

Introduction

to

Amateur Radio:

Handheld 101

CERT Communications Team  
Fremont, California  
<http://www.qsl.net/kg6adr/>

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## Course Outline

This course will teach you how to operate the type of handheld radio provided by the City of Fremont Fire Department for emergency communications. You will learn everything you need to know to get on the air.

- Frequencies and channels
- Basic receiver controls and features
  - Antenna connector
  - External speaker, microphone, and power connections
  - Power
  - Volume
  - Squelch
  - Monitor
  - Display and tuning
  - Exercise: receive a transmission from the instructor
- Basic transmitter controls
  - Power settings
  - Push to talk
  - PTT Lockout
  - Simplex operation
  - Exercise: transmit to your classmates
  - CTCSS encode and decode
  - Repeater operation — frequency offset
- Getting on the air
  - Calling another station
  - Give-and-take
  - Round robin
  - How to break in with emergency traffic
  - Jargon
  - Style
  - Criticism
- Nets
  - Directed nets
  - Net control
  - Messages
  - How do I join a net?
  - How do I pass a message?

# Introduction to the Frequency Spectrum

## CHART

Common Use	Freq. Scale	Wave-length	Ham Bands	National Simplex Calling Freq. (MHz)	Other Simplex Freq. (MHz)	Fremont Repeaters
AM radio	500 kHz					
Shortwave		160 m	1.8 – 2.0 MHz			
		80 m	3.5 – 4.0 MHz			
		40 m	7.0 – 7.3 MHz			
	10 MHz	30 m	10.10 – 10.15 MHz			
		20 m	14.00 – 14.35 MHz			
		17 m	18.068 – 18.168 MHz			
CB	25 MHz	15 m	21.00 – 21.45 MHz			
		12 m	24.89 – 24.99 MHz			
		10 m	28.0 – 29.7 MHz		52.000 52.020 52.040	
TV 2–6	50 MHz	6 m	50.0 – 54.0 MHz	52.525	52.540	
					53.020	
FM radio	100 MHz				144.365 145.700	
					146.400	
Aircraft					146.415 146.430	
		2 m	144 – 148 MHz	146.520	146.555	146.940– PL 123.0 147.015+ PL 103.5
	150 MHz				146.565 147.450	
TV 7–13		1.25 m	222 – 225 MHz	223.500	223.400	223.900– PL 103.5
Government	300 MHz				223.540	
GMRS, FRS		70 cm	420 – 450 MHz	446.000	446.500	441.525+ PL 123.0 442.600+ PL 107.2
TV 14–69	600 MHz					
		33 cm	902 – 928 MHz	906.500		
Cell phones	1.2 GHz	23 cm	1.24 – 1.30 GHz	1294.500		

## NOTES

- Lower frequencies have longer wavelengths and require longer antennas
- Higher frequencies are the most recent to become widely used.
- Higher frequencies require line-of-sight transmission.
- Lowest frequencies on this chart are called HF, or “high frequency,” because they were high frequencies when the term was first used in the early 1900s.

# Basic Receiver Controls

## OBJECTIVE:

At the end of this lesson you will be able to do the following on the Alinco DJ-191 VHF FM Transceiver:

- identify the antenna connector
- find and use the Off/On, Volume, Squelch, and Monitor controls
- explain what is shown on the LCD display
- input a frequency
- select a memory bank
- explain the functions and use the DTMF Key Pad

→ **Antenna Connector**

→ **Off and On**

→ **Volume Control**

→ **Squelch Control**

→ **LCD display**

→ **Tuning controls: VFO, memory channels, Band switching**

→ **Monitor**

→ **DTMF Key Pad**

# Basic Transmitter Controls

## OBJECTIVE:

At the end of this lesson you will be able to do the following on the Alinco DJ-191 VHF FM Transceiver:

- set transceiver for Hi or Lo power
- find and use the Push to Talk and Key Lock buttons
- find and explain use of the Speaker and Mic jacks
- explain and use simplex operation
- explain and set CTCSS codes

→ **Hi Power Lo Power**

→ **Push To Talk**

→ **PTT Lock**

→ **Key Lock**

→ **Speaker & Mic Jack**

→ **Simplex operation**

→ **CTCSS ENCODE AND DECODE**

# Getting on the Air

## OBJECTIVE:

At the end of this lesson you will be able to do the following with the Alinco DJ-191 VHF FM Transceiver:

- Explain how a repeater works
- Program the radio for accessing a repeater
- Call a station
- Join a round robin
- Break into a conversation with emergency traffic

→ **How does a repeater work?**

→ **Programming the radio to access a repeater**

→ **Calling a station**

→ **Normal give-and-take**

→ **Round robin (how does one start, how do I get in)**

→ **Breaking into a conversation with emergency traffic.**

# Networks

## OBJECTIVE:

At the end of this lesson you will be able to do the following:

- define a directed network
- Explain the duties of Net Control
- Enter an on-going network
- Explain the message format that CERT Comm will use
- Pass a proper message across a net.

→ **Networks**

→ **Directed nets**

→ **Net Control**

→ **Messages**

→ **How do I get into the net?**

→ **How do I pass a message?**

REFERENCES

# References:

CERT COMM STANDARD CHANNEL PROGRAMMING FOR CERT RADIOS

Channel	Frequency and offset	PL Tone	Remarks
1	147.015 MHz +	103.5 Hz	Resource repeater
2	147.015 MHz		Resource repeater output frequency. Use when repeater fails.
3	146.940 MHz –	123.0 Hz	Tactical repeater. Primary channel for CERT out-of-district communications.
4	146.940 MHz		Tactical repeater output frequency. Use when repeater fails.
5	145.700 MHz		ARES simplex frequency. Use for in-district communications.
6	145.030 MHz		Packet
7	146.505 MHz		CERT Simplex #1
8	147.450 MHz		CERT Simplex #2
9	146.520 MHz		National Simplex Frequency
10	162.550 MHz		Weather

PHONETIC ALPHABET AND NUMBERS

<b>A</b> lfa	<u>AL</u> FAH	<b>J</b> uliet	<u>JEW</u> LEE <u>ETT</u>	<b>S</b> ierra	SEE <u>AIR</u> RAH
<b>B</b> ravo	<u>BRAH</u> VOH	<b>K</b> ilo	<u>KEY</u> LOW	<b>T</b> ango	<u>TANG</u> GO
<b>C</b> harlie	<u>CHAR</u> LEE	<b>L</b> ima	<u>LEE</u> MAH	<b>U</b> niform	<u>YOU</u> NEE FORM
<b>D</b> elta	<u>DELL</u> TAH	<b>M</b> ike	<u>MIKE</u>	<b>V</b> ictor	<u>VIK</u> TOR
<b>E</b> cho	<u>ECK</u> OH	<b>N</b> ovember	NO <u>VEM</u> BER	<b>W</b> hiskey	<u>WISS</u> KEY
<b>F</b> oxtrot	<u>FOKS</u> TROT	<b>O</b> scar	<u>OSS</u> CAR	<b>X</b> -ray	<u>ECKS</u> RAY
<b>G</b> olf	<u>GOLF</u>	<b>P</b> apa	<u>PAH</u> <u>PAH</u>	<b>Y</b> ankee	<u>YANG</u> KEY
<b>H</b> otel	<u>HOH</u> TELL	<b>Q</b> uebec	KWEE <u>BECK</u>	<b>Z</b> ulu	<u>ZOO</u> LOO
<b>I</b> ndia	<u>IN</u> DEE AH	<b>R</b> omeo	<u>ROW</u> ME OH	/	stroke
0	Zero ZEE ROW	4	Four FOWER	8	Eight ATE
1	One WON	5	Five FIFE	9	Nine NINER
2	Two TOO	6	Six SICKS		
3	Three TREE	7	Seven SEV VEN		

## REFERENCES

## PROWORDS

Prowords (short for **procedure words**) make communication more efficient by expressing complex phrases in one or two easily identifiable words. But they are only effective if everybody understands them.

*affirmative*

I agree.

*break*

-person interrupting = I have emergency traffic

-person speaking = I have more to say after this short pause

*correct*

That is correct or true.

*correction*

I made a mistake, and will repeat from the last correct word.

*more to follow*

There will be more information later regarding this message.

*negative*

I disagree.

*out*

I am ending this conversation.

*over*

I'm done; go ahead and respond.

*roger*

I heard you and understand the message.

*say again*

Repeat all or part of your last message.

*say again all before*

Please repeat everything said before....

*say again all after*

Please repeat everything said after....

## REFERENCES

### RADIO GO PACK

- Transceivers identified with your call sign (especially 2 m HT)
- Spare batteries, charged
- Spare alkaline battery holder
- Charger – AC and/or DC powered
- Transceiver manual
- Cigarette lighter power adapter
- AC adapter
- Extension cords – AC, DC
- Headphones, earphone or headset
- Scanner
- Magnetic mount, J-pole or other portable antenna
- Coax cable
- Connectors and adapters
  - UHF (PL-259) barrel (female-female)
  - BNC barrel (female-female)
  - BNC male to UHF (PL-259) female
  - SMA male to BNC female
  - UHF Male to BNC Female
  - Anything special for your equipment
- Flashlight with spare batteries and bulbs
- Tools – basic set
- Wire – misc. types and lengths
- Soldering iron and solder
- Steno pad or notebook
- CERT message forms
- Clipboards
- Pens, pencils and marking pens
- CERT Photo ID badge
- Copy of radio license
- Repeater directory
- Change pouch with \$5 in quarters
- Duct, plastic friction and electrical tapes
- Miniature voice recorder for messages
- Spare fuses
- 50 feet of 1/8" nylon cord
- Appropriate clothing
- Food and water
- Clock
- Post-its

# Alinco DJ-191 Step-by-step Guide

## INITIAL SETUP

1. Press the **POWER** button located in the upper-left of the radio.
2. The **MONITOR** button, labeled **MON**, is the lowest button on the left side of the radio. Press and hold the **MONITOR** button. The word **BUSY** should appear on the screen and static should be heard. If someone's transmission is heard, rotate the knob on top of the radio until only static or silence is heard.
3. The **UP** and **DOWN** keys are located just above the display. Press the **UP** or **DOWN** key. The letters **VOL**, for *volume* appear on the screen. Press the **UP** or **DOWN** key repeatedly until the static is as loud as you want the actual received voice to be.
4. Release the **MONITOR** button.
5. The **FUNCTION** button, labeled **F**, is the upper-most button on the left side of the radio. When the **FUNCTION** key is pressed, the blue labels describe the keys. Press and hold the **FUNCTION** button.
6. Press the **UP** button. The letters **SQL**, for *sqlch*, appear on the screen.
7. If you hear static, press the **UP** key repeatedly until the static goes away. If you do not hear static, press the **DOWN** key until you do. Then press the **UP** key until the static goes away.
8. Release the **FUNCTION** button.

## TO RECEIVE AND TRANSMIT ON A PRE-PROGRAMMED CHANNEL

1. Check to see if **M** is displayed. If not, press the **A** key (also labeled **V/M** for *VFO/Memory*).
2. Rotate the knob on the top right of the radio until the desired memory number and frequency are displayed.
3. Listen. If the frequency is not being used, press the **PUSH-TO-TALK** button. The **PUSH-TO-TALK** button is the largest button in the center of the left side of the radio. It is labeled **PTT**. Take a breath and speak slowly and distinctly across the microphone. The microphone is located in the lower-right corner of the radio.

## REFERENCES

### TO RECEIVE AND TRANSMIT ON A FREQUENCY NOT PROGRAMMED

#### → Using simplex

1. If a **M** or **C** is displayed, press the **A** key (also labeled **V/M** for *VFO/Memory*).
2. If a  or  is displayed Press and hold the **FUNCTION** key (the top-most key on the left side of the radio, labeled **F**) and press the **2** key repeatedly until the  or  disappears. Release the **FUNCTION** key.
4. Key in all six digits of the desired frequency using the keypad. (NOTE: The last digit may be rounded up or down to the nearest *frequency step*. To change the *frequency step*, see the manual for the radio.) You may also change the frequency by rotating the dial on the top of the radio.
5. Listen. If the frequency is not being used, press the **PUSH-TO-TALK** button. The **PUSH-TO-TALK** button is the largest button in the center of the left side of the radio. It is labeled **PTT**. Take a breath and speak slowly and distinctly across the microphone. The microphone is located in the lower-right corner of the radio.

## TO RECEIVE AND TRANSMIT ON A FREQUENCY NOT PROGRAMMED

## → Using a repeater

1. Have the following information about the repeater available:
  - ❑ Output frequency
  - ❑ If positive or negative offset is used
  - ❑ If a tone (PL) is required, and if so, the tone frequency.
2. If a **M** or **C** is displayed, press the **A** key (also labeled **V/M** for *VFO/Memory*).
3. Key in all six digits of the repeater *output frequency* using the keypad. (NOTE: The last digit may be rounded up or down to the nearest *frequency step*. To change the *frequency step*, see the manual for the radio.)
4. Press and hold the **FUNCTION** key (the top-most key on the left side of the radio, labeled **F**). Press the **2** key repeatedly until either  for positive *offset* or  for negative *offset*, appears. (The **2** key is also labeled **SHIFT**, another name for *offset*.)
5. Release the **FUNCTION** key.
6. The *offset frequency* **0.60** should be displayed. If not, rotate the knob on the top of the radio until it is.
7. Press **PUSH-TO-TALK** briefly to exit 'offset set mode'. The **PUSH-TO-TALK** button, labeled **PTT**, is the largest button in the center of the left side of the radio.
8. If a *tone* (PL) is required, press and hold the **FUNCTION** button, then press the **4** key. (The **4** key is also labeled **T SQL** for *Tone Squelch*.) Release the Function button. A  is displayed. Rotate the knob on top of the radio until the proper *tone frequency* is displayed. Press **PUSH-TO-TALK** briefly to exit 'tone set mode'.
9. Listen. If the frequency is not being used, press the **PUSH-TO-TALK** button. Take a breath and speak slowly and distinctly across the microphone. The microphone is located in the lower-right corner of the radio.

## Alinco DJ-191 Quick Reference

<i>To:</i>	<i>Do the following</i>
Turn the radio on	Press the POWER key
Adjust the volume	Repeated press the UP or DOWN keys
Adjust the squelch	While holding the FUNCTION button, repeatedly press either the UP or DOWN keys.
Set the frequency	<ol style="list-style-type: none"> <li>1. If <b>M</b> or <b>C</b> is displayed, press the A key.</li> <li>2. Using the keypad, enter all 6 digits of the desired frequency</li> </ol>
Change to Simplex	If a <b>+</b> or <b>-</b> is displayed, hold the FUNCTION button and press the 2 key until they disappear.
Set offset for repeater (duplex) operation	<ol style="list-style-type: none"> <li>1. Hold the FUNCTION button and press the 2 key until either a <b>+</b> (for positive offset) or a <b>-</b> (for negative offset) appears. Release the FUNCTION button.</li> <li>2. The offset frequency <b>0.60</b> should be displayed. If it is not, or a different frequency is desired, rotate the dial until the desired offset frequency is displayed.</li> <li>3. Briefly press PUSH TO TALK.</li> </ol>
Set tone encode (PL)	<ol style="list-style-type: none"> <li>1. Press and hold the FUNCTION button, then press the 4 key until a <b>T</b> is displayed. Release the FUNCTION key.</li> <li>2. Rotate the dial until the desired tone frequency is displayed.</li> <li>3. Briefly press PUSH TO TALK.</li> </ol>
Change power	Press and hold the FUNCTION button, then press the LAMP H/L key. An <b>L</b> is displayed when the radio is set to low power.

REFERENCES

<i>To:</i>	<i>Do the following</i>
Recall a pre-programmed frequency	<ol style="list-style-type: none"> <li>1. If an <b>M</b> is not displayed, press the <b>A</b> key.</li> <li>2. Rotate the dial until the desired memory is displayed.</li> </ol>
Store settings in memory	<ol style="list-style-type: none"> <li>1. If an <b>M</b> is not displayed, press the <b>A</b> key.</li> <li>2. Rotate the dial to select the desired memory.</li> <li>3. Press the <b>A</b> key to enter VFO mode.</li> <li>4. Set up all radio parameters: frequency, offset, tone, etc.</li> <li>5. Press and hold the <b>FUNCTION</b> button, then press the <b>A</b> key. Release the <b>FUNCTION</b> button.</li> </ol>

# Glossary

*access code*

One or more *DMTF* digits used to access a repeater function like *autopatch*.

*alligator*

Enforcer of a repeater's *timeout*.

*amplitude modulation (AM)*

Modifying a *carrier* signal by varying its instantaneous power (or amplitude) to represent the information it carries.

*autopatch*

A repeater function that allows users to make telephone calls. Also called phone patch.

*band*

See frequency band.

*band opening*

A condition that results in greater than normal communication range on VHF or UHF.

*band plan*

A voluntary system of frequency allocations for each amateur radio band.

*bandwidth*

The frequency space occupied by a signal in the radio spectrum. The greater the bandwidth, the more space occupied and the more information that can be potentially carried.

*carrier*

Unmodulated transmitter signal, or, more technically, a signal of known characteristics that is modulated to carry information.

*channel*

A communications transmission path through any medium—wire, radio, optical fiber, etc. Also, the input/output frequencies used by a repeater.

*closed repeater*

A repeater for use only by members of a club that doesn't welcome use from all hams.

*co-channel interference*

Interference from another repeater or its users. Though repeater frequencies are coordinated, weather or other conditions can make signals extend farther than normal.

*controller*

The interface between a repeater's receiver and transmitter. It provides the *PTT*, *IDer*, *CTCSS*, *timeout* timer, and *autopatch*.

*control operator*

The ham operator or operators who are designated to control a repeater or other station.

**COR**

Carrier operated relay, equipment that keys up the transmitter when a carrier is received.

*courtesy tone*

An audible signal transmitted by a repeater at the end of one person's transmission to let the next person know that the repeater has reset and is available for use.

*coverage*

The geographical area where a repeater provides communication.

*cross band repeater*

A repeater that receives and transmits on one band and retransmits and receives on another.

**CTCSS**

Continuous Tone Controlled Squelch System. A sub-audible tone is transmitted by your radio along with your voice. Other radios or repeaters equipped with CTCSS decoders will not activate unless they hear this tone. Also called *PL™*.

**CW (Continuous Wave)**

An abbreviation for Morse Code.

## GLOSSARY

### *desense*

When a receiver is overloaded by a strong transmission, it becomes less sensitive and less able to pick up weak signals.

### *dropping out*

When the signal you are receiving isn't strong enough to keep the squelch open, the audio drops in and out, and may sound like you're receiving through a picket fence.

### *DTMF*

Dual Tone Multi Frequency, pairs of tones representing digits and symbols. Also called *Touch Tone*.

### *duplex*

Two-way transmission using two channels. Each end needs a separate receiver and transmitter so that the remote station's transmissions can be heard regardless of the state of the local transmitter.

### *duplexer*

A filter which allows a transmitter and a receiver to share a single antenna.

### *EOC*

Emergency Operations Center. What state governments call state or county facilities where emergency services and radio equipment is co-located. This EOC provides rapid deployment and coordination of emergency communications and drills.

### *ERP*

Effective radiated power. ERP takes into account the transmitter's output power, line loss, antenna gain, and insertion loss from other equipment in the line.

### *FEMA*

Federal Emergency Management Agency. <http://training.fema.gov/EMIWeb/cert/index.htm>

### *frequency modulation (FM)*

Modifying a *carrier* signal by varying its frequency to represent the information it carries. For voice, the frequency deviation is 5 kHz or less. In digital FM communications, the deviation is between 3 and 3.5 kHz.

### *frequency band*

A group of frequencies designated by government regulation for a specific purpose. Bands reserved for amateurs are called amateur bands or ham bands.

### *full duplex (FDX)*

A circuit which allows independent transmission in both directions simultaneously.

### *full quieting*

When a received signal is strong enough to completely overcome the atmospheric and thermal noise of the receiver.

### *gigahertz (GHz)*

A unit of frequency measurement. 1 GHz = 1,000 MHz = 1,000,000,000 Hz.

### *half duplex*

A circuit which allows information to be transmitted in only one direction at a time, used to describe computer protocols and transmission channels.

### *high frequency (HF)*

The region of the radio spectrum between 3 and 30 MHz.

### *Hertz (Hz)*

A unit of frequency, measured in cycles per seconds. 60 Hz = 60 cycles per second.

### *IDer*

The system that transmits a station's call sign with Morse Code or voice.

## GLOSSARY

### *impedance*

A measure of resistance to the flow of *RF energy* based on a combination of actual resistance losses due to inefficiency, or a mismatch between the two in an antenna feedline. Resistance, reactance, and impedance are all measured in ohms. Most ham transmitters are designed for an antenna system with an impedance of 52 ohms, ideally a 52 ohm feedline (such as RG-8 cable) connected to an antenna with an impedance of 52 ohms.

### *input frequency*

The receive frequency of a repeater.

### *intermodulation (intermod)*

An interfering frequency resulting from strong signals mixing and creating a third frequency that enters your receiver.

### *kerchunk*

Slang term for keying up and dropping a repeater momentarily without identifying.

### *keypad*

See *tone pad*.

### *kilohertz (kHz)*

A unit of frequency measurement. 1 kHz = 1,000 Hz.

### *liquid crystal display (LCD)*

A type of display used on many radios and electronic devices, characterized by dark characters on a lighter background.

### *linking*

Connecting repeaters together to form a network.

### *lower sideband (LSB)*

The style of single sideband transmission that uses only the lower sideband. See *amplitude modulation, single sideband, upper sideband*.

### *machine*

Slang for *repeater*.

### *megahertz (MHz)*

A unit of frequency measurement. 1 MHz = 1,000,000 Hz.

### *memory effect*

The tendency of nickel-cadmium (NiCd) batteries that are repeatedly recharged without being fully discharged to remember the point at which they're normally recharged, reducing battery life. There is debate over its causes, but it's always best to fully discharge a NiCd battery before recharging it.

### *negative offset*

When a repeater receives at a lower frequency than it transmits.

### *NOAA*

National Oceanic and Atmospheric Administration. Parent agency of the National Weather Service, providing 24 hour a day weather reports on several frequencies around 162 MHz.

### *odd split*

A non-standard frequency *split* between the transmit and receive frequencies of a repeater.

### *offset*

See *split*.

### *output frequency*

The transmit frequency of the repeater, which you tune your radio to.

### *packet radio*

Amateur communications, known by the protocol name AX.25.

## GLOSSARY

### *PL*

Motorola trademark for CTCSS, short for private line.

### *positive offset*

When a repeater receives at a higher frequency than it transmits.

### *propagation*

The means by which radio signals are carried from one location to another.

### *PTT*

Push to talk, the button you push to key up the transmitter.

### *repeater*

A relay station used to expand the coverage of mobile handheld radios.

### *repeater directory*

A listing of repeaters in a given area, typically showing the repeater's location, output frequency, offset, and any required CTCSS frequencies.

### *repeater pair*

The two frequencies—input and output—required by a repeater.

### *reverse patch*

The ability of a repeater to receive a telephone call and transmit it over the air.

### *radio frequency (RF)*

Signals generated by your transmitter, as well as cordless phones, computers, etc., that fall within the radio portion of the electromagnetic spectrum. Energy produced at these frequencies is called RF or RF energy.

### *rubber duck*

Common term for the flexible rubber-covered antenna generally supplied with handheld radios.

### *signal*

Energy intentionally introduced into a transmission path with the purpose of sending information.

### *signal-to-noise ratio (SNR)*

Ratio of the signal power to the noise power in a specified bandwidth, usually expressed in decibels; the smaller the ratio, the poorer the channel. Generally speaking, a ratio of 20 dB or more is excellent for voice. Broadcast video required 30 dB or more, but 1200 bps digital communications takes just 12 dB.

### *simplex*

Transmitting and receiving on the same frequency, generally without using a repeater.

### *single sideband (SSB)*

A form of amplitude modulation where only one of the two sidebands is transmitted. Either sideband may be transmitted while suppressing or reducing the carrier.

### *S meter*

A meter that provides a rough indication of received signal strength.

### *split*

The difference between a repeater's transmit and receive frequencies. In the 144 MHz band, 600 kHz is the conventional split; 1.6 MHz for the 220 MHz band; and 5 MHz for 440 MHz.

### *squelch*

The control that keeps the speaker silenced (squelched) until the signal level exceeds a certain point. Normally, you set the squelch to block noise and allow signals.

### *sub-audible tone*

See CTCSS.

### *tail*

The time between when someone stops talking and when the repeater stops transmitting.

## GLOSSARY

### *timeout*

When a transmitter automatically shuts down because it has been continuously operating for too long. Repeaters generally have a timeout of three minutes, and will time out if someone talks beyond the allotted time or if multiple users talk without letting the repeater drop. See *alligator*.

### *terminal node controller (TNC)*

A combined modem and packet assembler and disassembler, interfacing a computer terminal and RF transceiver. The TNC stores text typed on the terminal and stores it until the user hits a carriage return when it is assembled into a packet and sent to the destination station.

TNC's have commands to set timing parameters and the operator's call sign.

### *tone pad*

A keypad that generates *DTMF* tones.

### *Touch Tone*

An AT&T trademark for *DTMF*.

### *ultra high frequency (UHF)*

The region of the radio spectrum between 300 MHz and 3 GHz.

### *upper sideband (USB)*

The style of single sideband transmission that uses only the upper sideband. USB is used on VHF. See *amplitude modulation, single sideband, lower sideband*.

### *variable frequency oscillator (VFO)*

The radio's circuit that lets you tune higher and lower frequencies by pressing a key or turning a dial. Today's digitally synthesized radios usually use a tunable phase-locked loop (PLL) instead of a true VFO.

### *very high frequency (VHF)*

The region of the radio spectrum between 30 MHz and 300 MHz.

### *VHF Contest*

An on-air competition where activity is encouraged on VHF and UHF ham bands

Class title: \_\_\_\_\_

Date: \_\_\_\_\_

So we may serve you better, please answer these questions and hand in at end of class. Thank you!

	Agree Strongly	Agree	Neutral	Disagree	Disagree Strongly
I learned a lot in this class.	①	②	⑤	③	④
This class is an important part of my CERT training.	①	②	⑤	③	④
The topics covered were interesting to me.	①	②	⑤	③	④
The instructors gave clear explanations.	①	②	⑤	③	④
The instructors answered questions well.	①	②	⑤	③	④
Good balance of lecture/hands-on activities.	①	②	⑤	③	④
I would recommend this class to others.	①	②	⑤	③	④

	Too Fast	Just Right	Too Slow
The pace of the class was...	①	⑤	④
The length of the class was...	①	⑤	④

What topics would you add to this class (or suggest for future classes)?

What would you remove from this class?

What can we do to improve future classes?

How did you find out about this class?

Have you completed CERT training?  Yes  No

Do you have an amateur radio license?  Yes  No

Do you have:  Amateur radio  FRS radio  CB radio  Other \_\_\_\_\_

(Please check all that apply.)