# Technician License Course

**Technician License Course Chapter 6** Lesson Plan Module – 13 Contacting Other Hams – Part 1 **Contact Basics, Band Plans, Making Contacts** and Using Repeaters

## The Typical Telephone Conversation

- Greeting
- Identify who is participating
- Exchange information, generally taking turns
- Salutations
- End the conversation

### The Typical Ham Contact (QSO)

- Greeting
- Identify who is participating
- Exchange information, generally taking turns
- Salutations
- End the conversation

### **Radio Manners**

- Before transmitting, be sure the frequency is clear and you are authorized to use it!
- Station identification (10-minute rule)
- Frequencies are shared
  - No one has a prior claim to a frequency
  - Schedules, nets, pre-planned events
  - Be flexible, always have a "Plan B"

### Radio Manners

Signal reports
Power level
Avoid excess power
Location (QTH)
Grid locators RST

<u>R</u>eadability (1–5)
<u>S</u>trength (1–9)
<u>T</u>one (CW only 1–9)
"Your signal is 58"

### **Radio Manners**

 Advice and assistance Radio and antenna tests or checks Ham radio is self-regulated ARRL Official Observers Logging contacts – on paper or computer QSLs and award programs.

### **Band Plans**

 A band plan is a formal plan for organizing types of operation on a band Informal agreement – not a regulation –Intended for normal circumstances -Be flexible in times of heavy band use (contests, special events, DXpeditions) -Always have a "Plan B"

Making Contacts Repeater signal reports (examples) Full-quieting: signal is strong enough that no noise is heard

- Scratchy: occasional noise with your signal
- Flutter: multi-path from a mobile station
- In and out: occasionally copyable but mostly inaudible

### Making Contacts

• HF on CW or SSB "CQ" means "I am calling anyone" To answer give the station's call followed by your call once or twice Use of phonetics is common

## Making Contacts

- Taking turns
  - Nets
  - Roundtables
  - Shared contacts
- Breaking in
  - Wait for a pause
  - Give your call



## Making Contacts

### Simplex FM

- Each user takes turns to transmit
- Works for stations close to each other
- If you can hear the other station on the repeater input frequency, try simplex
- 2 meters: 146.52 MHz
- 70 cm: 446.00 MHz

### **Repeater Review**

- Specialized transmitter/receiver interconnected by a controller.
- Generally located at a high place.
- Receives and simultaneously retransmits your signal on a different frequency.
- Dramatically extends line-of-sight range.

### Repeater Review – How They Work





### **Duplex Communication**

- Transmitting on one frequency while simultaneously listening on a different frequency.
- Repeaters use duplex communications.
- Output frequency the frequency the repeater transmits on and you listen to.
- Input frequency the frequency the repeater listens to and you transmit on.

# Things to Know to Use a Repeater

- Output frequency
- Frequency offset
  - –And therefore the input frequency

Repeater access tones (if any)

### Identifying Repeaters

 Repeaters are frequently identified by their output frequency. -"Meet you on the 145.47 machine." Here the specific frequency is used. OR -"You mean the HARC repeater?" •Here the repeater is referenced by the sponsoring club name.

## Repeater Frequency Offset

- The offset frequencies (shifts or splits) are standardized to help facilitate repeater use.
- There are + and offsets depending on the plan.
- Different bands have different standardized amounts of offset.

Standard R	epeater		
Band	Offset		
10 Meters	-100 kH		
6 Meters	Varies b –500 kH		
2 Meters	+ or -60		
1.25 Meters	–1.6 M⊦		
70 cm	+ or -5 l		
902 MHz	12 MHz		
1296 MHz	12 MHz		

### **Offsets by Band**

### Ηz

oy region: Hz, –1 MHz, –1.7 MHz

### 0 kHz

### Ηz

### MHz

### **Repeater Access Tones** Prevents accessing multiple repeaters at once.

 Subaudible low-frequency tone must be present before the repeater transmitter will turn on.

**Repeater Access Tones**  Tones have various names (depending on equipment manufacturer). -CTCSS (continuous tone coded squelch system) -PL (a Motorola trade name for CTCSS) -Privacy codes or tones -DCS (digital coded squelch)

**Repeater Access Tones**  Access tones are usually published along with repeater frequencies. Could also be announced when the repeater identifies. -"PL is 123.0" meaning 123.0 Hz Tones are generally programmed into the radio along with frequency and offset.

### **Repeater Control**

- Repeater identification (Morse code or synthesized voice)
  - Same ID requirements as you have
- Time-out protection
  - Protects against continuous transmission in the event of a stuck PTT or long-winded speaker
  - Usually three minutes

### **Repeater Control**

 Courtesy beep or tone signals time-out timer reset

 May have an autopatch system for phone calls

**Common Problems**  Off frequency: causes audio distortion Low batteries: weak signal, audio distortion Poor location: hear repeater OK, can't make or maintain contact

 Access tone off or wrong: repeater is strong but can't access it

- **Common Problems**  Off frequency: causes audio distortion Low batteries: weak signal, audio distortion Poor location: hear repeater OK, can't make or maintain contact
- Access tone off or wrong: repeater is strong but can't access it
- Repeater drops in and out of your receiver: squelch setting too high

**Digital Repeater Systems**  Repeaters linked by the Internet Use digital audio – Voice Over Internet Protocol (VOIP) Similar to Skype Allows communication world-wide Internet Linking Relay Project (IRLP) Echolink Access codes on system websites

## **D-STAR**

- Both a repeater linking system and a digital voice protocol
- DV: Digital Voice mode (voice + 1200 baud data)
- DD: Digital Data mode (128 kbps data)
- Repeaters linked together worldwide
- Call user-to-user based on call sign
- Currently an ICOM system
- Yaesu and Kenwood also building digital systems

# **Technician License Course Chapter 6** Lesson Plan Module – 14 Communicating with Other Hams – Part 2 Nets, Emergency Communications, Special Modes and Techniques



### Nets

- Net is short for "Network"
  - Evolved over the years to share and exchange information in an organized and efficient way
- Social nets
- Traffic nets
- Emergency and public service nets

### Traffic Nets

 Traffic refers to formal messages that are relayed via Amateur Radio Radiogram structured to ensure accuracy National Traffic System (NTS) Procedures

Accountability

# **Emergency and Public Service Nets**

 Public service nets – training for emergency nets

 Training for ham operators as well as emergency groups and managers supported by Amateur Radio Emergency nets



### Net Structure

- Net Control Station (NCS)
  - Traffic cop who controls the flow of information
- Check-in and check-out procedures Priority/Emergency access to Net Control Communications discipline vital Learn and follow procedures

### Net Structure

 Speak only when directed, and only to whom directed

Follow through with your commitments

## The Radiogram

A BER	The American Radio Relay League RADIOGRAM Via Amateur Radio						
Number	Precedence	HX	Station of Origin	Check	Place of Origin	Time Filed Date	
207	P	E.	WIFN	10	LEBANON NH	1200 EST JAN 4	
To: MARK DOE RED CROSS DISASTER OFFICE 123 MAIN ST RUTLAND VT 05701 Telephone Number: 802-555-1212							
NEEL	<u> </u>	IOR	E Co	TS	AND	SANITATION	
KITS		AT.	AL	L	FIVE	SHELTERS	
JOAN SMITH SHELTER MANAGER							
RBC'D	From	Date	Time	SENT	To D	ate Time	
A licensed Anateur Redio Operator, whose address is The American Radio Relay League, Inc. is the National shown above, hendled this message free of charge. As Membership Society of licensed radio amateurs and the							

such messages are handled solely for the pleasure of operating, a "Ken" Operator can accept no compansation. A return nessage may be filed with the "Kan" delivering this nessage to you. Further information on Ameteur Redio may be obtained from ABAL Headquarters, 225, Main Street, Newington, CT 06111.

A

publisher of OST Magazine. One of its functions is promotion of public service communication among Anatour Operators. To that ond, The Longue has organized the National Traffic System for daily nationwide nessage handling.



## **Supporting Emergency Operations**

- One of the most important reasons for the existence of Amateur Radio.
- Get involved and use what you have learned.
- Know where you fit in the overall emergency management team.



## **Emergency Communications** Organizations

Radio Amateur Civil Emergency Service (RACES).

- Supports civil emergencies
- National in scope
- Amateur Radio Emergency Service <sup>®</sup> (ARES<sup>®</sup>).
  - Local and regional in scope
  - Supports non-governmental agencies
# **Emergency Communication Tips**

- Don't become part of the problem.
- You are a communicator, not a decision or policy maker.
- Don't give out unauthorized information.
- Know your abilities and limitations keep yourself safe.
- Follow radio discipline and net procedures.
- Protect personal information Amateur Radio communications is public.

### **Emergency Declarations** FCC may declare a Temporary State of **Communications Emergency.**

- Includes details of conditions and rules to be followed.
- Specifics communicated through web sites and ARRL bulletins, the NTS, and on-the-air. Avoid operating on restricted frequencies unless engaged in relief efforts.

# Making and Answering Distress Calls

- Rule number one speak in plain language!
- Mayday (voice); SOS (Morse code)
- Identify
- Give location
- State the situation
- Describe assistance required
- Provide other important information

# ess Calls guage!

**Tactical Communications**  Tactical Identifiers Facilitate communications Location- or function-specific Transcends operator changes FCC ID rules still apply • Give your FCC call sign every 10 minutes and when changing operators

# **Emergency Equipment**

### "Go-kits"

 Portable Amateur Radio equipment Emergency power sources Personal survival supplies and equipment

# **Emergency Communications Training**

- If you are going to participate, get training.
- Actively participate in training and drill activities.
  - Nets
  - Public service activities

Attend community meetings and get involved in your community.

# **Emergency Communications Training**

- Take emergency communication courses.
  - ARRL courses
  - FEMA courses on NIMS and other topics
    - May be required for your participation

# Awards, DXing, Contests

- On-the-air activities provide incentive to get on the radio.
- Learn about propagation as you search for specific stations on various bands.
- Improve operating skills.

# Awards, DXing, Contests

- On-the-air activities provide incentive to get on the radio.
- Learn about propagation as you search for specific stations on various bands.
- Improve operating skills.
- Fun!

### Awards

• WAC Contacting all six inhabited continents • WAS Contacting 50 states • VUCC Contacting 100 grid squares on VHF/UHF

# DXing

- Contacting stations far away a tradition since the first days of radio.
- On HF, usually means contacting stations in other countries.
- On VHF/UHF, means contacting stations outside your normal coverage area.

### Contests

 ARRL Rookie Roundup North American QSO Parties (ncjweb.com) State QSO Parties VHF/UHF Contests • CQ World Wide DX Contest (a big one!) Contest Calendars

# Field Day

- Emergency communications training with a competitive spirit.
- Set up portable station and antenna (in the field, mobile, anywhere!) and make as many contacts as possible.
- Get started with your local club or group great way to get involved.

# **Special Events**

- Special Event stations are set up to commemorate some significant local event.
- Usually stations are demonstration stations set up for public display.
- Commemorative certificates are awarded for contacting the stations.

# **Radio Direction Finding**

- Useful for locating interference or noise sources.
- Works best with a directional antenna.
- "Fox hunting" competitions offer a fun opportunity to learn and practice.
- Good training for search and rescue.



**Amateur Satellites** • OSCAR • Orbiting Satellites Carrying Amateur <u>R</u>adio Modes • FM Analog (SSB and CW) Digital International Space Station



# Satellite Terms

- Uplink Earth stations transmit to satellite
- Downlink Satellite transmits to stations on Earth
- Beacon Signal from satellite with information about satellite operating conditions
- Doppler Shift Shift in frequency due to relative motion between satellite and Earth station

## **Satellite Terms** Uplink – Earth stations transmit to satellite Downlink – Satellite transmits to stations on Earth

 Beacon – Signal from satellite with information about satellite operating conditions



# Satellite Terms Doppler Shift – Shift in frequency due to relative motion between satellite and Earth station

LEO – Low Earth Orbit

# Satellite Terms

- Spin fading caused by rotation of satellite
- Pacsat packet radio satellite
- Tracking software gives beam heading and times when satellite is in view
- Mode bands satellite is using for uplink and downlink (eg Mode U/V = 70 cm uplink, 2 meters downlink)

# **Other Special Modes**

- Slow Scan TV (SSTV)
  Sending snap-shot pictures
  One frame every few seconds
  Amateur TV (ATV)
  - Similar to commercial TV imagery
  - Uses analog TV format (NTSC)





# Other Special Modes

Radio Control (RC)
Telecommand
50 MHz band





# **Practice Questions**

# What is the most common repeater frequency offset in the 2 meter band?

# What is the most common repeater frequency offset in the 2 meter band?

### Plus or minus 600 kHz

# What is the national calling frequency for FM simplex operations in the 70 cm band?

# What is the national calling frequency for FM simplex operations in the 70 cm band?

### 446.000 MHz

# What is a common repeater frequency offset in the 70 cm band?

# What is a common repeater frequency offset in the 70 cm band?

### Plus or minus 5 MHz

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

How should you respond to a station calling CQ?

# What is the meaning of the procedural signal "CQ"?

# What is the meaning of the procedural signal "CQ"?

### Calling any station

### What brief statement is often used in place of "CQ" to indicate that you are listening on a repeater?
What brief statement is often used in place of "CQ" to indicate that you are listening on a repeater?

Your call sign

## What is a guideline to use when choosing an operating frequency for calling CQ?

What is a guideline to use when choosing an operating frequency for calling CQ?

Listen first to be sure that no one else is using the frequency Ask if the frequency is in use Make sure you are in your assigned band

What is the term used to describe an amateur station that is transmitting and receiving on the same frequency?

What is the term used to describe an amateur station that is transmitting and receiving on the same frequency?

Simplex communication

What is the term used to describe the use of a sub-audible tone transmitted with normal voice audio to open the squelch of a receiver?

What is the term used to describe the use of a sub-audible tone transmitted with normal voice audio to open the squelch of a receiver?



What common problem might cause you to be able to hear but not access a repeater even when transmitting with the proper offset?

What common problem might cause you to be able to hear but not access a repeater even when transmitting with the proper offset?

The repeater receiver may require an audio tone burst for access The repeater receiver may require a CTCSS tone for access The repeater receiver may require a DCS tone sequence for access

# Which "Q" signal indicates that you are receiving interference from other stations?

## Which "Q" signal indicates that you are receiving interference from other stations?



# Which "Q" signal indicates that you are changing frequency?

# Which "Q" signal indicates that you are changing frequency?



## Under what circumstances should you consider communicating via simplex rather than a repeater?

Under what circumstances should you consider communicating via simplex rather than a repeater?

When the stations can communicate directly without using a repeater

What should be done to insure that voice message traffic containing proper names and unusual words are copied correctly by the receiving station?

What should be done to insure that voice message traffic containing proper names and unusual words are copied correctly by the receiving station?

Such words and terms should be spelled out using a standard phonetic alphabet

# What describes the common meaning of the term "repeater offset"?

## What describes the common meaning of the term "repeater offset"?

## The difference between the repeater's transmit and receive frequencies

What might be the problem if you receive a report that your audio signal through the repeater is distorted or unintelligible?

What might be the problem if you receive a report that your audio signal through the repeater is distorted or unintelligible?

Your transmitter may be slightly off frequency Your batteries may be running low You could be in a bad location

## What is a grid locator?



## What is a grid locator?

## A letter-number designator assigned to a geographic location

## How is access to an IRLP node accomplished?



## How is access to an IRLP node accomplished?

## By using DTMF signals



## How might you obtain a list of active nodes that use VoIP?

## How might you obtain a list of active nodes that use VoIP?

## From a repeater directory

# How do you select a specific IRLP node when using a portable transceiver?

## How do you select a specific IRLP node when using a portable transceiver?

## Use the keypad to transmit the IRLP node ID

## What is meant by Voice Over Internet Protocol (VoIP) as used in amateur radio?

## What is meant by Voice Over Internet Protocol (VoIP) as used in amateur radio?

## A method of delivering voice communications over the Internet using digital techniques

## What is the Internet Radio Linking Project (IRLP)?

## What is the Internet Radio Linking Project (IRLP)?

A technique to connect amateur radio systems, such as repeaters, via the Internet using a Voice Over Internet Protocol

# What is the FCC Part 97 definition of telemetry?

## What is the FCC Part 97 definition of telemetry?

## A one-way transmission of measurements at a distance from the measuring instrument

# What is the FCC Part 97 definition of telecommand?
## What is the FCC Part 97 definition of telecommand?

## A one-way transmission to initiate, modify or terminate functions of a device at a distance

## When do the FCC rules NOT apply to the operation of an amateur station?

## When do the FCC rules NOT apply to the operation of an amateur station?

### Never, FCC rules always apply

### What do RACES and ARES have in common?

### What do RACES and ARES have in common?

## Both organizations may provide communications during emergencies

### What describes the Radio Amateur Civil Emergency Service (RACES)?

What describes the Radio Amateur Civil **Emergency Service (RACES)?** A radio service using amateur frequencies for emergency management or civil defense communications A radio service using amateur stations for emergency management or civil defense communications An emergency service using amateur operators certified by a civil defense organization as being

eo

Which of the following is an accepted practice to get the immediate attention of a net control station when reporting an emergency?

Which of the following is an accepted practice to get the immediate attention of a net control station when reporting an emergency?

Begin your transmission with "Priority" or "Emergency" followed by your call sign

Which of the following is an accepted practice for an amateur operator who has checked into an emergency traffic net?

Which of the following is an accepted practice for an amateur operator who has checked into an emergency traffic net?

Remain on frequency without transmitting until asked to do so by the net control station

## What is a characteristic of good emergency traffic handling?

## What is a characteristic of good emergency traffic handling?

### Passing messages exactly as received

Are amateur station control operators ever permitted to operate outside the frequency privileges of their license class?

Are amateur station control operators ever permitted to operate outside the frequency privileges of their license class?

Yes, but only if necessary in situations involving the immediate safety of human life or protection of property

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

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

The information needed to track the message as it passes through the amateur radio traffic handling system

## What is meant by the term "check" in reference to a formal traffic message?

## What is meant by the term "check" in reference to a formal traffic message?

### The check is a count of the number of words or word equivalents in the text portion of the message

### What is the Amateur Radio Emergency Service (ARES)?

### What is the Amateur Radio Emergency Service (ARES)?

Licensed amateurs who have voluntarily registered their qualifications and equipment for communications duty in the public service

# Who may be the control operator of a station communicating through an amateur satellite or space station?

Who may be the control operator of a station communicating through an amateur satellite or space station?

Any amateur whose license privileges allow them to transmit on the satellite uplink frequency

How much transmitter power should be used on the uplink frequency of an amateur satellite or space station?

How much transmitter power should be used on the uplink frequency of an amateur satellite or space station?

The minimum amount of power needed to complete the contact

## What is provided by satellite tracking programs?

### What is provided by satellite tracking programs?

Maps showing the real-time position of the satellite track over the earth The time, azimuth, and elevation of the start, maximum altitude, and end of a pass The apparent frequency of the satellite transmission, including effects of Doppler shift

Which amateur stations may make contact with an amateur station on the International Space Station using 2 meter and 70 cm band amateur radio frequencies?

Which amateur stations may make contact with an amateur station on the International Space Station using 2 meter and 70 cm band amateur radio frequencies?

Any amateur holding a Technician or higher class license

### What is a satellite beacon?



### What is a satellite beacon?

## A transmission from a space station that contains information about a satellite

## What are the inputs to a satellite tracking program?

## What are the inputs to a satellite tracking program?

### The Keplerian elements

## With regard to satellite communications, what is Doppler shift?

### With regard to satellite communications, what is Doppler shift?

An observed change in signal frequency caused by relative motion between the satellite and the earth station

## What is meant by the statement that a satellite is operating in mode U/V?
What is meant by the statement that a satellite is operating in mode U/V?

The satellite uplink is in the 70 cm band and the downlink is in the 2 meter band

# What causes spin fading when referring to satellite signals?

# What causes spin fading when referring to satellite signals?

## Rotation of the satellite and its antennas

# What do the initials LEO tell you about an amateur satellite?

## What do the initials LEO tell you about an amateur satellite?

## The satellite is in a Low Earth Orbit

# What is a commonly used method of sending signals to and from a digital satellite?

# What is a commonly used method of sending signals to and from a digital satellite?

### **FM Packet**

# What methods are used to locate sources of noise interference or jamming?

# What methods are used to locate sources of noise interference or jamming?

## Radio direction finding

# What would be useful for a hidden transmitter hunt?

# What would be useful for a hidden transmitter hunt?

## A directional antenna

What popular operating activity involves contacting as many stations as possible during a specified period of time?

What popular operating activity involves contacting as many stations as possible during a specified period of time?

## Contesting

## What is good procedure when contacting another station in a radio contest?

What is good procedure when contacting another station in a radio contest?

Send only the minimum information needed for proper identification and the contest exchange

# What is the maximum power allowed when transmitting telecommand signals to radio controlled models?

# What is the maximum power allowed when transmitting telecommand signals to radio controlled models?



What is required in place of on-air station identification when sending signals to a radio control model using amateur frequencies?

What is required in place of on-air station identification when sending signals to a radio control model using amateur frequencies?

A label indicating the licensee's name, call sign and address must be affixed to the transmitter

# What type of transmission is indicated by the term NTSC?

## What type of transmission is indicated by the term NTSC?

## An analog fast scan color TV signal

## End of Modules 13 & 14