
- Simplex vs Repeaters (Krissy)
- Linked Repeaters (Krissy)
- Beyond the 2m and 70cm bands (Greg)
- Digital: What is DMR, Fusion, D-Star? APRS? (Krissy)
- Other tools & services (Krissy)
- Gear Considerations (Pat)

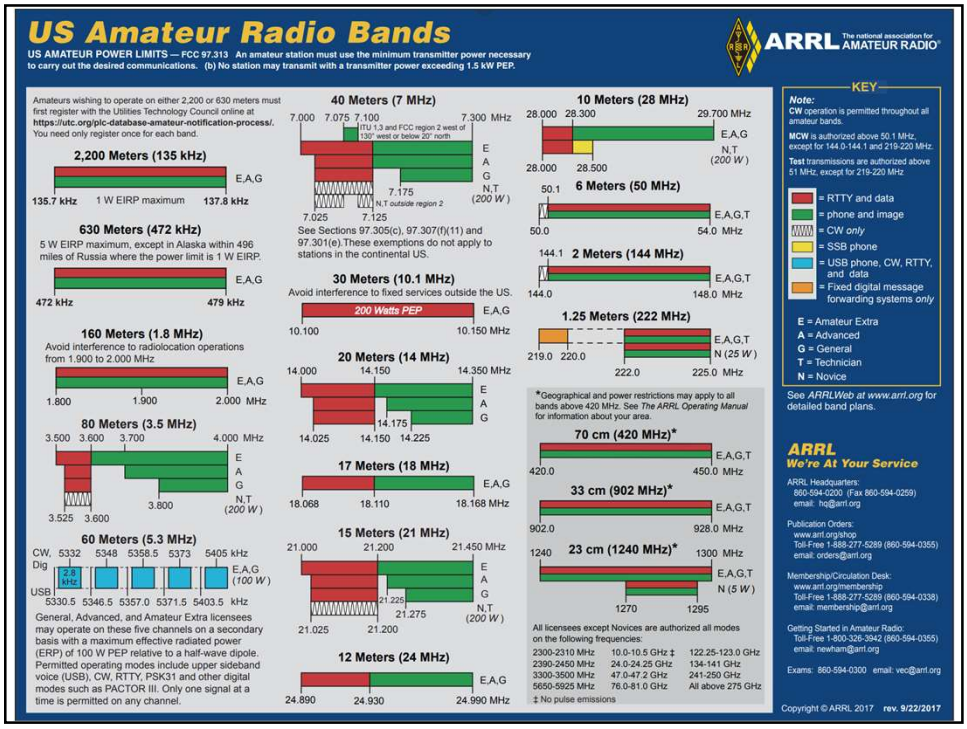
This class will introduce you to various modes and tell you where to find more information to get started.

Technician Privileges

- Reference: http://www.arrl.org/graphical-frequency-allocations
- Reference: Technician Class Frequency Privileges in Ham Radio - dummies

Band	Frequencies (In MHz)	Modes You Can Use
80 meters	3.525 – 3.600	CW
40 meters	7.025 – 7.125	CW
15 meters	21.025 – 21.200	CW
10 meters	28.000 – 28.300 28.300 – 28.500	CW, RTTY/data, 200 watts PEP max power CW, phone, 200 watts PEP max power
Above 50 MHz	All amateur privileges	6m, 2m, 1.25m, 70cm, 33cm, 23 cm

CW = Morse code; PEP = peak envelope power; RTTY = radioteletype.



Band Plan

- USA Band Plans: https://www.arrl.org/band-plan
- AZ Band Plans: https://azfreqcoord.org/bp/bp.htm
- What is a Band Plan? Per the ARRL: "A band plan refers to a voluntary division of a band to avoid interference between incompatible modes." Arizona has adopted ARRL UHF/VHF band plans with some minor changes and additions. Also used for coordinating repeaters.
- *Refer to the band plan when practicing different modes to ensure you are in the right allocation*

Repeaters

- Repeaters extend the range of your communication
- Common on UHF / VHF
- Typically owned by Clubs
- Where to find repeaters?
  - https://www.repeaterbook.com/ Website or App
  - Arizona Repeater Association: https://www.w7ara.org/z/Repeaters.aspx
  - RFinder Worldwide Repeater Directory: https://rfinder.net/ (subscription)

Simplex vs Repeaters

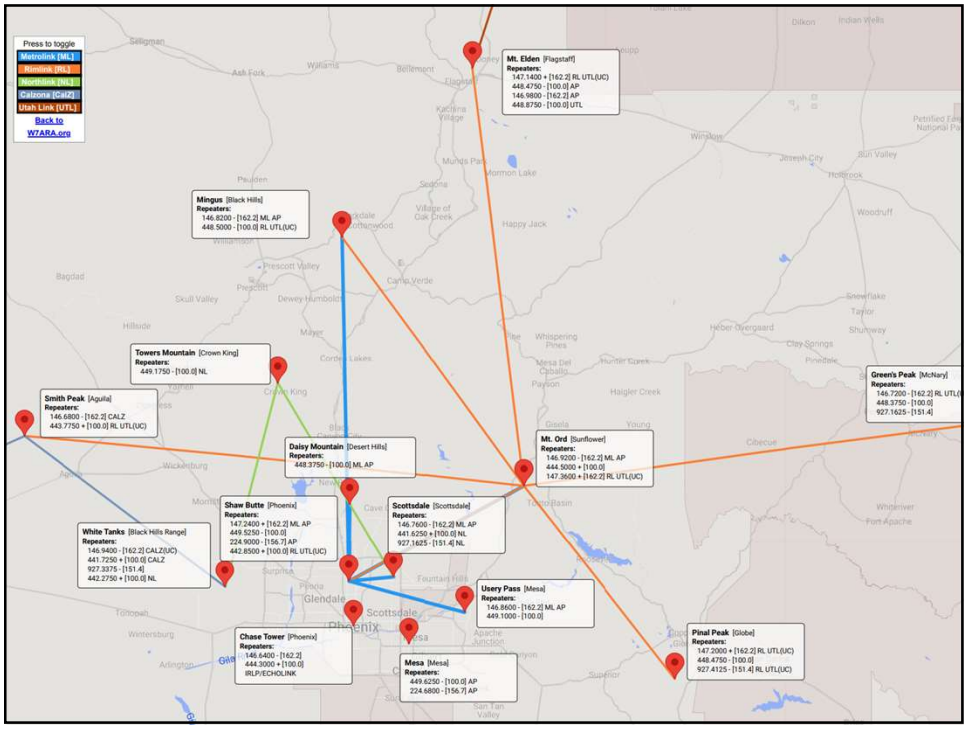
- Simplex: Transmitting on the same frequency you are receiving.
  - National Call Frequencies are simplex
  - 146.520, 223.500, and 446.000 MHz
- A repeater receives on one frequency and strengthens and retransmits on another frequency. This allows signals to reach a wider area. They are often on buildings or Peaks
  - Repeaters have an offset so you transmit on a different frequency than you receive. Offsets are standardized. Many modern radios can fill in the offset for you. There is a frequency value and a Positive vs Negative shift
  - Repeaters often have PL tones. You must have the right tone for the repeater to hear you. There is a standardized list of PL Tones
  - Some repeaters are closed (for member or special use only)
- Where to find repeaters?
  - https://www.repeaterbook.com/
  - Arizona Repeater Association: https://www.w7ara.org/z/Repeaters.aspx
  - RFinder Worldwide Repeater Directory: https://rfinder.net/
- Programming your Radio for Repeaters: CHIRP (Free), RT Systems ($), or vendor sotware will help. But learn how to do it without software too.

Repeater Etiquette

- Reference: Operating Tips – The WIN System - https://www.winsystem.org/operating-tips/ & Conduct and Policy (w7ara.org)
- Identify per regulations (avoid over identifying)
- Listen first before talking
- Do not acknowledge malicious interference
- To start a conversation, say your callsign (works simplex / call channel too)
  - I say “KI7GJJ Monitoring” or “KI7GJJ anyone want to have a short QSO”?
  - Works on the Call Channel too
- Keep conversations short, clean, friendly – You are sharing the repeater
- Move to Simplex for contacts close enough
- Join a conversation by Saying your callsign or “Comment” - Also works in a directed net or use “ReCheck”
- Use “Break” only for emergencies; not casual interruptions
- When you are in conversations let the repeater drop and allow a pause between transmissions so others can join in.
  - Invite others into the conversation.
  - When you key-up, allow a short pause before you start talking. This is important on linked repeaters.

Linked Repeaters

- What is a linked repeater?
  - Linked repeaters are part of a repeater system that transmit / receive to each other to extend the reach beyond what a single repeater can accomplish. Some systems may have an internet linkage to extend the reach even further.
- What linked repeater systems are near me?
  - Metrolink (ARA): ARA - Repeaters (w7ara.org)
  - Rimlink (ARA)
  - Win System: https://www.winsystem.org/
  - Cactus System (closed system)
  - Refer to RepeaterBook.com for more linked repeater systems
- Using a linked repeater system, you can talk to people all over the city or state. The Win (Western Intertie Network) System covers California, other states and other countries.
- It is especially important to follow repeater etiquette as you are sharing with more people
  - If you hear that an announcement that the repeater is on backup power, avoid casual conversations and save for emergencies or keep you conversation very short.



Arizona Repeater Association - W7ARA

Frequency	PL	Call-ID	Location	Link	Features
145.170 -	162.2	W7ARA	Portable Repeater		Public Service Events
146.640 -	162.2	W7ARA	Chase Tower, Phoenix		
146.680 -	162.2	K7LKL, John	Smith Peak, Aguila	CalZona	
146.720 -	162.2	W7ARA	Greens Peak, McNary	Rimlink	Utah link on demand
146.760 -	162.2	W7ARA	Scottsdale Airpark, Scottsdale	Metrolink	Autopatch (480, 602, 623)
146.820 -	162.2	W7ARA	Mingus Mtn., Cottonwood	Metrolink	Autopatch (480, 602, 623)
146.860 -	162.2	W7ARA	Usery Pass, Mesa	Metrolink	Autopatch (480, 602, 623)
146.920 -	162.2	W7ARA	Mt. Ord, Sunflower	Metrolink	Autopatch (480, 602, 623)
146.940 -	162.2	W7EX, Bill	White Tanks Mtn.	CalZona	User Linked
146.980 -	162.2	W7ARA	Mt. Elden, Flagstaff		Autopatch (928, 520, 602, 480, 623)
147.140 +	162.2	W7ARA	Mt. Elden, Flagstaff	Rimlink	Utah link on demand
147.200 +	162.2	W7ARA	Pinal Peak, Globe	Rimlink	Utah link on demand
147.240 +	162.2	W7ARA	Shaw Butte, Phoenix	Metrolink	Autopatch (480, 602, 623)
147.360 +	162.2	W7ARA	Mt. Ord, Sunflower	Rimlink	Utah link on demand
224.680 -	156.7	W7ARA	Mesa Repeater, Mesa	449.625	Autopatch (480, 602, 623)
224.900 -	156.7	W7ARA	Shaw Butte, Phoenix	449.525	Autopatch (480, 602, 623)

Rimlink System

147.360 Mt. Ord
147.140 Mt. Elden
146.720 Greens Peak
147.200 Pinal Peak
442.850 Shaw Butte
443.775 Smith Peak
448.500 Mingus Mountain
927.4125 Pinal Peak

Metrolink System

147.240 Shaw Butte
146.760 Scottsdale Airpark
146.860 Usery Pass
146.920 Mt. Ord
146.820 Mingus Mtn.
448.375 Daisy Mtn.

Rimlink and Utah - Intermountain Intertie:
448.875 Mt. Elden, always linked.
Any repeater on Rimlink can connect to the Intermountain Intertie maintained by the Utah VHF Society. http://utahvhfs.org/snowlink.html
- Use the same link codes from either the Arizona or Utah side.
- The links will automatically disconnect with 10 minutes of inactivity.

Linking Codes:
Connect - Link: ##360
Remove - Link: ##370

CalZona Link: 441.725 White Tanks & 146.680 Smith Peak always on link into the San Diego area.
East County Repeater Association:
https://ecra-sd.com/?page_id=951

146.940 White Tanks connected on demand.

Linking Codes:
Connect 146.940 - CalZona Link: ##171
Remove 146.940 - CalZona Link: ##172

Arizona Repeater Association - W7ARA

Frequency	PL	Call-ID	Location	Link	Features
441.625 +	100.0	W7ARA	Scottsdale Airpark, Scottsdale	Northlink	
441.725 +	100.0	W7EX, Bill	White Tanks Mtn.	CalZona	146.94, 927.3375
442.275 +	100.0	W7ARA	White Tanks Mtn.	Northlink	
442.850 +	100.0	W7ARA	Shaw Butte, Phoenix	Rimlink	Utah link on demand
443.775 +	100.0	W7ARA	Smith Peak, Aguila	Rimlink	Utah link on demand
444.300 +	100.0	W7ARA	Chase Tower, Phoenix		IRLP/Echolink
444.500 +	100.0	W7ARA	Mt. Ord, Sunflower		
448.375 -	100.0	W7ARA	Daisy Mtn., Desert Hills	Metrolink	Autopatch (480, 602, 623)
448.375 -	100.0	W7ARA	Greens Peak, McNary		
448.475 -	100.0	W7ARA	Pinal Peak, Globe		
448.475 -	100.0	W7ARA	Mt. Elden, Flagstaff		Autopatch (928, 520, 602, 480, 623)
448.500 -	100.0	W7ARA	Mingus Mtn., Cottonwood	Rimlink	Utah link on demand
448.875 -	100.0	W7ARA	Mt. Elden, Flagstaff		Utah linked
449.100 -	100.0	W7ARA	Usery Pass, Mesa		
449.175-	100.0	W7ARA	Towers Mtn., Crown King	Northlink	
449.525 -	100.0	W7ARA	Shaw Butte, Phoenix	224.9	Autopatch (480, 602, 623)
449.625 -	100.0	W7ARA	Mesa Repeater, Mesa	224.68	Autopatch (480, 602, 623)
927.1625 - 25.	151.4	W7ARA	Scottsdale Airpark, Scottsdale	Northlink	
927.1625 - 25.	151.4	W7ARA	Greens Peak, McNary		
927.3375 - 25.	151.4	W7ARA	White Tanks Mtn.	CalZona	Only linked in net configuration.
927.4125 - 25.	151.4	W7ARA	Pinal Peak, Globe	Rimlink	Utah link on demand

Autopatch Sequence: Key up, announce your call sign, then, without unkeying, press the * key followed by the 3-digit area code + 7-digit number. Keep the radio keyed for about half a second after entering the last digit, then, unkey.

The repeater will announce "autopatch" and place the call. When finished, key up, announce your call sign, press the # key, and then unkey. The repeater will respond with "call complete" and the time. There is a 3 minute limit per call. (911 calls have a 15 minute timer.)

Northlink: The hub 449.175 Towers Mtn. is linked to 441.625 & 927.1625 Scottsdale, and 442.275 White Tanks

IRLP Node 7620/Echolink Node 474525: 444.300 Chase Tower
Connection: Key up, announce your call sign, without unkeying, (IRLP: enter 4 digit node) (Echolink: * plus node)
Disconnect: (IRLP: 73) (Echolink: #)

Membership Info:
To join or renew your membership with the ARA, please visit https://www.w7ara.org/mbr/Membership.aspx Dues are $20/yr. (Jan. 1 through Dec. 31) with a one-time initiation fee of $10. Life and family memberships are available.

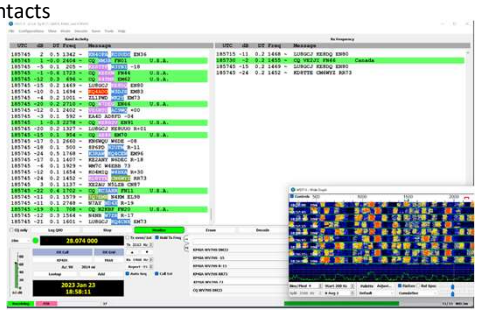
VHF, UHF & 900 Repeater Systems www.w7ara.org **January 29, 2023**

Beyond 2m & 70cm

- 2m SSB: 2meternet.com – Your 2M Home Single Sideband on 2 Meters: The Other VHF Mode (hamradioschool.com)
  - Allows RF-only contacts beyond 2m FM and Repeaters (300-1,500 miles! - with proper conditions & equipment)
  - Small antennas, requires a radio that does SSB
- Voice on 10m (HF)
  - Digital on 28.000 – 28.300 MHz
  - Voice on 28.300 – 28.500
  - There are 10m Repeaters that you may be able to hear with improved propagation! Unfortunately, they are out of the Technician privileges …
- Consider learning CW (Morse Code)
  - Reference: Code Practice Files (arrl.org)
  - Reference: CW Online Classes: Structure - Long Island CW Club
  - Can be aided by computer to send/receive
- 6m – Not very active here
- Satellites
- *When logging contacts use UTC*

FT-8 on 10m

- Reference:Get Started with FT8 - An Introduction for Beginners | WSJT-X Ham Radio – YouTube
- FT-8 is Weak Signal for making lots of contacts
- HF SSB Transceiver
- Audio Interface
  - Sound Card in Radio or
  - External Sound card (i.e., signallink)
- Computer
- FT-8 Software: WSJT-X (Free)
- Interfaces with other Software
  - Logging contacts
  - Map visual (Gridtracker, PSKreporter)
- No internet; “Real radio”



Contacting Satellites

- Reference: https://hamradioprep.com/ham-radio-satellites/
- 2 basic types of satellites: FM satellites and linear transponders
- FM satellites use Cross Banding
  - You transmit on a frequency (uplink) and receive on a frequency (downlink).
  - If uplink is in the 2 m and downlink in the 70 cm band it's mode is V/U (V for VHF, U for UHF)
  - ISS has V/U repeater. Uplink=145.990 MHz & downlink=437.800 MHz with CTCSS tone of 67.0 Hz
- You need HT capable of duplex operation (or 2 HTs) and a handheld, dual-band Yagi
- Find Satellites:
  - AMSAT - AMSAT Online Satellite Pass Predictions
  - LIVE REAL TIME SATELLITE TRACKING AND PREDICTIONS (n2yo.com)
- More information: WorkSat-01062023 (work-sat.com)

Digital Modes: DMR, Fusion, D-Star, APRS

- Internet-Assisted digital modes. Internet expands your reach
- DMR, Fusion, D-star are three similar digital modes – just different formats.
- APRS is for send/receiving packets or short messages
- You generally need a radio equipped to use these modes (although there are ways to access them without a radio)
  - There are Software tools that will get you access
- They can be RF only, but are really used as Internet-enabled multi-linked repeater systems to allow wide coverage
- You can access via a local repeater or a "Hot Spot". Many "Hot Spots" can access all modes and can convert from one mode to another
  - You can make your own (cheaper)
  - Or purchase (OpenSpot, ZumSpot) $100-$200
  - Pi-Star is the software that runs on a Raspberry Pi

Fusion & DMR

- C4FM / Fusion / WiresX:
  - Proprietary Yaesu mode. You need a Yaesu radio to access it
  - WHAT IS SYSTEM FUSION? | SystemFusion (yaesu.com)
  - WVARC has a repeater nearby in Sun City
  - C4FM is the digital modulation technology (Continuous Four Level Frequency Modulation)
  - Fusion is Yaesu implementation of C4FM
  - WiresX is layer above Fusion and links multiple repeaters/nodes using "Rooms"
- DMR (Digital Mode Radio): a Motorola protocol. Started in commercial radios
  - Need a radio ID to talk on DMR: https://radioid.net/register
  - Download official copy of your license from FCC
  - Anytone, Btech, Radioddity, TYT, BaoFeng, Ailunce all make DMR Radios
  - DMR-Marc and BrandMeister networks plus a couple of others have "Talkgroups"
  - Has its own language. Refer to AMATEUR RADIO GUIDE TO DIGITAL MOBILE RADIO to learn more
  - https://hose.brandmeister.network/
  - DMR For Dummies – All you need to know to get started using DMR in Amateur Radio

D-Star & APRS

- D-Star (Digital Smart Technologies for Amateur Radio) is the oldest developed by Icom:
  - Icom and Kenwood make radios for D-star
  - You need to register with a nearby D-star repeater: http://www.dstarinfo.com/repeater-list.aspx
  - Not as many repeaters, but still access to a lot of "Reflectors"
  - Popular reflectors: 14C (Fourteen Charlie) or 1C or 30C
  - Reference: Reflectors - D-STAR Info (dstarinfo.com)
  - Reference: D-StarUsers.org Your Source for D-Star Digital Amateur Radio Information! (dstarusers.org)
- APRS (Automatic Packet Reporting System)
  - Some Radios have APRS built in (TNC) - converts digital data into audio tones
  - Frequently used for GPS coordinates & weather stations
  - Can contact the ISS!
  - Use of Digipeters extends the reach (Intenet enabled) & allows sending Text Msgs
  - Can use just RF
  - Website: APRS.fi
  - Application: PinPoint APRS software for amateur radio

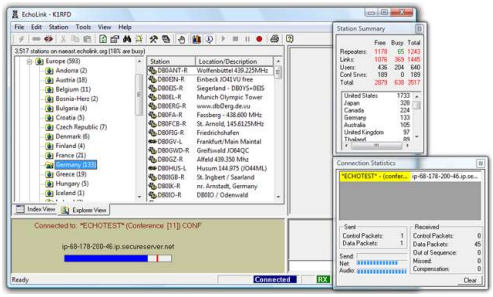
Other tools & services

- There are many tools and services that link RF and Internet to access other hams
- Free Tools/services available
- Generally, require registration to prove you are authorized to operate on ham bands
- Many options including
  - Peanut
  - Echolink
  - Hamshack hotline (VOIP for Hams)
  - And many others …
- Provide connections when RF link alone is not possible
- I encourage you to give them a try and checkout others not shown here

Peanut & HH

- Peanut: http://www.pa7lim.nl/peanut/
  - Access to DMR, Fusion, D-star
    - To see all DPLUS (starting with REF) rooms you must be USTRUST registered!
    - Make sure you are DMR registered user to use and see the DMR rooms!
  - You need a Peanut code to enter the Peanut network
  - Runs on Windows or Andriod
- Hamshack Hotline: https://hamshackhotline.com/
  - Free VOIP telecom service for the Ham Radio community
  - Requires Registration
  - Use a supported SIP capable phone
    - Can find them used sometimes at a good price
    - Refer to list of support models
  - Call others on HH or use the RF Links/Bridges

Echo Link



- Ref: https://www.echolink.org/
- Communicate with stations via Internet using streaming-audio
- Been around since 2002
- Need to Register to use
- Access to
  - Echolink repeaters
  - To other hams using internet
  - To other simplex nodes
- Can connect to your station with appropriate interface hardware to create a simplex node, or can access via Windows, iOS, Android

Emergency Communications

- Consider training for Emergency Communications
- Register with MCECG (Maricopa County Emergency Communications Group)
  - It's a group, not a club
  - Can signup to provide communications support for Public Service Events (such as races, parades)
  - It a way to use your radio, meet other hams, and provide a public service and learn how to use your Ham Skills to respond to an emergency
- Join AzRCCC (Arizona Red Cross Communication Club)
  - This is a club with meetings and membership fee
  - Excellent opportunity to learn more about Ham Radio and about Emergency Communications
  - Signing up and volunteering for the Red Cross is optional
- Take Training
  - FEMA IS-100, IS-200, IS-700, IS-800 courses, are pre-requisites for taking the FEMA AuxComm course. Introduce you to the National Incident Management System (NIMS) and the Incident Command System (ICS). These are concepts used in just about any disaster response. Free online independent study courses. AuxComm is an intensive, multi-day, in-person class.
  - Register for a FEMA SID (Student ID) prior to taking classes

Gear Considerations

How to select your first (or Next gear)

- How are you going to use it?
  - At Home
  - On Road
  - SOTA/POTA
  - Making a Go-Box
- Space limitations?
- Are you planning to advance to General for HF?
- Want to use 10m or 6m?
- What is your Budget
  - Used equipment may be more budget friendly
  - Special deals at Ham Fests

Your Next Radio

- Radios
  - Mobile Radios make a good first base station –
    - can move to vehicle as/when needed
    - Can fit in a go-box
    - More power than an HT
  - Ease of Front Panel programming for Field use?
    - Or program and forget it?
  - Computer connection for programming and digital operation
  - Do you want Digital Capability? (Fusion, DMR, D-Star, APRS?)
    - HT's work great with HotSpots
  - CW Capability?
  - Software Defined Radio or conventional?
  - Consider Scanners or SDRs for listening on other bands

Antennas, Power, Other items

- Antennas
  - Do you have antenna restrictions to work around
    - How much room do you have
    - HOA
    - Height
  - If use Mag Mount remember to provide a ground plane
  - Directional vs Omni Directional
  - What bands do you want to cover (UHF, VHF, HF)
  - Consider power out of your radio
  - Get the right connector type or adapters
  - Make or Buy? Portable?
- Need Power for Mobiles or Base stations
  - Switching or Linear, Battery, Solar?
  - How many devices will you plug in? How many Amps?
  - Use Anderson Power Poles to make it easy to connect/disconnect
- Other items: Desk mike, headphones, speaker-mic, computer, Nano VNA or SWR meter. Don't forget the Coax (don't go cheap)

Appendix - References

- AllStar: https://www.allstarlink.org/
- APRS (pinpoint): https://pinpointaprs.com/
- APRS and using to contact ISS: http://www.aprs.org/iss-faq.html
- APRS: https://www.jpole-antenna.com/2018/09/17/introduction-to-aprs-the-automated-packet-reporting-system/
- APRS: https://aprs.fi/
- APRS: http://www.aprs.org/
- ARA (AZ Repeater Association): https://www.w7ara.org/z/Repeaters.aspx
- ARA: https://www.w7ara.org/z/Conduct.Aspx
- ARRL: https://www.arrl.org/band-plan
- ARRL: http://www.arrl.org/graphical-frequency-allocations
- AZ Band Plans: https://azfreqcoord.org/bp/bp.htm
- CW (ARRL): http://arrl.org/code-practice-files
- CW (Long Island): https://longislandcwclub.org/cw-online-classes/
- DMR: https://radioid.net/
- DMR: https://www.dmrfordummies.com/
- D-STAR: http://www.dstarinfo.com/reflectors.aspx
- D-STAR: http://www.ws1sm.com/D-STAR.html
- D-STAR: https://dstarusers.org/

Appendix - References

- Echolink: https://www.echolink.org/
- FT-8 YouTube: https://www.youtube.com/watch?v=YyWX0i87P0o
- Fusion: http://systemfusion.yaesu.com/what-is-system-fusion/
- Ham Radio for Dummies: https://www.dummies.com/article/technology/digital-audio-radio/ham-radio/technician-class-frequency-privileges-in-ham-radio-164186/
- Ham Radio Outlet: Ham Radio Outlet
- Hamshack Hotline: https://hamshackhotline.com/
- IRLP (Internet Radio Linking Project): https://irlp.net/
- Peanut: http://www.pa7lim.nl/peanut/
- Radioddity: Radioddity | Choose Connectivity, Choose Radioddity
- RadioReference: RadioReference.com - Scanner Frequencies and Radio Frequency Reference
- RepeaterBook:https://www.repeaterbook.com/
- RFinder: https://rfinder.net/
- WinSystem: https://www.winsystem.org/ (Can listen to stream on line)
- WinSystem: https://www.winsystem.org/operating-tips/

Appendix - References

- Parks on the Air (POTA) - https://parksontheair.com/
- QRZ: https://www.qrz.com/
- Satellites: https://hamradioprep.com/ham-radio-satellites/
- Satellites: https://www.amsat.org/track/
- Satellites: https://www.n2yo.com/
- Satellites: https://www.work-sat.com/ewExternalFiles/WorkSat-01062023.pdf
- Summits on the Air (SOTA) - https://www.sota.org.uk/
- Summits on the Air (SOTA): https://www.arrl.org/radio-operating-from-summits
- 2m SSB: https://www.2meternet.com/
- CHIRP: https://chirp.danplanet.com/projects/chirp/wiki/Home
- RT Systems: https://www.rtsystemsinc.com/
- Checkout YouTube Playlist: (94) New Ham Workshop – YouTube
- YourTube: 5 Mistakes New Hams Make

EmComm

Consider getting involved and trained in Emergency Communications with your Ham Radio License.

- MCECG - https://www.mcecg.net/guest/
- FEMA Training: https://training.fema.gov/
  - Click on “IS Course Study” and search for:
    - 100.c
    - 200.c
    - 700.b
    - 800.d
- FEMA SSID: https://cdp.dhs.gov/femasid
- AzRCCC: https://www.k7arc.org/