Technician Licensing Class Introduction Wes Hardaker wes@ws6z.com http://www.ws6z.com/

Special thanks to K3DIO The Plano Amateur Radio Klub (TX) Some of this material comes from them





Rules and Procedures

• (Sub-agenda missing!)

Definitions

- Harmful interference is a transmission that disturbs other communications.
- Amateur Radio is the official name for Ham radio
 - "Ham" was a derogatory term that we liked and kept
 - Originally tied to unskilled telegraph operators
- "Shack": where you keep your radios hooked up
 - People will talk about their "shack"
 - It's not an actually shack.
 - (well... for most people its not)

The ITU



- International Telecommunications Union
 - The "ITU"
 - Coordinates Frequency Allocation
 - Divides the world into 3 regions
 - U.S. is in Region 2, and the FCC is our agency
 - An independent frequency coordination agency

The World is a Big Place (but radio waves make it small)



The FCC

The Federal Communications Commission:

- Makes the rules in the U.S.
- Enforces those rules
- Makes agreements with other countries
- Grants you a "Amateur Radio Service" license
- Assigns Callsigns
 - HAM: WS6Z (That's me!)FM Radio: KXJZ (NPR in sac)
- Maintains the "Universal Licensing System" (ULS)
 Holds all licenses, not just HAMs

The Amateur Radio Service

- An Amateur Radio Station is "a station in an Amateur Radio Service consisting of the apparatus necessary for carrying on radio communications."
 - Amateur Radio Rules are defined in "Part 97"
- Purposes:
 - To provide a voluntary noncommercial communications service to the public, particularly in times of emergency.
 - Contribution to the advancement of the radio art
 - Provide advancement skills in both commenications and technical phases of the art
 - To increase the number of trained radio operators and electronics experts
 - Enhance international goodwill.

Amateur Operator Licenses

- Three current levels of licenses:
 - Technician
 - General
 - Amateur Extra
- Past Levels:
 - Novice
 - Advanced
- There is no minimum age!

Element 2 Element 3 Element 4

Names of the test sections

Your License

- Is normally good for 10 years
 - If you forget to renew, you must not transmit!
 Until your renewal appears in the ULS
 - Grace period to renew after expiration:
 - 2 years (without retesting)
- Advice: renew before your time is up!
 - If you're a member of the "American Radio Relay League" (ARRL), they'll send you a reminder

Your Responsibilities

- Ensure your station is operated in accordance with the FCC rules
- Keep your address up to date in the ULS
 - They MUST be able to mail you via **USPS**
 - If mail is returned, they can revoke your license

(duh!)

- Keep your correct name in the ULS
 - i.e., if you get married and change your name

What is a station?

- Part 97:
 - "A station in an Amateur Radio Service consisting of the apparatus necessary for carrying on radio communications"
 - Huh?
- Think of a station as all of:
 - You (the "Control Operator")
 - Your radio
 - Your antenna
 - Other gear
- Similar to whatever a FM radio station needs

Control Operator

- A "Control Operator" is:
 - An operated designed by the licensee to be responsible for the stations **transmissions**
 - Assures compliance with FCC rules
 - IE, you when using your radio
 - Another licensed ham when using your radio
 If they are the CO, their privileges are in use
- Every amateur station must have a control operator present when transmitting.
- Only one license may be held by one person
- Minimum license is the Technician class

Control Point

- Where the control operator operates
 - Basically within reach of the power switch!
 - Most of the point is: you must ensure proper operation and safety!
- Only an "automatically controlled" station doesn't required a control operator at the control point

Amateur Radio Station



Types of Control

- Local
 - Being controlled right at the radio
- Remote
 - Radio is transmitting from one location
 - Operator is somewhere else
 - But can still control the radio
 - EG, over another frequency, internet, ...
- Automatic
 - Control operator isn't present



Control Summary

Your license

- Gives you the privilege of operating a station
- The same way multiple DJs operate radio stations
 - You can let others transmit from your station
 - With their license
 - With your callsign if you **designate** to another HAM
 - With your callsign if you're the control operator
- It assigns **you** the **responsibility**
 - To ensure all rules are followed
 - To ensure a licensed person is the control operator of your station

Third Party Communications

- When a message is sent between two stations for someone else
 - Must not receive payment!
- International 3rd party communications
 - Transmit both call signs at the end of each communication
 - Must have 3rd party agreements with the country
- Examples:
 - Passing a message
 - Making a phone patch
 - An unlicensed person talking on your radio
 - Remember: you must be at the control point

Amateur Radio Station: 3rd-party



Amateur Radio Callsigns

- Each Ham gets a callsign:
 - Are allocated sequentially
 - Starts with W, A, N, or K in the U.S.
 - Contain a single digit 0-9
 - Numbers indicate area of the country
 - E.G. California is number 6
 - Current starting prefix is KK6...
 - Based on where you're living when issued
 - Can be changed on request
- Which one is a **valid U.S. Callsign**?
 - KMA3505, W3ABC, KDKA, 11Q1176

U.S. Call Sign Regions



Club and Event Call Signs

- Clubs can get club call signs:
 - Must have a minimum of 4 members
 - Apply through a Club Station Call Sign Administrator
- Special Event Callsigns
 - 1x1 "Temporary" Callsigns
 - Any amateur operator can apply for one
 - Has the same usage requirements as yours
 - Must also ID with your callsign once an hour

Vanity Callsigns

- You can request your ideal callsign
 - FCC's "Vanity Callsign" program
 - Currently \$16.10 (2013) and is good for 10 years
 - Commonly used to get initials
 - Can be renewed on the internet
 - Restricted in length
 - Extra classes can get shorter lengths
 - 2x1 or 1x2
 - Mine: KI6NQW \rightarrow WS6Z

Amateur Operator Tests

- The FCC outsources their testing
- "Volunteer Examination Coordinators"
 - "VEC"s coordinate exams
 - Test and assign examiners
 - Generally large organizations
 - The biggest is the ARRL
- A "Volunteer Examiner"
 - The friendly volunteers administering the test
 - A "VE" is operator accredited by a VEC
 - 3 VEs required to administer a test
 - Must be present during the entire exam!

Amateur Operator Tests

- 3 VEs must be:
 - "General" or higher for a Technician test
 - "Extra" for testing Generals and Extras
 - 18 Years or older
 - Passed the VE written test
- Upon passing:
 - A Certificate of Successful Completion of Examination (CSCE) for that element
 - Useful, for example, if you pass the General test but not the Tech (rare)
 - Valid for license upgrade for 365 days.

What you can get

VE Badges & FCC License(s)





Call Sign/Number Grant Date Expiration Date K3DIO 07-06-2006 09-24-2016	File Number Print Date 0002670444 07-06-2006	Effective Date 07-06-2006
Operator Privileges Station Privileges Amateur Extra PRIMARY	THIS LICENSE IS NOT TRANSFERABLE SPECIAL CONDITIONS/ENDORSEMENTS:	
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VEC Coordinator

		W5YI-VEC					
Natio	mal Volunt	eer Kxan	niner Coo	rdinator			
This centifies	that:	NAME		STATION CALL SIGN			
DATE OF ISSUE: CITY / STATE (Sess	ion Site)	NUMBER AND STREET					
		CITY	STATE	ZIP			
	has SUCCESSF	ULLY PASSED the f	ollowing elements:				
and will be given credit for the date of issue of this of the date of issue of this of the date of issue of this can be be be (see Section 97.301 of to of this certificate. (See (Technician), /AG (Gene Section 97.119(f)).	or this examination element when the appropresentificate. (See Section 97.505(a)6)). IS SUCCESSFULLY PASSE Class Operator CC-issued amateur radio license, this certificate. (Section 97.9(b)). When operating on an in ral) or (AE (Amateur Extra Class). Use the	riate additional examination eleme D all elements for the f General Class Operator ficate validates temporary (interir the license of your new operator nterim basis in the telegraphy / e word "Temporary" before the	Collowing operator license Collowing operator license Amateur n) operation with the rights and privil class, or for a period not to exceed data / image /RTTY mode, you must identifier (KT, AG or AE) when oper	tion session within 365 days from Class: Extra Class Operator leges of your new operator class 365 days from the date of issue append your call sign with /KT rating in the voice mode. (See			
THIS CERT	IFICATE IS NOT A LICENSE	E PERMIT OR ANY OT	HER KIND OF OPERATI	ING AUTHORITY			
	IMPORTANT: If you hold a current	VOLUNTEER EXAMINERS					
HAM HAM HAM HAM HAM HAM HAM HE CC-granted Technician Class operator license, and if this certificate (CSCE) indi- cates Elements 1 (5 wpm) telegraphy credit, this CSCE indefinitely permits you HF operating privileges as specified in Section 97.301(e) of the FCC Rules. This document must be retained indefinitely with your Technician Class operator license in order to validate those privi- leges.		SIGNATURE (1.) (2.) (3.)	VE-#	STATION CALL SIGN			
	W5YI-VEC; NATIONAL VOLUNTEER EXAMINER COORDINATOR						
S	IGNATURE OF APPLICANT	P.O. Box 5651	01 • Dallas, Texas 75356 • Tel: (8	17) 860-3800			
White Original - Applica	nt	Yellow - VE Team Records	토님, 일 귀화감정을 없는 것	Pink -VEC Office			

So... When can you "Key-Up"???

- You are licensed and can operate
 - When you have passed your test elements
 - When you appear in the FCC ULS database
 - http://wireless.fcc.gov/uls/
 - Note other sites (ARRL) offer lookup too
 - But they're delayed by up to 24 hours

Keying-Up: Identifying Yourself

- You must transmit your callsign:
 - To identify yourself
 - Not identifying during a transmission is an "unidentified communication or signal"
 - Every 10 minutes
 - When you stop communication
 - Must use English callsigns even when speaking a different language
- IE:
 - Should: Use your call sign when you say hello
 - Must: Use your call sign when you say goodbye
 - Must: And every 10 minutes in between

Identifying Yourself

- Callsigns can have self-assigned indicators
 - EG: /P or "mobile"
 - "Slash W3", "Stroke W3", ...
 - Must not conflict with FCC rules
 - Must not conflict with foreign prefixes
- If you upgrade to a General
 - Can use new frequencies immediately
 - Until upgrade is in the database, add "/AG" when operating in the new frequencies
 - Same is true for Extra, but it's not on your test

Identifying Yourself

- "illegal unidentified transmission"
 - Unidentified transmission
 - You must ID even test transmissions
 - Frequently heard: "radio test, CALLSIGN"
- Dummy loads
 - A fake antenna for testing radios
 - Devices used for testing
 - They radiate "very little"
 - Reduces on-air interference!



Identifying Yourself on Another Radio

When visiting another station (someone else's)

- Identify with their station ID
- Then yours, if on a frequency they're not authorized for
 - e.g., "This is WS6Z using KK6ABC's station"
- You are **both** responsible for proper operation
- If you are the control operator
 - You must use your privileges
 - Even if they have a higher license

Special Locations

If on a plane:

- You must request permission from the pilot in command
- You must not use the aircraft's radio equipment
 - (i.e., must use a ham radio even if the aircraft radio can transmit on ham frequencies)

International Waters

• Vessel must be documented and registered to the U.S.

Identifying Repeaters

- If you operate a repeater, it must ID too!
 - Techs can own and operate repeaters
- Acceptable ID methods
 - By phone (voice) using the English Language
 - By video image conforming to standards
 - By morse code at 20 words-per-minute or less

Foreign Interactions

- You can transmit:
 - Wherever the FCC reigns
 - Or there is a Reciprocal Operating Agreement in place (next slide)
- Anyone can get a FCC Amateur license
 - Including foreign visitors
 - Except foreign representatives
- You can talk freely to any foreign country
 - Unless prohibited by either government
 - If they notified the ITU it objects

Operating in Foreign Countries

- "Reciprocal Operating Agreement"
 - Agreement between two countries
 - Reciprocal Operating Authorization:
 - Lets you operate in other countries
 - Lets foreign visitors operate in the U.S.
 - Restrictions on class and frequencies
 - Many now require a U.S. Extra license

Allowed Communication

- You can talk to other services when allowed
 - (almost a useless statement, but its on the test)
- Not allowed:
 - Regular communication that could be done through another radio services
 - Interfering with primary users
 - Some HAM bands are secondary to others
 - i.e. they get priority over that frequency set
 - e.g.: Ham 70cm/440MHz frequencies:
 - Amateur radio is secondary to the military
 - No repeaters in the Sacramento Area
 - The airforce PavePaws(?) shut them all down
 - We're primary in some bands!

Allowed Communication

• U.S. military station during an Armed Forces Day Communications Test

Good Communication

- Listen first! Listen first! Listen first!
 - For at least a minute
- If you hear a newly licensed station
 - Offer to help them if they're having trouble!
- When responding (or any other time)
 - Ensure you're using an authorized frequency
 - They may be using frequencies you can't
- Part 97 states: When circumstances are not specifically covered by FCC rules, the general operating standard of good engineering and good amateur practices must be applied to amateur station operation.

IRLP and EchoLink

- Internet Radio Linking Project (IRLP)
 - Links radios via the internet
- EchoLink: Similar but Different
- Basically "Voice over IP" (VoIP)
- A **repeater directory** will indicate if a reater has IRLP, EchoLink (**VoIP**) ability.
- They work by:
 - You key-up a repeater
 - Use the keypad to transmit a code to it
 - Open a new connection code
 - Close the connection



EchoLink: Talk from a computer

👗 EchoLink - K1RFD-L								
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Voice transmissions

- Called "phone transmissions" in part 97
- Various ways of sending voice:
 - FM
 - AM
 - SSB
- SSB uses
 less bandwidth
 than FM
 - Better for weak signals



Memorize These Numbers!

Much more on these later...

- Command and control:
 - Tele<u>command</u>: A one-way transmission to initiate, modify or terminate functions of a device at a distance
 - e.g. a command to turn off a repeater feature
 - e.g. a radio controlled plane
 - Maximum of 1 Watt to radio controlled models
 - Label the transmitter with a callsign and address
 - IRLP commands probably fit this
 - Telemetry: A one-way transmission of measurements at a distance from the measuring instrument
 - e.g. a temperature sensor sending data

Packet: sends data packets between radios

- Uses a Terminal Node Controller (TNC)
- Computer ↔ TNC ↔ Tranceiver
- Used to communicate with satelites
- Includes a checksum, header, auto-repeat
- Usually FM on VHF

RTTY, **PSK31**, **MFSK**, and others:

- Uses the sound card to connect to the radio
- Sound card ↔ Radio's microphone and audio
 - And converts received audio to digital
- PSK: Phase Shift Keying
 - PSK31: low-rate data transmission mode

- Digital modes
 - SSTV: Slow-scan TV: images over ham-radio
 - NTSC: analog fast-scan TV (video)
 - 70cm bandwidth: 6 MHz
 - APRS: Automatic Position Reporting System
 - Uses a GPSr to send location information
 - BER: Bit Error Rate
 - Parity Bit: An extra code element used to detect errors

- Digital modes
 - SSTV: Slow-scan TV: images over ham-radio
 - NTSC: analog fast-scan TV (video)
 - APRS: Automatic Position Reporting System
 Uses a GPSr to send location information
 - BER: Bit Error Rate
- CW: Carrier Wave International Morse
 - Narrowest bandwidth!
 - (uses very little of the frequency range)
 - Maximum bandwidth: only 150 Hz
 - (compare to FM: 1500 Hz)
 - Straight key, electronic keyer, keyboard

- Talking to satellites and space stations
 - There are ham repeaters on satellites!!
 - Space Station: a amateur station above 50km
 - If you have a licence for the uplink frequency
 - (use the minimum power necessary)
 - Technicians using 2m/440 U/V mode!
 - A satellite has a huge line of sight!
 - You can talk to people in other countries
 - Satellites often have "beacons"
 - Transmit information about it
 - Satellite tracking programs can help find them
 - Draws a map of when they will pass overhead

Q-Codes

- "Q-signal" or "Q-codes"
 - short 3-letter codes
 - Created for sending frequent concepts over CW
- Examples
 - QRM: I'm receiving man-made interference from other wstations
 - QSY: I'm changing frequencies
- Don't say these over voice! It's silly!
 - But... many people do.
 - "I'm going to QSY; too much QRM on this frequency"
- See the internet for a long list

Q-Signals: commonly heard

QRM Something is causing interference QRN I am troubled by static/noise. **ORP** I am running low power. QRT I am going off the air. Who is calling me? QRZ Your signal is fading. QSB QSL I received the message. QSO I will communicate with directly. **OSY** I am changing frequency to **OTH** My location is 50

Grid Locators

• A letter-number designator indicating a geographic location

• Translate lat/long coordinates to letters/numbers



You May <u>NOT</u>

- Transmit Music
 - Including background music in the room
 - (ie, turn down your stereo and tv)
 - Except retransmitting manned spacecraft audio
 (if they're playing musing on the ISS)
- Broadcast to the general public
 - IE, you're not allowed to be a news radio station
- Transmit "false or deceptive" messages
 - I.E. you can't lie; you must tell the truth
- The transmitting station is accountable if a repeater station inadvertently retransmits communications that violate FCC rules.

You May <u>NOT</u>

- Transmit indecent or obscene language
 - It is offensive to some people
 - Young children could receive it
 - The FCC Rules prohibit it
- There is no official list defining exactly what is indecent or obscene for amateur radio!
- Let your family use your station when you're not there
 - They can't be a control operator
- Get paid or do any work over the air
 - Unless you're the control operator of a club station and sending information > 40 hours week

You May <u>NOT</u>

- Use codes, ciphers or encryption
 - Except space stations
 - And radio controlled craft
- Do any sort of work
 - You can't call your boss using an auto-patch
 - Basically, anything that makes anyone money
 - Except to offer occasional equipment for sale
 - You can only be compensated if part 97 allows it
 - Basically, never except when teaching as part of classroom instruction at an educational institution



Sensitive Subjects

- Don't use racial or ethnic slurs
 - It's offensive to some
 - It reflects poorly on the amateur community
- These types of communication are NOT prohibited (i.e., they're allowed):
 - Political discussions
 - Jokes and stories
 - Religious Preferences
 - "Communications incidental to the purposes of the amateur service and remarks of a personal character"

- Intereference in ANY receiver is:
 - Caused by:
 - A fundamental overload
 - Basically, the near by signals are too strong and the receiver can't handle it
 - Spurious emissions
 - Something is generating signals outside of the frequency range it should be generating signals for

Harmonics

 Emissions at regular frequency intervals from the main frequency being transmitted on

- You MAY NOT cause intentional interference
- If you receive a report that your signal is causing "splatter" or interference on nearby frequencies, you should check your transmitter for:
 - Off frequency operation
 - Spurious emission
 - (your radio is not operating correctly)
- If you're unintentionally causing interference
 - Identify your station
 - And move to a different frequency

 Receiver front-end overload results from near-by strong signals





Pre-HD TV signal interference example

- Modern cheap consumer electronics
 - Aren't equipped with interference protection
 - You may need to add filters
 - Phones
 - TVs (use a **band-reject filter**)
- The owner of the TV/radio is responsible!
 - IE, they must buy and install needed filters
 - But good HAMs should help them :-)
- A break in a cable TV line may
 - Cause TV interference during your transmission
 - Cause interference to your reception

If you're causing interference

- Telephones/TVs:
 - Telephones can act like a radio receiver
- Useful items to add:
 - Ferite Chokes (audio cables)
 - Low-pass and High-pass filters
 - Notch and Band-pass filters
 - Band-Reject Filter
- If you get complaints:
 - Check your equipment for good amateur practice
 - Make sure it's not affecting your own Telephones/TVs/...



Ferite Chokes

If you're causing interference

- Telephones/TVs:
 - Telephones can act like a radio receiver
 - Install an RF Filter
- Useful items to add:
 - Ferite Chokes (audio cables)
 - Low-pass and High-pass filters
 - Notch and Band-pass filters
 - Band-Reject Filter
- If you get complaints:
 - Check equipment for good amateur practice
 - Make **sure it's not affecting your own** Telephones/TVs/...



Ferite Chokes

If they are causing interference

A part 15 device is a consumer device

- Almost everything
- Clock radios, phones, walkie-talkies, etc.
- If a neighbors part 15 device is interfering:
 - Work with the neighbor to find the device
 - **Politely** inform them the FCC rules state they should stop using the device
 - **Ensure** your station meets the standards of good amateur practice
- Finding interference or transmitters:
 - Use "Radio Direction Finding" "directional antenna"

• Part 97 definition:

- That which seriously degrades, obstructs, or repeatedly interrupts a radio communication service operating in accordance with the Radio Regulations
- Common sources of interference for me:
 - My car engine
 - One older car killed one repeater
 - (I solved this: sold the car)
 - My computers
 - One operates at a frequency right near a repeater frequency
 - Weed eaters!

Interference – Ham Bands

- If your radios have issues
 - It may transmit it's signal (say, FM)
 - And maybe more than just that, unfortunately

"Splatter or interference on nearby freqs"

- Extra signals higher or lower in the frequency spectrum
- What to do?
 - Check your transmitter for off-frequency operation or spurious emissions
 - Have your radio fixed or fix it yourself
 - Install a filter between the transmitter and the antenna

Power Levels

- You must use the minimum power necessary to achieve communication.
 - For repeaters
 - For simplex
 - For HF
 - • •

Station Requirements

- FCC is allowed to inspect at any time:
 - Your station
 - Your records
- Security and protection
 - When not in use it's recommended you unplug:
 - The power
 - Microphones
 - Keeps unauthorized people from using it

Distortion

- If someone says you sound distorted
 - Your batteries may be low
 - (they can't supply enough current)
 - Your transmitter could be off frequency
 - You could be in a bad location
 - Also: Your microphone gain could be too high
- If your SSB signal is garbled
 - **RF** energy could be getting into the microphone circuit causing **feedback**
- Electrical Ignition Noise
 - Causes a "high pitched whine"
- Doppler shift DOES NOT cause interference

Questions?

?