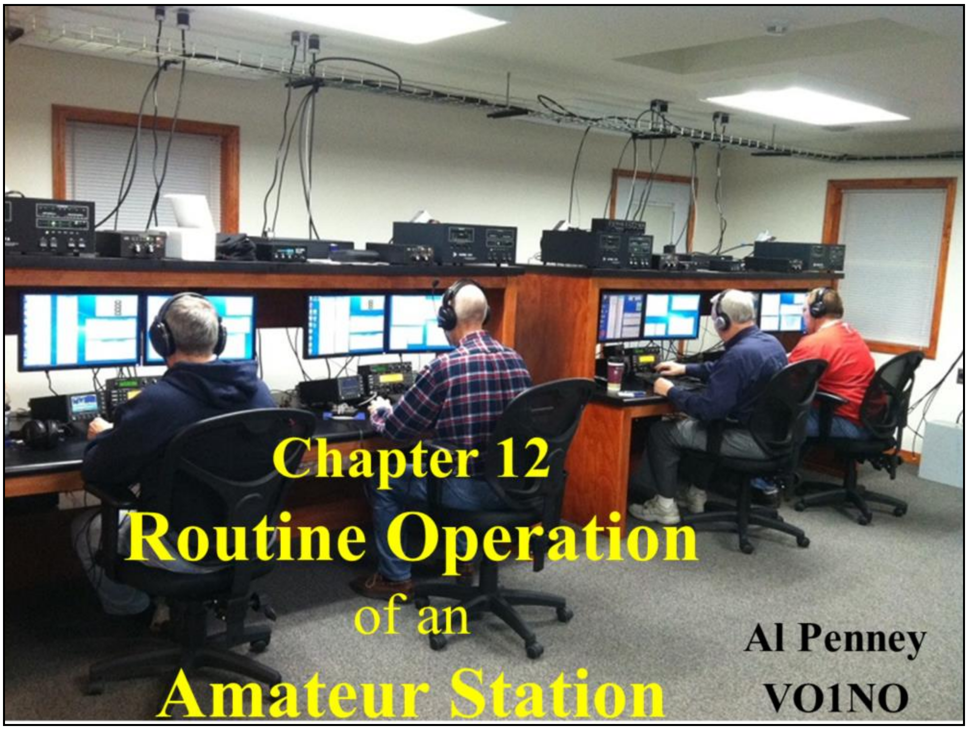
Chapter 12
Routine Operation
of an
Amateur Station
Al Penney
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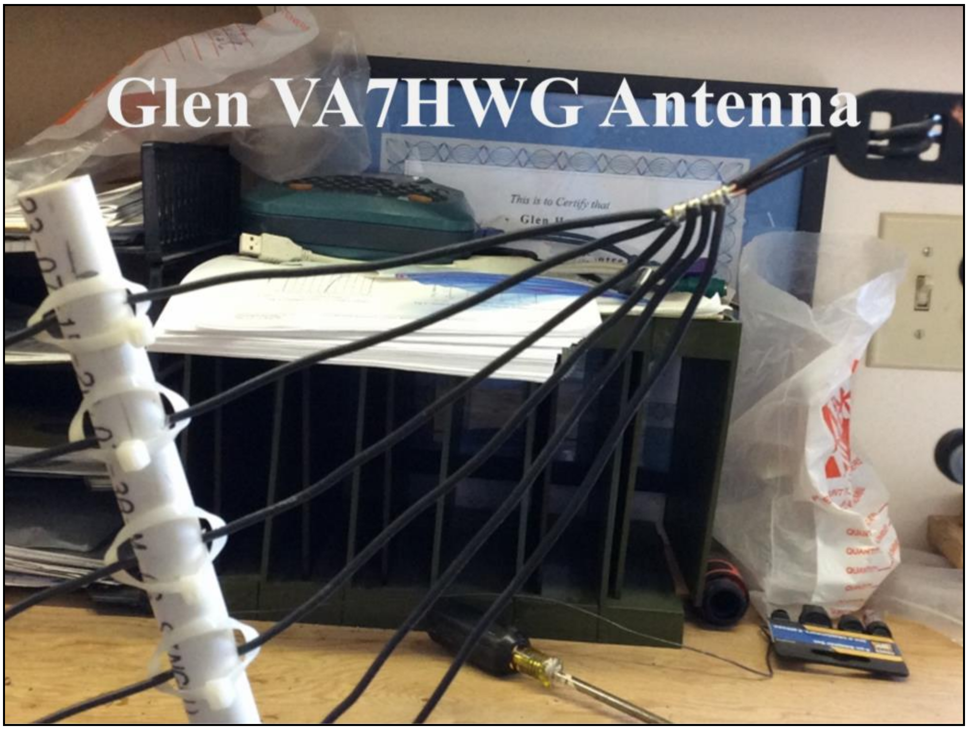


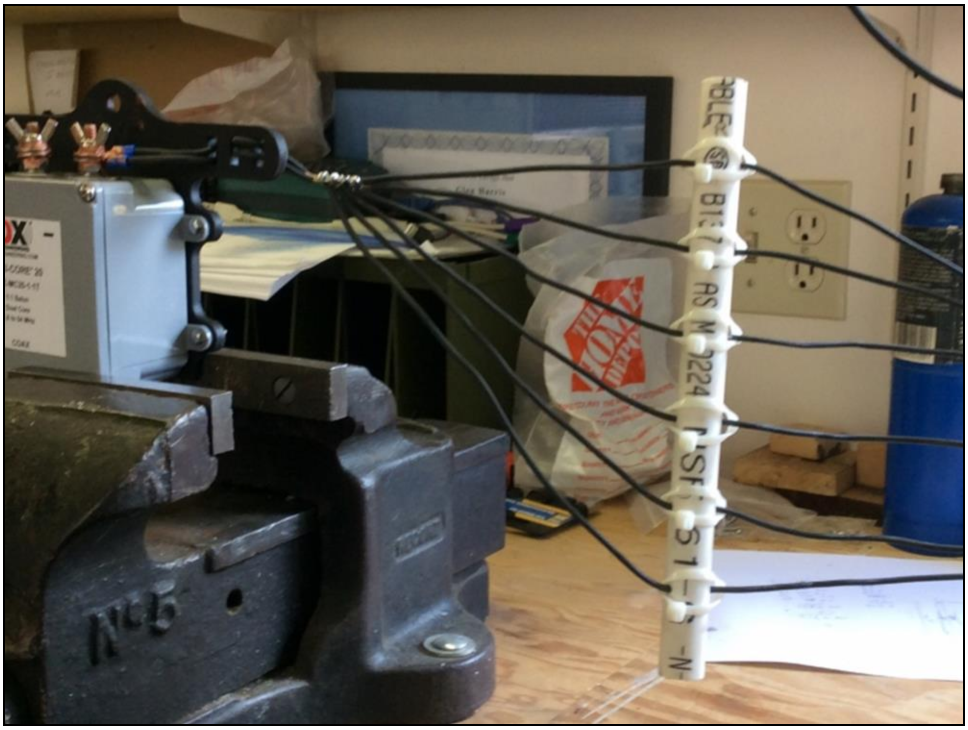
I finally got the multiband inverted V antenna up. I just have to tune it using my Nano VNA analyzer. This should give me 80m, 40m, 20m, 17m, 15m, and 10m.

The Balun is 9.45m above the ground, and the ends are 2.74m above the ground. Total length of the antenna is 36.88m.

73

Glen

VA7HWG



Objective

- To become familiar with:
  - Basic operating procedures for various modes;
  - QSL Cards and QSL'ing;
  - Logging;
  - UTC Time;
  - Nets; and
  - Distress Communications.

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Q Codes

- Standardized **3-letter codes** starting with “Q”.
- Used by commercial, military, aviation and Amateur Radio operators.
- Primarily for **CW**, but often used on voice.
- If used with a question mark code is a question.
- If no question mark it is a reply or request.

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The **Q-code** is a standardized collection of three-letter codes all of which start with the letter "Q". It is an operating signal initially developed for commercial radiotelegraph communication and later adopted by other radio services, especially amateur radio. To distinguish the use of a Q-code transmitted as a question from the same Q-code transmitted as a statement, operators either prefixed it with the military network question marker "INT" (dit dit dah dit dah) or suffixed it with the standard Morse question mark UD (dit dit dah dah dit dit).

Although Q-codes were created when radio used Morse code exclusively, they continued to be employed after the introduction of voice transmissions. To avoid confusion, transmitter call signs are restricted; no country is ever issued an ITU prefix starting with "Q".

Codes in the range QAA–QNZ are reserved for aeronautical use; QOA–QQZ for maritime use and QRA–QUZ for all services.

Used in their formal question / answer sense, the meaning of a Q-code varies depending on whether the individual Q-code is sent as a question or an answer. For example, the message "QRP?" means "Shall I decrease transmitter power?", and a reply of "QRP" means "Yes, decrease your transmitter power", whereas an unprompted statement

"QRP" means "Please decrease your transmitter power". This structured use of Q-codes is fairly rare and now mainly limited to amateur radio and military Morse code (CW) traffic networks.

The original Q-codes were created, *circa* 1909, by the British government as a "list of abbreviations ... prepared for the use of British ships and coast stations licensed by the Postmaster General". The Q-codes facilitated communication between maritime radio operators speaking different languages, so they were soon adopted internationally. A total of forty-five Q-codes appeared in the "List of Abbreviations to be used in Radio Communications", which was included in the Service Regulations affixed to the Third International Radiotelegraph Convention in London (The Convention was signed on July 5, 1912, and became effective July 1, 1913.)

Q-Codes – (Card 1 of 3)

QNI	Call for net stations to report in.
QNU	The net has traffic for you.
QRA	My call sign is _____. /What is your call sign?
QRG	Your exact frequency (or that of _____) is _____kHz (or MHz.) /What is my exact frequency (or that of ____)?
QRH	Your frequency is varying. /Does my frequency vary?
QRK	Your readability of your signals is (1-5.) /What is my readability?
QRL	I am busy (or I am busy with_____.) /Is this frequency busy?
QRM	Your transmission is being interfered with ______ (on a scale of 1-5.) /Is my transmission being interfered with ____?
QRN	I am bothered by static (on a scale of 1-5.) /Are you bothered by static?
QRO	Increase power. /Should I increase power?
QRP	Decrease power. /Should I decrease power?
QRQ	Send faster (_______wpm). /Should I send faster?

Q-Codes – (Card 2 of 3)

QRS	Send slower (_______wpm). /Should I send slower?
QRT	Stop sending. /Should I stop sending?
QRU	I have nothing for you. /Do you have anything for me?
QRV	I am ready. /Are you ready?
QRX	I will call you again at _____ hours (on ______ kHz or MHz.) /When will you call me again? (Minutes are usually implied.)
QRZ	You are being called by _______ (on _______ kHz or MHz.) /Who is calling me?
QSA	The strength of your signals is (1-5.) /How is the strength of my signals?
QSB	Your signals are fading. /Are my signals fading?
QSD	Your keying is defective. /Is my keying defective?
QSK	I can hear you between signals. You may break in on my transmission. /Can you hear me between signals, and if so, may I break in on your transmission?

Q-Codes – (Card 3 of 3)

QSL	I am acknowledging receipt (of a message or transmission.) /Can you acknowledge receipt?
QSN	I heard you (or ______) on _____kHz (or MHz.) /Did you hear me (or ______) on _____kHz (or MHz?)
QSO	I can communicate with _____ direct (or relay through_____.) /Can you communicate directly with (or relay through_____?)
QSP	I will relay to ______. /Will you relay to _____?
QST	General call addressing all amateur stations.
QSX	I am listening to ____ on ____ kHz (or MHz.) /Will you listen to ____ on ____ kHz (or MHz?)
QSY	Change transmission to another frequency (or to ____ kHz or MHz.) /Shall I change transmission to another frequency?
QTC	I have traffic for you (or for____). /What traffic do you have?)
QTH	My location is_____. /What is your location?
QTR	The exact time is ______. /What is the exact time?

Phonetic Alphabet

Letter	Word	Pronunciation	Letter	Word	Pronunciation
A	ALFA	AL-FAH	N	NOVEMBER	NO-VEM-BER
B	BRAVO	BRAH-VOH	O	OSCAR	OSS-CAHR
C	CHARLIE	CHAR-LEE	P	PAPA	PAH-PAH
D	DELTA	DELL-TAH	Q	QUEBEC	KEH-BECK
E	ECHO	ECK-OH	R	ROMEO	ROW-ME-OH
F	FOXTROT	FOKS-TROT	S	SIERRA	SEE-AIR-RAH
G	GOLF	GOLF	T	TANGO	TANG-GO
H	HOTEL	HOH-TELL	U	UNIFORM	YOU-NEE-FORM
I	INDIA	IN-DEE-AH	V	VICTOR	VIK-TAHR
J	JULIETT	JEW-LEE-ETT	W	WHISKEY	WISS-KEY
K	KILO	KEY-LOH	X	X-RAY	ECKS-RAY
L	LIMA	LEE-MAH	Y	YANKEE	YANG-KEY
M	MIKE	MIKE	Z	ZULU	ZOO-LOO

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The **International Radiotelephony Spelling Alphabet**, commonly known as the **NATO phonetic alphabet** or the **ICAO phonetic alphabet**, is the most widely used radiotelephone spelling alphabet. The **ITU phonetic alphabet and figure code** is a variant.

To create the alphabet, the International Civil Aviation Organization (ICAO) assigned codewords acrophonically to the letters of the English alphabet, so that letters and numbers would have distinct names that would be most easily understood by those who exchange voice messages by radio or telephone, regardless of language differences or the quality of the communication channel. Such spelling alphabets are often called "phonetic alphabets“.

International adoption

After the phonetic alphabet was developed by the International Civil Aviation Organization (ICAO) (see history below) it was adopted by many other international and national organizations, including the International Telecommunication Union (ITU), the International Maritime Organization (IMO), the United States Federal Government (as Federal Standard 1037C: Glossary of Telecommunications

Terms, and its successor ANSI T1.523-2001, ATIS Telecom Glossary, both of which cite Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms, but modifying the spelling of alfa and juliett) and the Federal Aviation Administration (FAA), and the International Amateur Radio Union (IARU), the American Radio Relay League (ARRL), the Association of Public-Safety Communications Officials-International (APCO); and by many military organizations such as the North Atlantic Treaty Organization (NATO) and the now-defunct Southeast Asia Treaty Organization (SEATO).

A spelling alphabet is used to spell parts of a message containing letters and numbers to avoid confusion, because many letters sound similar, for instance "n" and "m" or "f" and "s"; the potential for confusion increases if static or other interference is present. For instance the message "proceed to map grid DH98" could be transmitted as "proceed to map grid Delta-Hotel-Niner-Ait". Using "Delta" instead of "D" avoids confusion between "DH98" and "BH98" or "TH98". The unusual pronunciation of certain numbers was designed to reduce confusion as well.

In addition to the traditional military usage, civilian industry uses the alphabet to avoid similar problems in the transmission of messages by telephone systems. For example, it is often used in the retail industry where customer or site details are spoken by telephone (to authorize a credit agreement or confirm stock codes), although ad-hoc coding is often used in that instance. It has been used often by information technology workers to communicate serial or reference codes (which are often very long) or other specialised information by voice. Most major airlines use the alphabet to communicate passenger name records (PNRs) internally, and in some cases, with customers. It is often used in a medical context as well, to avoid confusion when transmitting information.

Several letter codes and abbreviations using the spelling alphabet have become well-known, such as Bravo Zulu (letter code BZ) for "well done", Checkpoint Charlie (Checkpoint C) in Berlin, and Zulu Time for Greenwich Mean Time or Coordinated Universal Time. During the Vietnam War, the U.S. government referred to the Viet Cong guerrillas and the group itself as VC, or Victor Charlie; the name "Charlie" became synonymous with this force.

History

Prior to World War I and the development and widespread adoption of two-way radio that supported voice, telephone spelling alphabets were developed to improve communication on low-quality and long-distance telephone circuits.

The first non-military internationally recognized spelling alphabet was adopted by the CCIR (predecessor of the ITU) during 1927. The experience gained with that alphabet resulted in several changes being made during 1932 by the ITU. The resulting alphabet was adopted by the International Commission for Air Navigation, the predecessor of the ICAO, and was used for civil aviation until World War II.[16] It continued to be used by the IMO until 1965.

Throughout World War II, many nations used their own versions of a spelling alphabet. The U.S. adopted the Joint Army/Navy radiotelephony alphabet during 1941 to standardize systems among all branches of its armed forces. The U.S. alphabet became known as *Able Baker* after the words for A and B. The Royal Air Force adopted one similar to the United States one during World War II as well. Other British forces adopted the RAF radio alphabet, which is similar to the phonetic alphabet used by the Royal Navy during World War I. At least two of the terms are sometimes still used by UK civilians to spell words over the phone, namely *F for Freddie* and *S for Sugar*.

To enable the U.S., UK, and Australian armed forces to communicate during joint operations, in 1943 the CCB (Combined Communications Board; the combination of US and UK upper military commands) modified the U.S. military's Joint Army/Navy alphabet for use by all three nations, with the result being called the US-UK spelling alphabet. It was defined in one or more of CCBP-1: *Combined Amphibious Communications Instructions*, CCBP3: *Combined Radiotelephone (R/T) Procedure*, and CCBP-7: *Combined Communication Instructions.* The CCB alphabet itself was based on the U.S. Joint Army/Navy spelling alphabet. The CCBP (Combined Communications Board Publications) documents contain material formerly published in U.S. Army Field Manuals in the 24-series. Several of these documents had revisions, and were renamed. For instance, CCBP3-2 was the second edition of CCBP3.

During World War II, the U.S. military conducted significant research into spelling alphabets. Major F. D. Handy, directorate of Communications in the Army Air Force (and a member of the working committee of the Combined Communications Board), enlisted the help of Harvard University's Psycho-Acoustic Laboratory, asking them to determine the most successful word for each letter when using "military interphones in the intense noise encountered in modern warfare.". He included lists from the US, Royal Air

Force, Royal Navy, British Army, AT&T, Western Union, RCA Communications, and that of the International Telecommunications Convention. According to a report on the subject:

The results showed that many of the words in the military lists had a low level of intelligibility, but that most of the deficiencies could be remedied by the judicious selection of words from the commercial codes and those tested by the laboratory. In a few instances where none of the 250 words could be regarded as especially satisfactory, it was believed possible to discover suitable replacements. Other words were tested and the most intelligible ones were compared with the more desirable lists. A final NDRC list was assembled and recommended to the CCB.[30]

After World War II, with many aircraft and ground personnel from the allied armed forces, "Able Baker" was officially adopted for use in international aviation. During the 1946 Second Session of the ICAO Communications Division, the organization adopted the so-called "Able Baker" alphabet[8] that was the 1943 US–UK spelling alphabet. But many sounds were unique to English, so an alternative "Ana Brazil" alphabet was used in Latin America. But the International Air Transport Association (IATA), recognizing the need for a single universal alphabet, presented a draft alphabet to the ICAO during 1947 that had sounds common to English, French, Spanish and Portuguese.

From 1948 to 1949, Jean-Paul Vinay, a professor of linguistics at the Université de Montréal worked closely with the ICAO to research and develop a new spelling alphabet.[31][8] ICAO's directions to him were that "To be considered, a word must:

1. Be a live word in each of the three working languages.
2. Be easily pronounced and recognized by airmen of all languages.
3. Have good radio transmission and readability characteristics.
4. Have a similar spelling in at least English, French, and Spanish, and the initial letter must be the letter the word identifies.
5. Be free from any association with objectionable meanings."[30]

After further study and modification by each approving body, the revised alphabet was adopted on 1 November 1951, to become effective on 1 April 1952 for civil aviation (but it may not have been adopted by any military).[16]

Problems were soon found with this list. Some users believed that they were so severe that they reverted to the old "Able Baker" alphabet. Confusion among words like *Delta* and *Extra*, and between *Nectar* and *Victor*, or the unintelligibility of other words during poor receiving conditions were the main problems. Later in 1952, ICAO decided to revisit the alphabet and their research. To identify the deficiencies of the new alphabet, testing was conducted among speakers from 31 nations, principally by the governments of the United Kingdom and the United States. In the United States, the research was conducted by the USAF-directed Operational Applications Laboratory (AFCRC, ARDC), to monitor a project with the Research Foundation of The Ohio State University. Among the more interesting of the research findings was that "higher noise levels do not create confusion, but do intensify those confusions already inherent between the words in question".[30]

By early 1956 the ICAO was nearly complete with this research, and published the new official phonetic alphabet in order to account for discrepancies that might arise in communications as a result of multiple alphabet naming systems coexisting in different places and organizations. NATO was in the process of adopting the ICAO spelling alphabet, and apparently felt enough urgency that it adopted the proposed new alphabet with changes based on NATO's own research, to become effective on 1 January 1956,[32] but quickly issued a new directive on 1 March 1956[33] adopting the now official ICAO spelling alphabet, which had changed by one word (November) from NATO's earlier request to ICAO to modify a few words based on U.S. Air Force research.

After all of the above study, only the five words representing the letters C, M, N, U, and X were replaced. The ICAO sent a recording of the new *Radiotelephony Spelling Alphabet* to all member states in November 1955.[8] The final version given in the table above was implemented by the ICAO on 1 March 1956,[16] and the ITU adopted it no later than 1959 when they mandated its usage via their official publication, *Radio Regulations*.[34] Because the ITU governs all international radio communications, it was also adopted by most radio operators, whether military, civilian, or amateur. It was finally adopted by the IMO in 1965. During 1947 the ITU adopted the compound number words (*Nadazero*, *Unaone*, etc.), later adopted by the IMO during 1965.[*citation needed*]

In the official version of the alphabet,[1] the non-English spellings Alfa and Juliett are used. *Alfa* is spelled with an *f* as it is in most European languages because the English and French spelling *alpha* would not be pronounced properly by native speakers of some other languages – who may not know that *ph* should be pronounced as *f*. *Juliett* is spelled with a *tt* for French speakers, because they may otherwise treat a single final *t* as silent. Some published versions incorrectly list "alpha" and "juliet" – presumably because of the use of spell checker software – but those spellings are never correct and should be changed back to "alfa" and "juliett" wherever such mistakes are found

Difficult Words

- Difficult words may be spelled using the phonetic alphabet and preceded by the proword **I SPELL**.
- If the operator can pronounce the word to be spelled, he/she will do so before and after the spelling to identify the word.
- ***Example:*** TRIVIA - I SPELL TANGO ROMEO INDIA VICTOR INDIA ALFA - TRIVIA

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Numbers

To distinguish numerals from similarly pronounced words, the proword **FIGURES** may be used preceding numbers.

NUMERAL	SPOKEN AS	NUMERAL	SPOKEN AS
0	ZE-RO	5	FIFE
1	WUN	6	SIX
2	TOO	7	SEV-EN
3	THU-REE	8	AIT
4	FOW-ER	9	NIN-ER

Note: When conditions are good there is no objection to pronouncing numerals in the regular way i.e., THREE, FIVE, NINE etc.

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Numbers

When conditions are poor, numbers can be transmitted digit by digit except that exact multiples of thousands may be spoken as such.

Example:

Numeral	**Spoken As**
44	FOW-ER FOW-ER
90	NIN-ER ZE-RO
7000	SEV-EN THOUSAND
5318	FIFE THU-REE WUN AIT

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Expressing Time

24 Hour Time	12 Hour Time	24 Hour Time	12 Hour Time
0000	Midnight	1200	Noon
0100	1 AM	1300	1 PM
0200	2 AM	1400	2 PM
0300	3 AM	1500	3 PM
0400	4 AM	1600	4 PM
0500	5 AM	1700	5 PM
0600	6 AM	1800	6 PM
0700	7 AM	1900	7 PM
0800	8 AM	2000	8 PM
0900	9 AM	2100	9 PM
1000	10 AM	2200	10 PM
1100	11 AM	2300	11PM

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When necessary to express the time, the 24-hour clock system shall be used.
NOTE: There is no "twenty-four hundred" since the twenty-fourth hour is identical to the zero hour of the next, therefore time designator 2400 **is not used.**

All operators are responsible for keeping the correct time. Correct time may be confirmed by tuning to the time signals broadcast by CHU and WWV. CHU transmits time signals on 3.330, 7.850 and 14,670 MHz from just south of the Ottawa Airport. WWV transmits on 5, 10, 15, 20 and 25 MHz from Bolder, Colorado. Note that conversion to local time is necessary.

Antenna Polarization

- VHF/UHF FM – Vertical
- VHF/UHF Weak Signal – Horizontal
- High Frequency – Either, as the polarization changes randomly traveling through the ionosphere.
- Satellite – Best results obtained using Circular polarization, either Right Hand or Left Hand (RHCP or LHCP).

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VHF/UHF FM
Vertical Polarization

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VHF/UHF Weak Signal Horizontal Polarization

High Frequency
Either Polarization


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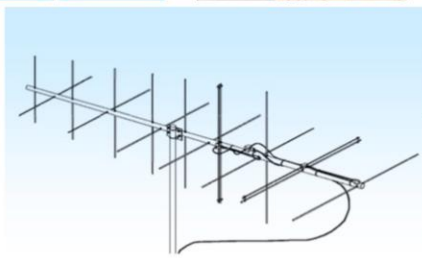
Satellite
Circular Polarization



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Channelized FM VHF/UHF

- Very popular for **local communications**:
  - Local liaison, nets, emergency communications;
  - **Frees up HF** for DX, prevents interference; and
  - Radios and antennas **small and portable**.
  - **Good Signal + Noise to Noise Ratio.**
- Usually **channelized**, not VFOs as is common on HF (Variable Frequency Oscillator).
- Once on correct channel, **no tuning required**.
- **Capture Effect** allows only strongest signal.

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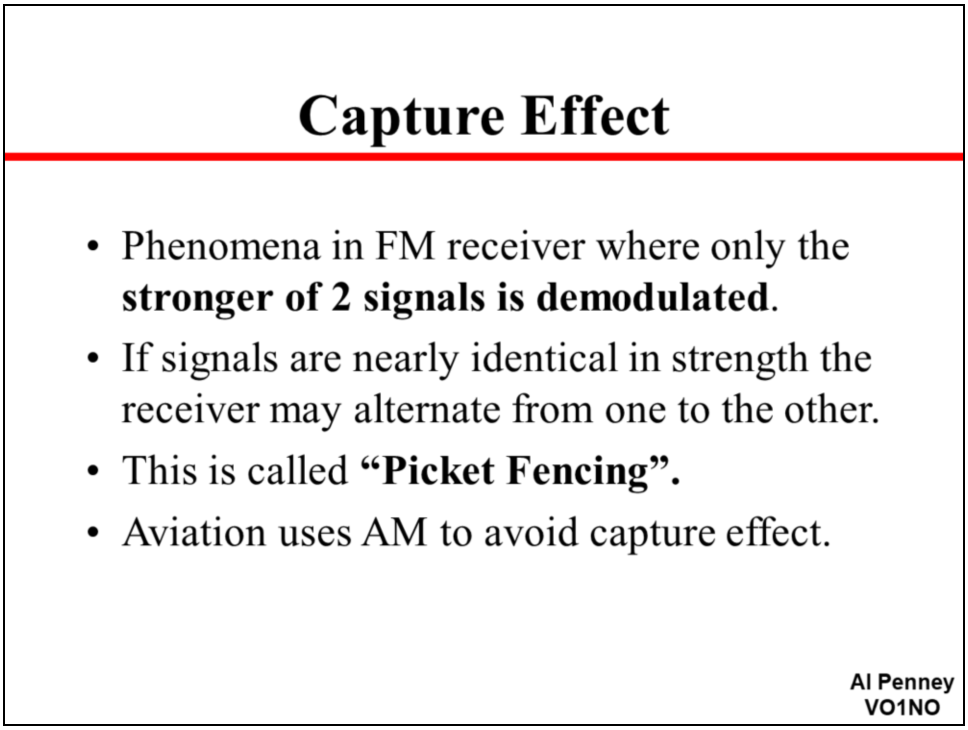
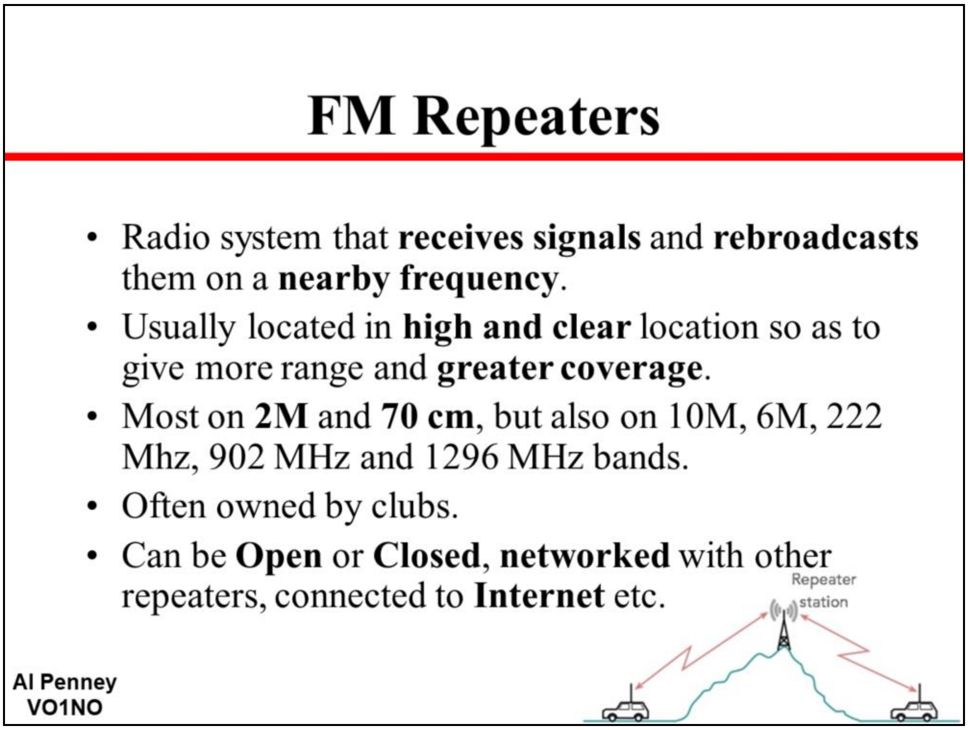


In a radio receiver, the **capture effect**, or **FM capture effect**, is a phenomenon associated with FM reception in which only the stronger of two signals at, or near, the same frequency or channel will be demodulated.

The capture effect is defined as the complete suppression of the weaker signal at the receiver's limiter (if present) where the weaker signal is not amplified, but attenuated. When both signals are nearly equal in strength, or are fading independently, the receiver may switch from one to the other and exhibit picket fencing.

The capture effect can occur at the signal limiter, or in the demodulation stage, for circuits that do not require a signal limiter. Some types of radio receiver circuits have a stronger capture effect than others. The measurement of how well a receiver can reject a second signal on the same frequency is called the capture ratio for a specific receiver. It is measured as the lowest ratio of the power of two signals that will result in the suppression of the smaller signal.

Amplitude modulation, or AM radio, transmission is not subject to this effect. This is one reason that the aviation industry, and others, have chosen to use AM for communications rather than FM, allowing multiple signals transmitted on the same channel to be heard



An **amateur radio repeater** is an electronic device that receives a weak or low-level amateur radio signal and retransmits it at a higher level or higher power, so that the signal can cover longer distances without degradation. Many repeaters are located on hilltops or on tall buildings as the higher location increases their coverage area, sometimes referred to as the radio horizon, or "footprint". Amateur radio repeaters are similar in concept to those used by public safety entities (police, fire department, etc.), businesses, government, military, and more. Amateur radio repeaters may even use commercially packaged repeater systems that have been adjusted to operate within amateur radio frequency bands, but more often amateur repeaters are assembled from receivers, transmitters, controllers, power supplies, antennas, and other components, from various sources.

Country	Number of Repeaters by Band						
	6M	2M	1.25M	70cm	33cm	23cm	Total
North America							
Canada	49	1287	66	812	26	28	2268
Mexico	1	137	3	71	0	0	212
United States	601	8466	1409	10368	586	355	21785
South America							
Argentina	4	283	8	83	0	4	382
Bolivia	0	1	0	0	0	0	1
Brazil	2	565	21	143	0	0	731
Chile	0	125	0	12	0	0	137
Colombia	0	25	0	4	0	0	29
Ecuador	0	38	0	0	0	0	38
Panama	0	22	2	13	0	0	37
Paraguay	0	7	0	3	0	0	10
Peru	0	5	0	1	0	0	6
Uruguay	1	14	0	6	0	0	21
Venezuela	0	8	0	2	0	0	10
Central America and Caribbean							
Anguilla	0	0	0	0	0	0	0
Antigua and Barbuda	0	0	0	0	0	0	0
Bahamas	0	2	0	0	0	0	2
Barbados	0	1	0	0	0	0	1
Belize	0	0	0	6	0	0	6
Bermuda	0	1	0	1	0	0	2
Costa Rica	0	12	1	3	0	0	16
Caribbean Netherlands	0	1	0	1	0	0	2
Cayman Islands	0	2	0	0	0	0	2
Cuba	0	65	0	0	0	0	65
Dominican Rep.	0	76	1	29	0	0	106
El Salvador	0	9	0	1	0	0	10
Grenada	0	2	0	0	0	0	2
Guatemala	0	3	0	1	0	0	4
Haiti	0	5	0	1	0	0	6
Honduras	0	11	0	2	0	0	13
Jamaica	0	5	0	1	0	0	6
Nicaragua	0	3	0	0	0	0	3
Saint Kitts Nevis	0	1	0	0	0	0	1
Saint Vincent, Grenadines	0	2	0	0	0	0	2
Trinidad and Tobago	0	2	0	0	0	0	2
Overall Repeater Numbers IARU Region 2	**6M**	**2M**	**1.25M**	**70cm**	**33cm**	**23cm**	**Total**
	658	11186	1511	11564	612	387	25918

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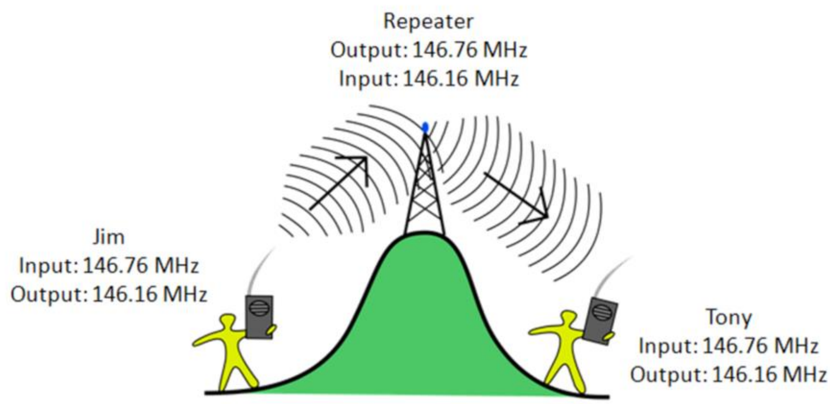
As of
1 Oct 2022

FM Repeater Operation



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Introduction

In amateur radio, repeaters are typically maintained by individual hobbyists or local groups of amateur radio operators. Many repeaters are provided openly to other amateur radio operators and typically not used as a remote base station by a single user or group. In some areas multiple repeaters are linked together to form a wide-coverage network

Frequencies

Repeaters are found mainly in the VHF 6 meter (50–54 MHz), 2 meter (144–148 MHz), 1.25-meter band (1¼ meters) (220–225 MHz) and the UHF 70 centimeter (420–450 MHz) bands, but can be used on almost any frequency pair above 28 MHz. In some areas, 33 centimeters (902–928 MHz) and 23 centimeters (1.24–1.3 GHz) are also used for repeaters. Note that different countries have different rules; for example, in the United States, the two meter band is 144–148 MHz, while in the United Kingdom (and most of Europe) it is 144–146 MHz.

Repeater frequency sets are known as "repeater pairs", and in the ham radio community most follow *ad hoc* standards for the difference between the two frequencies, commonly called the *offset*. In the USA and Canada two-meter band, the standard offset is 600 kHz (0.6 MHz), but sometimes unusual offsets, referred to as *oddball splits*, are used. The actual frequency pair used is assigned by a local frequency coordinating council.

In the days of crystal-controlled radios, these pairs were identified by the last portion of the transmit *(Input)* frequency followed by the last portion of the receive *(Output)* frequency that the ham would put into the radio. Thus "three-four nine-four" (34/94) meant that hams would transmit on 146.34 MHz and listen on 146.94 MHz (while the repeater would do the opposite, listening on 146.34 and transmitting on 146.94). In areas with many repeaters, "reverse splits" were common (i.e., 94/34), to prevent interference between systems.

Since the late 1970s, the use of synthesized, microprocessor-controlled radios, and widespread adoption of standard frequency splits have changed the way repeater pairs are described. In 1980, a ham might have been told that a repeater was on "22/82"—today they will most often be told "682 down". The 6 refers to the last digit of 146 MHz, so that the display will read "146.82" (the output frequency), and the radio is set to transmit "down" 600 kHz on 146.22 MHz. Another way of describing a repeater frequency pair is to give the repeater's output frequency, along with the direction of offset ("+" or "plus" for an input frequency above the output frequency, "−" or "minus" for a lower frequency) with the assumption that the repeater uses the standard offset for the band in question. For instance, a 2-meter repeater might be described as "147.34 with a plus offset", meaning that the repeater transmits on 147.34 MHz and receives on 147.94 MHz, 600 kHz above the output frequency.

Operating terms

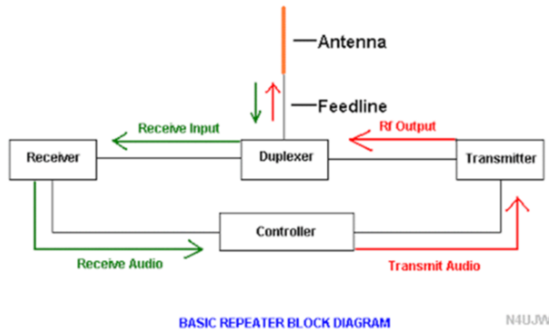
•**Timing Out** is the situation where a person talks too long and the repeater timer shuts off the repeater transmitter.

•**Kerchunking** is transmitting a momentary signal to check a repeater without identifying. In many countries, such an act violates amateur radio regulations. The term "Kerchunk" can also apply to the sound a large FM transmitter makes when the operator switches it off and on.

•**Lid** refers to a poor operator (radio methods) usually from improper training from other Amateurs or exposure to different types of operation such as CB radio.

FM Repeater

Repeater cabinet



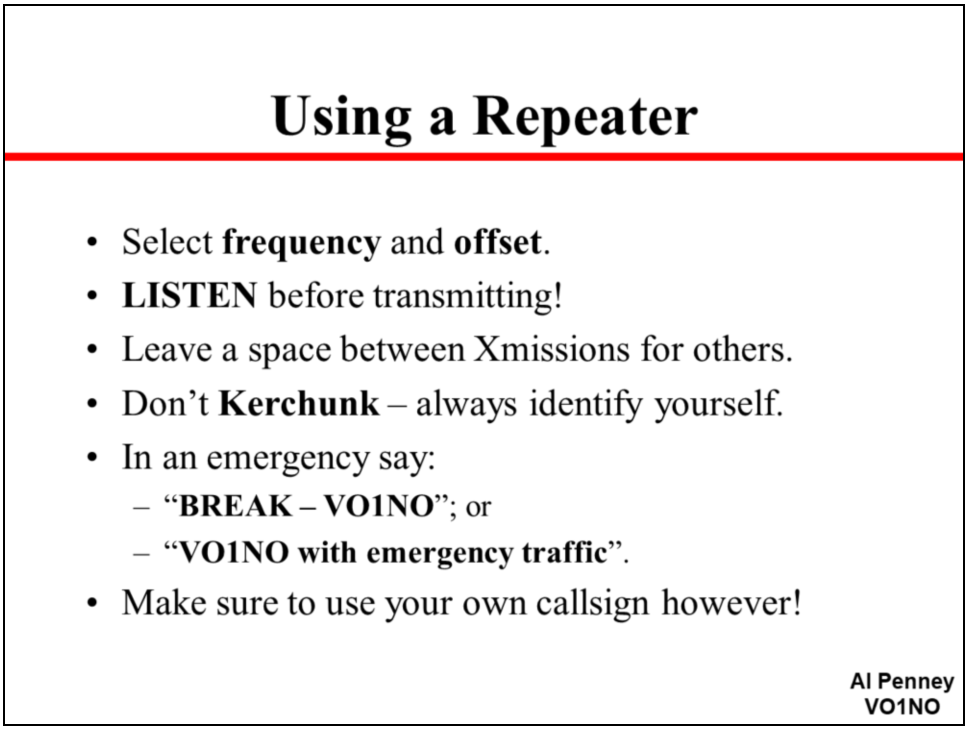
Duplexer

Al Penney
VO1NO

The most basic repeater consists of an FM receiver on one frequency and an FM transmitter on another frequency usually in the same radio band, connected together so that when the receiver picks up a signal, the transmitter is keyed and rebroadcasts whatever is heard.

In order to run the repeater a repeater controller is necessary. A repeater controller can be a hardware solution or even be implemented in software.

Repeaters typically have a timer to cut off retransmission of a signal that goes too long. Repeaters operated by groups with an emphasis on emergency communications often limit each transmission to 30 seconds, while others may allow three minutes or even longer. The timer restarts after a short pause following each transmission, and many systems feature a beep or chirp tone to signal that the timeout timer has reset.



YOUR FIRST CONVERSATION AND CONTACT ON A REPEATER! That most exciting day just arrived! You now have passed your exam and have been issued your first call sign by ISED.

You have your station all set up and you are ready for your first contact on a repeater! You chose a local repeater frequency and dial it up on your rig. You just keyed your mic, gave out your call sign and now you hear........your call sign and someone coming back to you with his call sign.....he un keys and the repeater is waiting for YOU!
BRAIN LOCK SETS IN! "What do I do? What do I talk about? Will I remember all those rules, regulations, theory and all that other stuff I had to study?

The simple answer is.......probably not......but don't worry!

First thing....try to write his call sign down and if he gives his name, that too. Lots of good operators recognize a new ham instantly on the air and they will guide you with patience, understanding, maybe some fun prodding and picking at you to get you to relax and have fun with your new license.

He will WELCOME you!
A good operator will never make you feel unwanted on the air. He may ask you to repeat your call sign just to make certain he understood who he is talking to and if you forget to give your name, he will ask for it. Most hams don't like to talk to a "call sign", so getting names and also locations helps to start the conversation.
If you make mistakes....he will most likely let you know what you did wrong and inform you as to the correct way in a friendly manor.

Don't be surprised if he asks you all the questions instead of the other way around. He is just trying to get you to feel relaxed on the air. As your experience grows in ham radio, aways try to remember your first contact and how excited and nervous you were. Now it's your turn and you are the one responding to a new ham and his first contact! Make him feel at home and.......be a good operator.....like your first contact was! Repeater ID.....you and it!
You must transmit your call sign at the beginning and end of a contact and at least every 30 minutes during the course of any communication. You do not have to transmit the call sign of the station to whom you are transmitting, but you can. Never transmit without identifying. For example, keying your microphone to turn on the repeater without saying your station call sign is called Kerchunking and is technically illegal. If you do not want to engage in conversation, but simply want to check if you are able to access a particular repeater, simply say "(your call sign...... testing)."

Using a Repeater

- To **call** a specific person:
  - VE1MR this is VO1NO
- He will respond:
  - VO1NO, VE1MR
- To join an existing conversation **give your callsign** during a pause.
- To look for anyone to talk to say **"VO1NO listening on 147.180"** or give the repeater name.

Al Penney
VO1NO

How do you make a call on an Amateur Repeater?

First, LISTEN AND LISTEN SOME MORE...... to make sure that the repeater is not already in use. When you are satisfied that the repeater is not in use, set your transmitter power to the minimum and increase only as needed to make contact with the repeater, begin with the callsign of the station you are trying to contact followed by your callsign. e.g. " N4??? this is N3???". (The N3??? is your callsign). If you don't establish contact with the station you are looking for, wait a minute or two and repeat your call.
If you are just announcing your presence on the repeater it is helpful to others that may be listening if you identify the repeater you are using AND your callsign. e.g. " This is N3??? listening on the 84 machine or you could also say This is N3??? listening on 146.84 Dallas or the location of the repeater if known. This allows people that are listening on radios that scan several repeaters to identify which repeater you are using.
If the repeater you are using is a busy repeater you may consider moving to a simplex frequency (transmit and receive on the same frequency..... see more below), once you have made contact with the station you were calling. Repeaters are designed to enhance communications between stations that normally wouldn't be able to communicate because of terrain or power limitations.

If you can maintain your conversation without using the repeater, going "simplex" (both stations on same frequency in a different part of the band) will leave the repeater free for other stations to use that can't establish simplex communications!

Suggestions for Repeaters

- Be polite – don’t interrupt or cut others off.
- Don’t discuss controversial subjects.
- Don’t forget identification requirements.
- Be discrete - not too much personal information.
- Watch your language! Don’t monopolize!
- Use simplex if possible. Check repeater input freq.
- Avoid stupid terminology! Do NOT say “destinated”, “We” if alone, 10 Codes, Q-codes, “Hi hi” instead of laughing, repeating everything 2 or 3 times, or “73s”.
- Support a local club – repeaters are not cheap!

Al Penney VO1NO

One last thought....SUPPORT YOUR LOCAL REPEATER/S.
It takes LOTS of money to maintain a repeater and the money has to come from somewhere. If you can't donate funds, then donate your time, assistance, equipment, knowledge, labor or anything of value to the repeater owner to help keep it on the air. It will be appreciated! Even simple things like mowing the grass around the repeater area is certainly appreciated. If the repeater is on a mountain top, enjoy the view while you are there. All repeaters need some kind of care from time so volunteer your time when others don't.

1.) Even 'mild' obscenities are not good operating practice. This includes suggestive phrases, and suggestive phonetics.

2.) **Do not monopolize the repeater.** If 90 % of the conversations for long periods of time, night after night, include you and one or two others, something is wrong. If other hams turn off their radios for big blocks of time because they can hardly talk to someone other than you, something is wrong. You do not own, nor single handedly finance the repeater. It is suppose to be a shared resource. Don't drive other people off the air. **You know who you are!**

3.) If you feel compelled to interrupt an existing conversation, remember that it is **no more polite** to do so on the air than if you did it in person. Would you barge into a roomful of people engaged in a discussion without saying anything of interest? ...or even worse, saying something completely unrelated to the topic of conversation?

4.) Ignore jammers and others who try to disrupt the repeater's normal operation. Without any reaction from the repeater users, they will have no audience and probably go away in short order.

5.) If you are someone who is the subject of frequent interference, it may be a sign that **you** are aggravating people with your operating habits. This may be a sign that it is time for you to adjust your attitude and use of the repeater. This isn't always the case, but history has shown that those who have the most trouble with jammers are the ones who have caused the most friction amongst the repeater users.

6.) Transmit your call sign when you first come on the air. Make sure you ID once every 10 minutes, but there is no need to identify too often. Ignore stations who break-in without identifying.

7.) Don't cough, clear your throat, sneeze, etc., on the air; Unkey your microphone first.

8.) Be upbeat and courteous. Don't complain. This especially includes complaining about other hams, the repeater, or some aspect of the hobby. We all deal with unsafe and discourteous drivers, please don't describe their actions to us on the air.

9.) Do not use the word "break" to join a conversation. It is not considered good operating practice and in some circles the word "break" is reserved for announcing emergencies. The appropriate amateur radio term is break-in. If you simply want to join in, just transmit your call sign.

10.) Promptly acknowledge any break-in stations and permit them to join the conversation or make a quick call.

11.) Do not use phrases learned on 11 meters such as "**handle**", "**making the trip**", "**got a good copy on me?**", "**the personal here is...**", "**what's your 20?**", "**you're giving me 20-pounds**", and other strange phrases which should stay on CB. Speak plain English; this is not a cult. The less said about 11 meters on the air the better.

12.) The commuting hours (drive times) should be left to the many mobile stations who have limited time to converse. Home based stations should refrain from frequent or prolonged use of the repeater during these hours. The repeater is there to help extend the range of mobiles and portables, so be courteous and give them priority during commuting hours.

13.) Following a roundtable, or rotation format is the best way for 3 or more to participate. Don't ignore people by not passing it to them for several turns.

14.) Not all repeaters have "courtesy tones". Provide a brief pause between transmissions in order to allow folks to join in. People breaking into a conversation should transmit their call sign when the current user unkeys.

Repeater Offset

- Difference between repeater's receive and transmit frequencies called the **Offset**.
- Amount depends on **band**.
- Can be **Plus or Minus** (+ or -).
- Many Xceivers set it automatically – it is part of the band plan.
- **Simplex** communications use **same frequency** – no offset required.

Al Penney
VO1NO

Repeaters use a scheme called duplex where they can transmit and receive at the same time.

In order to be able to achieve this, the repeater transmitter signal must not interfere with the receiver so that it is sufficiently sensitive to receive transmissions at the same time it is transmitting.

To achieve this the receiver and transmit channels are offset sufficiently to enable this to occur. The difference between the repeater transmit and receive channels is called the "offset."

Repeater offset requirement

Most repeaters operate using the same location for transmit and receive, and normally they use the same antenna.

In order that the transmitter signal does not enter the receiver and overload the input and desensitise it, the signal from the repeater passes into a duplexer.

The purpose of this is to provide a filter for the receiver section of the repeater that only passes signals on the receive channel and rejects those on the transmit channel of the repeater. Often this consists of a band-pass filter for the receive channel and a notch filter for the transmit channel.

Also for the transmitter, filtering must ensure that no spurious signals are radiated on the receive channel as this would also impair the sensitivity of the repeater receiver.

The degree of the offset between the transmit and receive signals must be such that sufficient filtering can be achieved, whilst also taking into consideration the aspects of the band to be used: factors like its bandwidth, band-planning and the like. Also, in view of the way filters operate, spacing in terms of an absolute frequency difference can be less at lower frequencies than at higher frequencies.

Standardisation of repeater offsets

It is also important that the receive / transmit offsets for amateur radio repeaters are standardised so that they are easier to use. Accordingly there are a variety of offsets standardised for the different amateur radio bands in different areas of the world.

What is Offset?

You may have seen the word "offset" mentioned in the Tramsmitter section above. So exactly what is a repeater offset you may ask?

In order to listen and transmit at the same time, repeaters use two different frequencies. One for it's transmit frequency and another for it's receive frequency. On the 2 meter ham band these frequencies are 600 kHz (or 600 kilohertz) apart. On other bands, the offsets are different. As a general rule, if the output frequency (transmit) of the repeater is below 147 mHz, then the input frequency (listening) is 600 kilohertz lower. This is referred to as a negative offset. If the output is 147 Mhz or above, then the input is 600 kilohertz above. This is referred to as a positive offset.

Virtually all ham radios sold today set the offset once you have chosen the operating frequency automatically. Example: If the repeater output is 146.840 Mhz. The input, or the frequency the repeater receiver listens on is 146.240 Mhz (600 kilohertz below 146.840mHz).

If you have your radio tuned to 146.840 Mhz, (the repeater's output frequency), when you push the mic button, your radio automatically transmits on 146.240 Mhz, 600kHz down from 146.840. When you release the mic button to listen, your radio switches back to 146.840 mHz to listen on the repeater's output frequency. Note: There are exceptions to the rule so check your local repeater listings.

Standard Repeater Input/Output Offsets

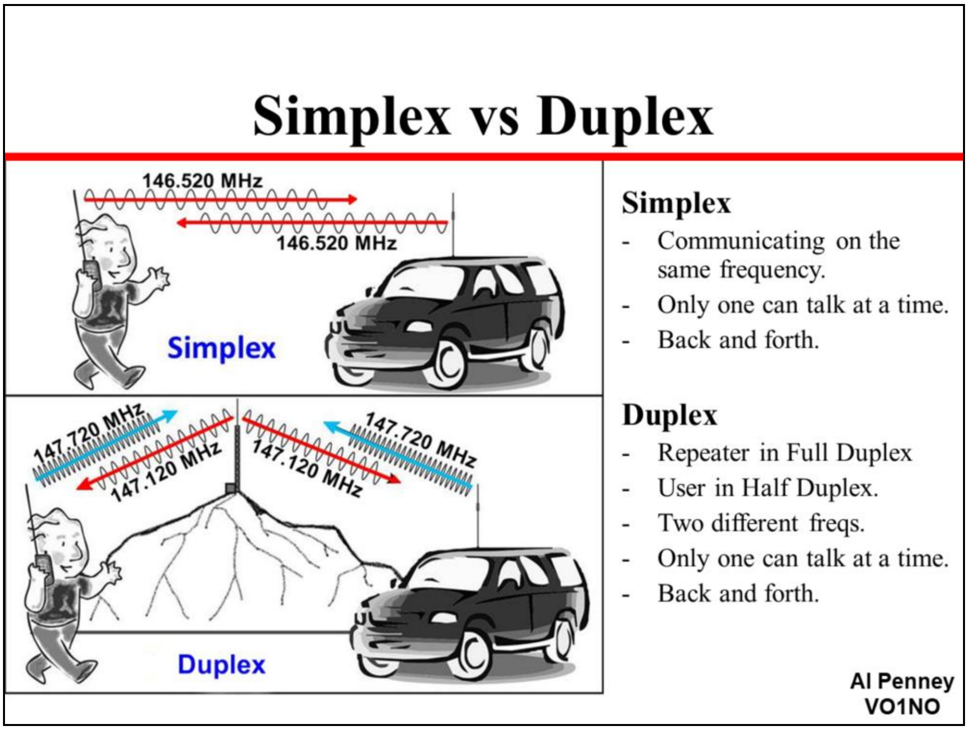
Band	Offset
6 meters	1 MHz
2 meters	600 kHz
1.25 meters	1.6 MHz
70 cm	5 MHz
33 cm	12 MHz
23 cm	20 MHz

Repeater Offsets

- Repeater Offsets are standardized:

Band	Offset
10 meters	100 kHz
6 meters	1 MHz
2 meters	600 kHz
1.25 meters	1.6 MHz
70 cm	5 MHz
33 cm	12 MHz
23 cm	20 MHz

Al Penney
VO1NO



Simplex – In the amateur radio context, *simplex operation* means the radio stations are communicating with each other directly, on the same frequency. Both stations take turns transmitting and receiving on the same frequency with no repeater or other device in between.

Duplex – Duplex operation means that a radio station transmits on one frequency and receives on a different frequency.

Full Duplex – Operating duplex with the ability to transmit and receive *simultaneously.*

Half Duplex – Operating duplex but having to switch between transmit and receive.

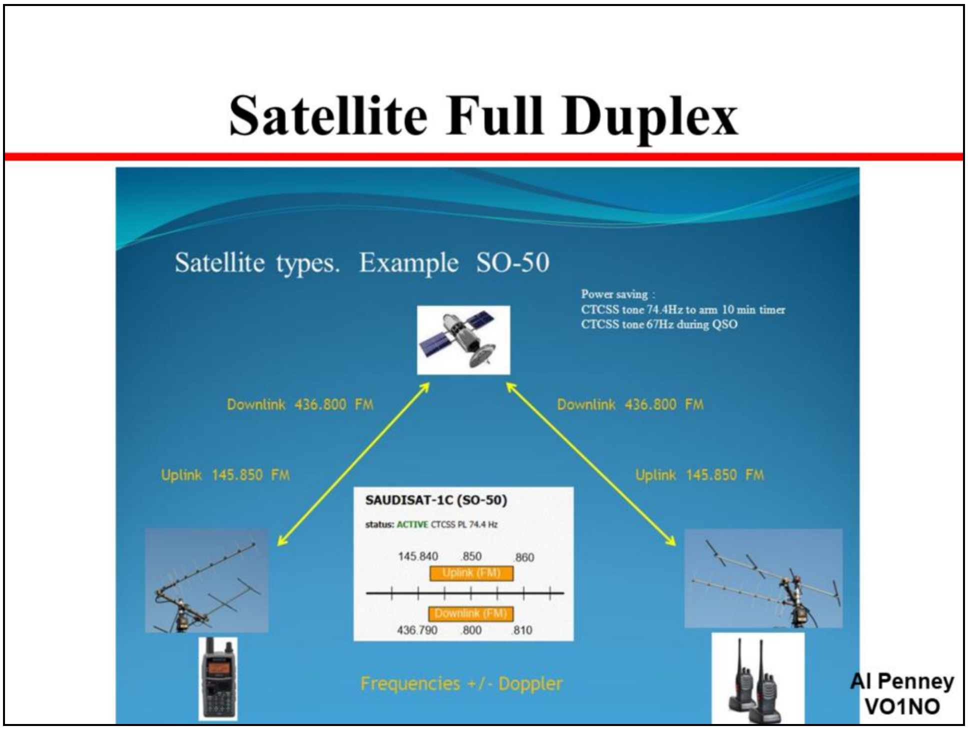
Repeaters

Examples of simplex vs. duplex operations. The repeater station (lower image, on mountain) is full duplex, instantly retransmitting a received signal. Each user's station is half duplex, unable to transmit and receive simultaneously, but shifting between the transmit and receive frequencies.

Very often simplex and duplex operation are associated with FM on the VHF and UHF bands. If you are talking to another ham directly, on one frequency, with no repeater involved, that is simplex operation.

FM repeater operation uses two frequencies: the repeater receive frequency and the repeater transmit frequency. The repeater's job is to take the signal it hears on its receiver and retransmit it on the transmit frequency. Repeaters operate in *full duplex* mode, because they receive and transmit at the same time. The repeater user is usually operating in *half duplex,* using two frequencies but switching between transmit and receive. Some FM ham radio gear can operate in full duplex mode (usually employing two different ham bands) but most equipment is half duplex only.

We refer to a repeater by its transmit frequency, which is the frequency the user listens on. When the user transmits, the radio automatically changes frequency as required by the repeater's *offset* (the difference between its transmit and receive frequencies.) The repeater offset is sometimes referred to as the *repeater split*.



Satellite Operating

Satellites use one ham band for the uplink and another ham band for the down link. For example, the FO-50 satellite uses 2M for the uplink and 70 cm for the downlink. Similar to a repeater, the satellite operates *full duplex,* transmitting the signal that is heard on the receiver (uplink). Ham satellites use different modulation types, including FM, SSB, CW and digital formats. It is the most common example of "non-simplex" SSB operating on the VHF bands.

It is highly desirable for the satellite user to also operate *full duplex* (usually with headphones to avoid feedback). That way, the user can determine how well he is getting into the satellite, operate with minimum power and just do a better job of avoiding interference to other users. Satellite radios such as the FT-736R permit this. The operator can hear him/herself (with a slight delay because of the time it takes for the signal to travel to and from the satellite).

CTCSS Tones

- **Continuous Tone Coded Squelch System**.
- Used to **prevent unwanted signals** from breaking a receiver's **squelch** – usually used for repeaters, but also regular transceivers.
- If transmitted signal does not include tone, the squelch will not open.
- Tone is too low in frequency to hear (**sub-audible**).
- Motorola term is PL – **Private Line**.

Al Penney
VO1NO

What is a PL or CTCSS Tone?

PL, an acronym for Private Line, is Motorola's proprietary name for a communications industry signaling scheme called the Continuous Tone Coded Squelch System, or CTCSS. It is used to prevent a repeater from responding to unwanted signals or interference. Tone Squelch is an electronic means of allowing a repeater to respond only to stations that encode or send the proper tone. In other words, if a repeater is set up to operate only when a PL tone of say, 136.5Hz is heard by it's receiver, then it will allow the transmitting station access. If your station, (your mobile, base or hand held) does not transmit the tone that the repeater receiver has been programmed for, when you key up, then the receiver of the repeater does not hear you and will not be usable by your station until you set the proper tone in your radio to be transmitted when you key your mic. Any modern station may be set up to transmit this unique low frequency tone that allows the repeater to operate. If a repeater is "In PL mode" that means it requires a CTCSS tone (PL tone) to activate the repeater. Due to severe congestion of ham repeaters in some areas, most repeaters are "PL'ed".
These repeaters were once called closed repeaters.

TABLE OF COMMON PL TONES (in Hz)

67.0	94.8	131.8	171.3	203.5
69.3	97.4	136.5	173.8	206.5
71.9	100.0	141.3	177.3	210.7
74.4	103.5	146.2	179.9	218.1
77.0	107.2	151.4	183.5	225.7
79.7	110.9	156.7	186.2	229.1
82.5	114.8	159.8	189.9	233.6
85.4	118.8	162.2	192.8	241.8
88.5	123.0	165.5	196.6	250.3
91.5	127.3	167.9	199.5	254.1

CTCSS Tones

TABLE OF COMMON PL TONES (in Hz)

67.0	94.8	131.8	171.3	203.5
69.3	97.4	136.5	173.8	206.5
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77.0	107.2	151.4	183.5	225.7
79.7	110.9	156.7	186.2	229.1
82.5	114.8	159.8	189.9	233.6
85.4	118.8	162.2	192.8	241.8
88.5	123.0	165.5	196.6	250.3
91.5	127.3	167.9	199.5	254.1

Al Penney
VO1NO

Repeater Time Out Timer

- Shuts repeater **transmitter off** if receiver is on for predetermined period (usually 3 min).
- Leave a few seconds for timer to **reset** before pressing your PTT.
- **Courtesy beep** indicates timer reset.

Al Penney
VO1NO

Repeater etiquette

The first and most important rule is LISTEN FIRST. Nothing is more annoying than someone that "keys up" in the middle of another conversation without first checking to make sure the repeater is free. If the repeater is in use, wait for a pause in the conversation and simply announce your call sign and wait for one of the other stations to acknowledge your call.

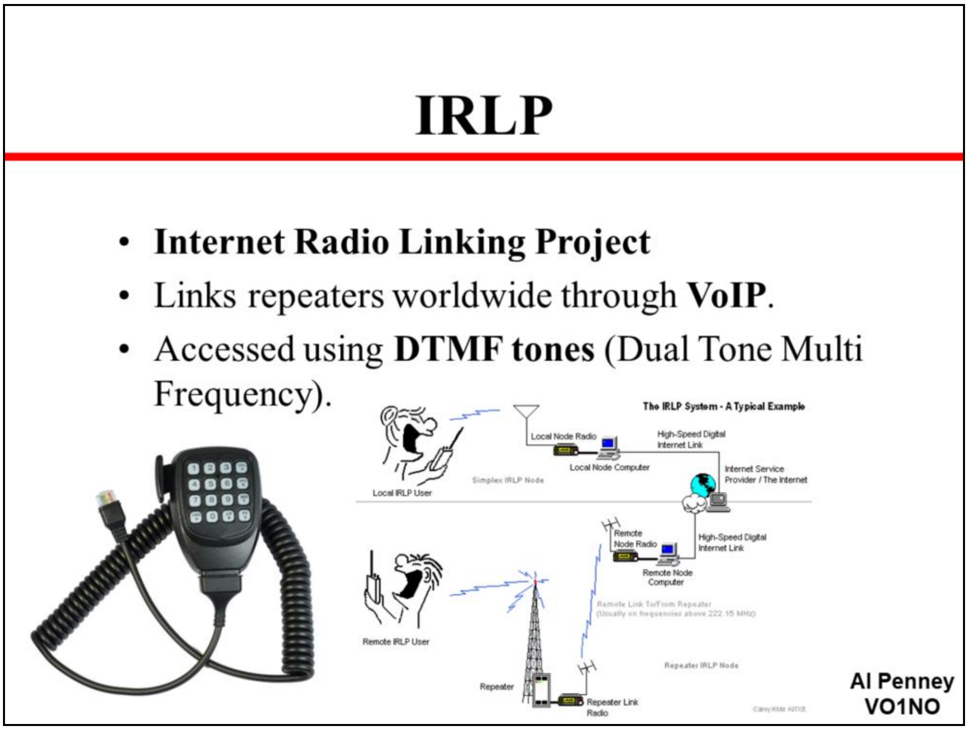
When you are using the repeater leave a couple of seconds between exchanges to allow other stations to join in or make a quick call. Most repeaters have a "Courtesy Beep" that will help in determining how long to pause. The courtesy beep serves two purposes, a repeater timeout function and it allows other to join in or make a call. Repeaters have a time out function that will shut down the transmitter if the repeater is held on for a preset length of time (normally three minutes). This ensures that if someone's transmitter is stuck on for any reason, it won't hold the repeater's transmitter on indefinitely.

When a ham is talking and releases the PTT switch on their radio, the controller in the repeater detects the loss of carrier and resets the time-out timer. When the timer is reset, the repeater sends out the courtesy beep. If you wait until you hear this beep (normally a couple of seconds), before you respond, you can be sure that you pause a suitable length of time. After you hear the beep, the repeater's transmitter will stay on for a few more seconds before turning off. This is referred to as the "hang time". The length of hang time will vary from repeater to repeater but the average is about 2 or 3 seconds. You don't have to wait for the "hang time" to drop before keying up again, but you should make sure that you hear the courtesy beep before going ahead.

Note: If you don't wait for the beep and allow the time-out timer to reset, or run on longer than the timer is set for, you will time-out the repeater. The repeater will not function till you allow the timer to reset.

Note: Some repeaters do not use a courtesy beep (or tone). Listen closely to the repeater after you ID or listen to a conversation on the repeater and you can find out if the repeater uses a courtesy tone or not.

Note: Some repeaters use the presence or absence of a courtesy tone to tell users what "MODE" a repeater is in… for example. Is the repeater running on backup power or not… or is the repeater linked to another repeater or not. If you hear a courtesy tone sometimes and no tone another, ask if there is a "control operator" on the air and have him/her explain what the differences mean.



The **Internet Radio Linking Project**, also called **IRLP**, is a closed-source project that links amateur radio stations around the world by using Voice over IP (VoIP). Each gateway consists of a dedicated computer running custom software that is connected to both a radio and the Internet. This arrangement forms what is known as an IRLP Node. Since all end users communicate using a radio as opposed to using a computer directly, IRLP has adopted the motto *"Keeping the Radio in Amateur Radio"*.

Amateur radio (or *ham*) operators within radio range of a local node are able to use DTMF tone generators to initiate a node-to-node connection with any other available node in the world. Each node has a unique 4 digit node number in the range of 1000–8999. A real-time searchable list of all nodes worldwide (including their current status) is available anytime by viewing the IRLP Network at a Glance. As of February 2019, there are over 1,500 active nodes.

IRLP was invented by David "Dave" Cameron, VE7LTD. Born and raised in West Vancouver, British Columbia, Canada, Cameron attended the University of British Columbia where he joined the UBC Amateur Radio Society. He built his first repeater and computer-based repeater controller in the 1990s.

Cameron installed the first three IRLP nodes in November 1997. They used the Windows operating system (OS) with VocalTec's iPhone installed. There were problems with the software, mainly in the fact that iPhone is not very stable nor is it controllable. After running iPhone for close to 6 months on active connections to Vernon, British Columbia, Canada and Saint John, New Brunswick, Canada, Cameron decided to rebuild the nodes and essentially start over. This is when the Linux OS and the Speak Freely software were first tested.

On November 12, 1998, the VE7RHS node was first installed in Gage Towers, UBC, Vancouver, British Columbia, Canada using Linux. A few days later, the VE7RVN node came online from the residence of Michael Paul Illingby, VE7TFD in Vernon, British Columbia, Canada. Since this point, no further problems were experienced. This planted the seed for the IRLP network to grow. New nodes slowly launched across Canada, followed by the United States and worldwide.

EchoLink is somewhat similar to IRLP, but is not the same thing.

EchoLink is a computer-based Amateur Radio system distributed free of charge that allows radio amateurs to communicate with other amateur radio operators using Voice over IP (VoIP) technology on the Internet for at least part of the path between them. It was designed by Jonathan Taylor, a radio amateur with call sign K1RFD.

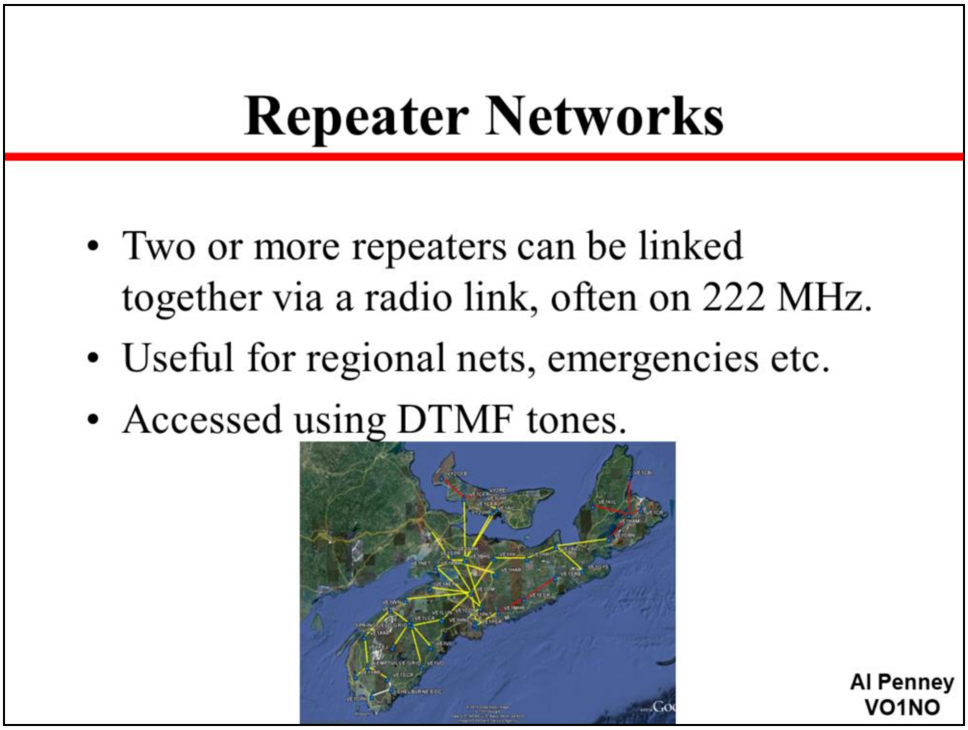
The system allows reliable worldwide connections to be made between radio amateurs, greatly enhancing Amateur Radio's communications capabilities. In essence it is the same as other VoIP applications (such as Skype), but with the unique addition of the ability to link to an amateur radio station's transceiver. Thus any low-power handheld amateur radio transceiver which can contact a local EchoLink node (a node is an active EchoLink station with a transceiver attached) can then use the Internet connection of that station to send its transmission via VoIP to any other active EchoLink node, worldwide. No special hardware or software is required to relay a transmission via an EchoLink node.

Before using the system, it is necessary for a prospective user's callsign to be validated. The EchoLink system requires that each new user provide positive proof of license and identity before his or her callsign is added to the list of validated users. There is no cost for this service, and it ensures that this system is used only by licensed amateur radio operators.

Internet linking

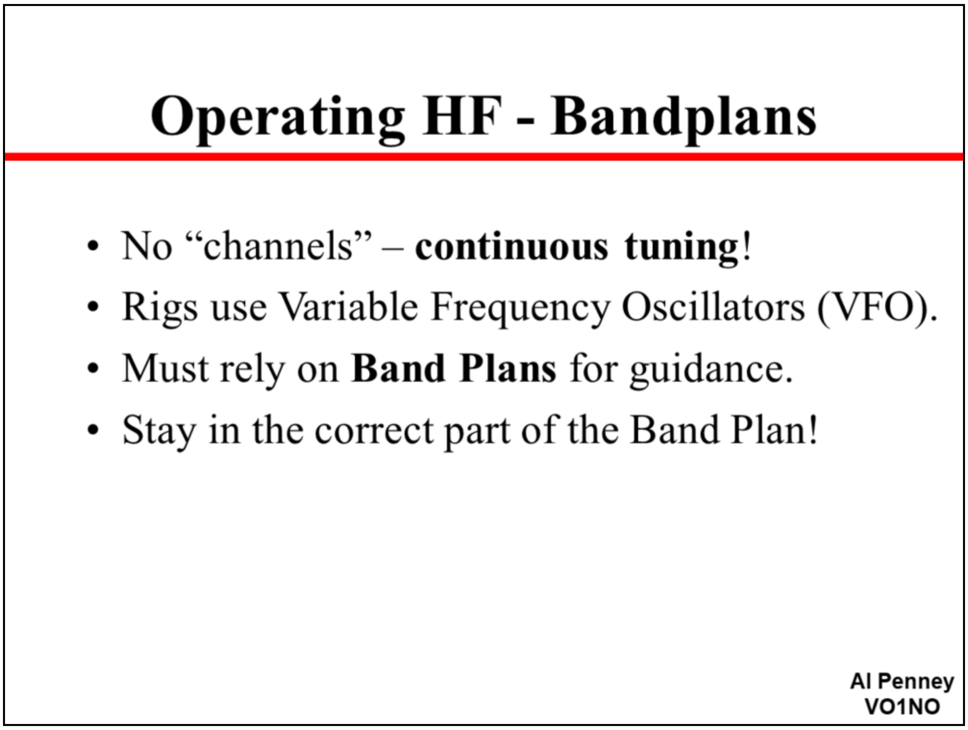
Repeaters may also be connected over the Internet using voice over IP (VoIP) techniques. VoIP links are a convenient way to connecting distant repeaters that would otherwise be unreachable by VHF/UHF radio propagation. Popular VoIP amateur radio network protocols include D-STAR, Echolink, IRLP, WIRES and eQSO. Digital Mobile Radio (DMR), D-STAR, Fusion, P25 and NXDN all have a codec in the user radio and along with the encoded audio, also send and receive user number and destination information so one can talk to another specific user or a Talk Group. Two such worldwide networks are DMR-MARC and Brandmeister.

For example, a *simplex gateway* may be used to link a simplex repeater into a repeater network via the Internet.



Repeater networks

Repeaters may be linked together in order to form what is known as a *linked repeater system* or *linked repeater network*. In such a system, when one repeater is keyed-up by receiving a signal, all the other repeaters in the network are also activated and will transmit the same signal. The connections between the repeaters are made via radio (usually on a different frequency from the published transmitting frequency) for maximum reliability. Some networks have a feature to allow the user being able to turn additional repeaters and links on or off on the network. This feature is typically done with DTMF tones to control the network infrastructure. Such a system allows coverage over a wide area, enabling communication between amateurs often hundreds of miles (several hundred km) apart. These systems are used for area or regional communications, for example in Canwarn nets, where storm spotters relay severe weather reports. All the user has to know is which channel to use in which area.



HF Operations: The Difference with HF

For many newer hams the world of HF operations may seem a strange and mysterious place. There are no comforting predefined voice channels, the audio is often noisy and the signal strength quite variable, sometimes multiple stations overlap in a confusing manner, and there are cryptic sub-bands providing bizarre and varied digital sounds. And that's just to name a few of the many HF quirks.

If some of those things confuse you and make you shy away from trying HF operations, this article is for you. Let's unfold some of this HF messiness and simplify that which is different with HF.

No Channels? For the typical ham who has mostly conducted VHF and UHF voice operations on FM repeaters and simplex channels, the absence of defined channels on the HF bands is perhaps one of the most stark differences initially confronted. On an HF band an operator may tune to any carrier frequency that keeps transmitted signals within the band privileges of the operator's license class, usually down to a tuning resolution of 100 hertz or perhaps 10 hertz. Contiguous tuning, free of restrictive channelization!

This contiguous tuning allowance across a band, combined with multiple possible operational modes, may seem chaotic at first and you may ask, "How do operators find one another and have a QSO via a common operating mode?" There are a couple of different considerations in answer to this question. Let's start with sub-bands, and then consider the matter of contiguous tuning within sub-bands.

Sub-bands: The HF bands from 10 meters down to 80 meters are divided into sub-bands (with exceptions of 30 meters and 60 meters that each have special rules in lieu of sub-bands). An HF band's sub-band may be designated for only phone operations or for only digital data operations, including CW. So, within a sub-band operators can begin to match up their desired operating modes.

In an HF phone sub-band the overwhelming mode of choice among hams is single sideband (SSB). Full bandwidth AM is also used occasionally, but SSB tends to dominate for reasons of bandwidth efficiency. With the exception of a segment of the 10 meter band, FM phone is prohibited on the HF bands due to its large consumption of bandwidth.

So, operators seeking voice contacts will tune within the phone sub-band and use either the upper sideband or the lower sideband SSB mode, and there is a standard convention for which to use depending upon the band in use. The higher frequency bands above the 30 meter band (20m, 17m, 15m, 12m, 10m, VHF, and UHF bands) utilize the upper sideband (USB), while the lower frequency bands below 30 meters (40m, 80m, 160m) use the lower sideband (LSB).

Similarly, an operator seeking contacts by CW or a digital mode will tune into the data sub-band, avoiding cross-mode interference with those jawing by phone mode. Each band tends to have even finer subdivisions of spectrum within which the various digital modes will congregate. For instance, CW ops tend to group in the very lowest frequency portion of a data sub-band, while computer-generated digital signalers will group by specific mode in slices of spectrum a little higher in frequency, but still within the data sub-band. So, you'll find the RTTY signals near one another, the PSK31 users grouped, and so on. Further, each digital mode and CW have unique characteristic sounds that allow receiving operators to identify like kinds.

Contiguous Tuning: Let's assume you like to talk. With your voice. Using words. And because of that eccentric penchant you seek phone contacts on an HF band. Let's imagine you have a multimode transceiver that operates on the 15 meter band. What do you do to snag another enthusiast who has the same communication whims regarding real, actual, talking?

First, of course, you identify and tune within the phone sub-band of the 15 meter HF band. Referencing our handy band plan chart compliments of RAC you can see that the 15 meter phone band extends from 21.150 MHz to 21.450 MHz for Canadian hams. Assuming you are a SSB kind of person you also ensure that your transceiver is set to upper sideband mode. Then, with grace and precision you twirl your mighty VFO across the vast contiguous range of frequencies for which you are privileged to operate!

And perhaps you hear other QSOs ongoing. Dialing further you may hear a lonely call of "CQ, CQ, CQ…" To answer the CQ call you simply match up your tuned carrier value with the calling operator's frequency, judging the tuned value by the quality of the sound received. When you have a nicely received signal you're ready to respond by simply transmitting your call sign and awaiting acknowledgement by the other station. You should use ITU standard phonetics to issue your call sign for weak signal reasons we will explore shortly.

Alternatively, you may wish to make your own CQ call on the band, casting your hook into the RF sea. Before you do, you should take some additional actions before you push-to-talk, as follows.

Selecting a Frequency: Be sure to do the following before you start your CQ call or call to another specific station on an an HF band.

• *Keep it in the sub-band* – Make sure your entire transmit bandwidth will be within the sub-band for which you have frequency privileges. Remember, a SSB signal consumes about 3 kHz: It will extend 3 kHz above the USB carrier frequency to which you have tuned, or 3 kHz below the LSB carrier frequency. Be sure the entire extent of that USB or LSB signal will be within the phone sub-band

• *Listen first* – And listen for a good long while. Several dozen seconds is a good idea. Why? Because you want to know if the frequency you have selected is already in use by other operators. If so, you should move on down the dial and try again. And why wait so long? Because you may be able to receive only one side of a QSO, and the unheard station may be transmitting a long description of his recent harrowing antenna-erecting adventure.

• *Ask if the frequency is in use* – If you hear no other user on the frequency, simply transmit, "Is the frequency in use?" followed by your call sign. Other users will usually respond politely if they are indeed using the frequency.

• *CQ!* – If you have followed these steps and the frequency is clear, make your CQ call. Usually when calling CQ you will want to elaborate and transmit for several seconds to allow other operators dialing around the band to stumble across your signal. A typical CQ call may go something like this: *"CQ CQ CQ. CQ 15 meters. Whiskey Zero Sierra Tango Uniform calling CQ. Whiskey Zero Sierra Tango Uniform calling CQ and standing by."*

Those Messy, Overlapping, Irregular Weak Signals: Another huge difference with HF operation that most VHF/UHF FM hams will immediately note is the quality of the audio. Compared to typical FM phone audio the SSB audio heard on the HF bands can seem substantially degraded. Multiple factors contribute to the reduced fidelity of SSB phone audio.

Bandwidth: The quality of transmitted audio is commensurate with signal bandwidth. A 15 to 20 kHz wide FM phone signal sounds quite good usually as compared to a 3 kHz SSB signal. Just fundamental information theory at work.

QRN: Amplitude modulated signals like SSB are subject to naturally produced noise, such as that from lightning strikes, as well as other electrical noise. FM signals are much less susceptible to such noise sources.

QRM: Interference or noise from other operators can frequently degrade the signal you desire to receive. Given two or more SSB signals that are each about 3 kHz wide, any amount of partial overlap of those signals is feasible. For example, suppose you are tuned to 21.400 MHz conducting a QSO and your USB signal extends up to 21.403 MHz. Another station besides your contact that you can receive is tuned to 21.402 MHz. Your QSO signals will overlap with the other "offending station" signal by 1 kHz, from 21.402 to 21.403. You may hear the offending signal as garbled audio that interferes with your signal reception.

And remember, to that other QSO *you* are the "offending station." What do you do? Initially, make sure you have sufficient clearance on the band when selecting a frequency. Once established and a conflict occurs with another QSO or operator, you can either move along the band to find a clear 3+ kHz region or you may politely inform the offending station of his interference and ask if he would please move away a bit. Usually whoever has first established a QSO on a given frequency is yielded to by subsequently transmitting stations, but no operator has sole rights to any frequency. Good amateur practice calls for integrity, politeness, good will, and patience on the air with our fellow hams.

Weak Signals: The frequencies of the HF bands will propagate over the horizon great distances thanks to the ionosphere's effects. This contrasts with the local RF "line-of-sight" range of UHF and VHF signals. As signals propagate they spread out geometrically, with effective power falling off as the square of the propagation distance (inverse square law). In other words, by the time your 100 watt signal reaches Sydney, Zurich, or Buenos Aires it will be many orders of magnitude weaker than when it left your antenna. It will be very weak, making reception a bit more of a challenge than picking up the megaphone signal from your local repeater, and especially so when much stronger local signals are nearby on the band. This is why high quality receivers with low noise floors and good *selectivity* are desired by the serious ham.

Irregular Signals: Because HF signals are refracted from the ionosphere, the characteristics of the ionosphere impact the quality of the signal and its propagation. The ionosphere is not a smooth and consistently behaving atmospheric phenomenon. Rather, it is patchy, with higher density of ions in some regions than in others, and changing constantly. As a result of changing *atmospheric conditions* you may experience irregular signals. A signal that was strong just a moment ago may fade away to nothing in only a few seconds. A station that you could not hear when you began your QSO may seem to suddenly impose itself on your conversation. Fading and irregular signals have their own Q signal, QSB. When QSB happens, refer to that part above about politeness, good will, and patience on the air. It's just part of the game and part of the magic!

Filtering Signals: Another aspect of radio science that is more common with modes other than FM, and quite frequently employed with SSB or CW on the HF bands, is signal filtering. The whole point of filtering received signals is to avoid nearby interference on the band and to reduce noise (increase signal-to-noise ratio) so that the desired weak signals may be received. (See *HamRadioSchool.com General License Course* book section

4.3, *Signal Processing*, for more information on filtering.)

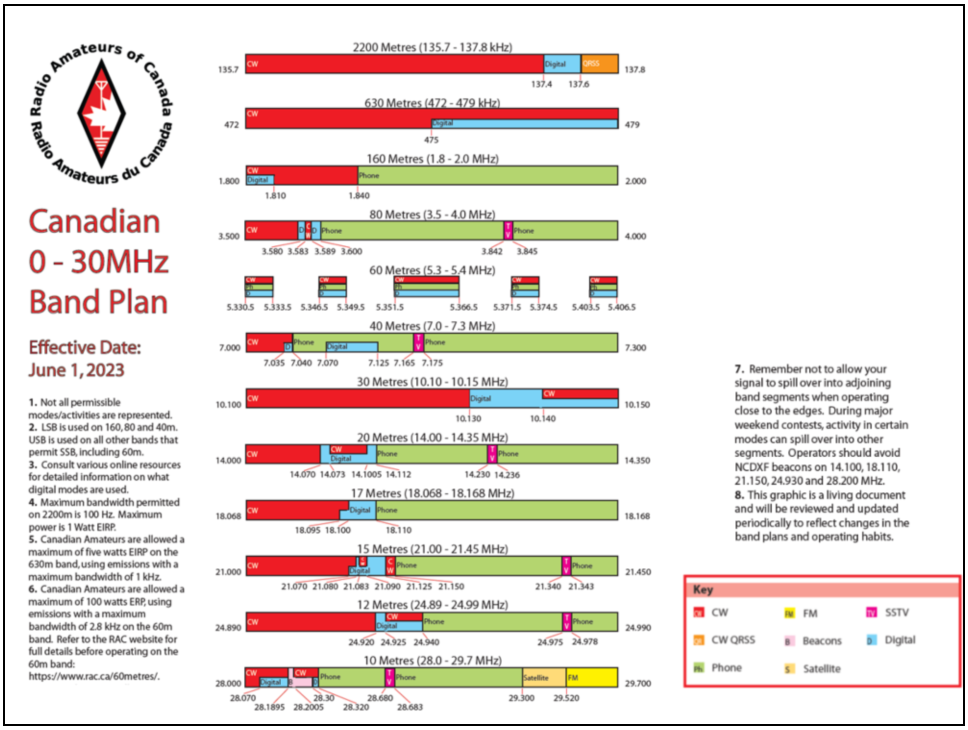
Many modern transceivers employ *digital signal processing* (DSP) that offers great flexibility of filtering options. You may want to establish any of the following types of basic filters on a received signal, and DSP lets you do it with ease:

• *Band Pass Filter* – Remember that your signal has a specific bandwidth. It is good to match the receiver bandwidth to the bandwidth of the desired signal to obtain the best signal-to-noise ratio. For instance, a SSB signal is about 3 kHz. You can establish a 3 kHz receive bandwidth, or you can establish a band pass filter that is significantly narrower in order to filter out interfering signals immediately adjacent to the desired signal on the band. With the adjacent interference filtered away your receiver can better detect the desired signal on which the filter band is positioned.

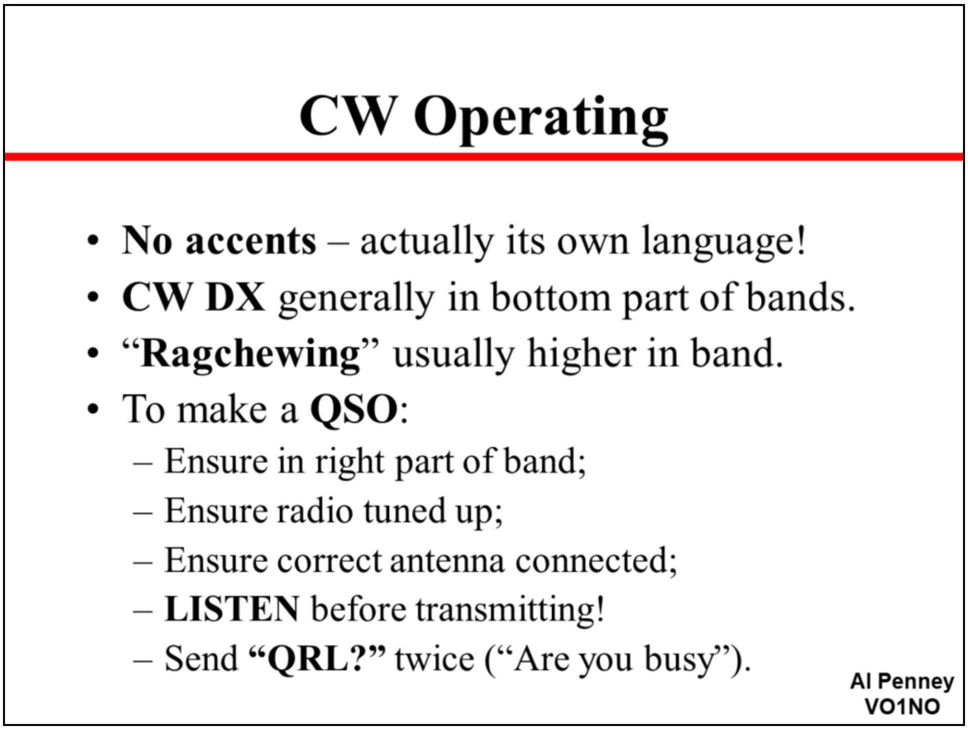
• *Notch Filter* – A notch filter is a very narrow filter that can remove an interfering carrier or other narrow bandwidth interference while leaving the bulk of the desired receive signal intact. It is sort of the inverse of the band pass filter in that it eliminates a narrow range of frequencies rather than allowing a specified band to be received.

• *Digital Noise Reduction* – Various types of noise can be reduced by digitally processing a received band of signals. Most DSP systems provide multiple digital filter types for noise elimination, sometimes using sophisticated algorithms that are available to you with a simple press of a key. Digital noise reduction techniques can improve the intelligibility of another station's audio under poor conditions.

You can learn more about digital signal processing in this previous Ham Radio 101 article: https://hamradioschool.com/an-introduction-to-digital-signal-processing-dsp/



Radio Amateurs of Canada
Radio Amateurs du Canada
Canadian 0 - 30MHz Band Plan
Effective Date: June 1, 2023
1. Not all permissible modes/activities are represented.
2. LSB is used on 160, 80 and 40m. USB is used on all other bands that permit SSB, including 60m.
3. Consult various online resources for detailed information on what digital modes are used.
4. Maximum bandwidth permitted on 2200m is 100 Hz. Maximum power is 1 Watt EIRP.
5. Canadian Amateurs are allowed a maximum of five watts EIRP on the 630m band, using emissions with a maximum bandwidth of 1 kHz.
6. Canadian Amateurs are allowed a maximum of 100 watts ERP, using emissions with a maximum bandwidth of 2.8 kHz on the 60m band. Refer to the RAC website for full details before operating on the 60m band: https://www.rac.ca/60metres/.
2200 Metres (135.7 - 137.8 kHz)
630 Metres (472 - 479 kHz)
160 Metres (1.8 - 2.0 MHz)
80 Metres (3.5 - 4.0 MHz)
60 Metres (5.3 - 5.4 MHz)
40 Metres (7.0 - 7.3 MHz)
30 Metres (10.10 - 10.15 MHz)
20 Metres (14.00 - 14.35 MHz)
17 Metres (18.068 - 18.168 MHz)
15 Metres (21.00 - 21.45 MHz)
12 Metres (24.89 - 24.99 MHz)
10 Metres (28.0 - 29.7 MHz)
7. Remember not to allow your signal to spill over into adjoining band segments when operating close to the edges. During major weekend contests, activity in certain modes can spill over into other segments. Operators should avoid NCDXF beacons on 14.100, 18.110, 21.150, 24.930 and 28.200 MHz.
8. This graphic is a living document and will be reviewed and updated periodically to reflect changes in the band plans and operating habits.
Key
CW
FM
SSTV
CW QRSS
Beacons
Digital
Phone
Satellite



ARRL member Rod Vlach, NN0TT:

CW is my mode of choice. I don't claim to be an expert on CW operating procedures but I have always tried to follow the practices outlined in ARRL publications such as *The ARRL Operating Manual*. Although there is no law governing good procedure, it benefits us all to use a set format. The majority of CW operators I have contacted also use the procedures listed here.

CW depends heavily on Q-signals, abbreviations and prosigns. These shortcuts make communicating more efficient. Phone operators have procedures, too--they literally speak the words, but sometimes use abbreviations borrowed from the CW operators' Q-signal list. This article is dedicated to CW operation, where shortcuts are necessary.

Listen First

I include listening as a procedure because it is the expedient thing to do and it enables us to find out what's happening on a particular band. I have heard some hams start a CQ right on top of a QSO in progress. This will happen occasionally with DX signals because the local station or the DX station may actually not hear each other. In many instances a little patience can avoid an interruption. Before calling CQ I will listen up and down a few kilohertz to avoid a frequency that would QRM an operator near my chosen frequency. Usually I will not answer a CQ that is being called on top of a QSO in progress, but answering a CQ near an ongoing QSO is another matter.

The bands are crowded, and especially when propagation is good signals can be coming in from all over the world. Many of us have limited time to be on the air, and if we are to operate at all we are probably going to occasionally, but unintentionally, QRM someone. It's not uncommon for CW hams to be working a QSO and hear two or three other QSOs in progress at the same time on nearby frequencies. Experienced CW operators consider that situation as part of the game. We should avoid choosing a frequency that would obviously impede an established QSO. In that case, we need to make a call judgment (no pun intended).

QRL?

The courteous thing to do is send the Q-signal "QRL?" (The equivalent of "is the frequency in use?"). I've heard some operators send QRL? and then immediately start pounding out a CQ. QRL? is not intended to be an announcement of starting a CQ--rather it is to determine if a CQ will interfere with an ongoing QSO. On the other hand, I have heard some hams send "QRL?" three or more times, which itself may be causing QRM. Sending QRL? once should be sufficient. No matter how hard we try we are bound to step on someone's headphones sooner or later.

CQ

I personally find endless CQs very annoying, and I usually won't reply to a lengthy CQ. I *might* answer a long CQ from North Korea. Thinking that a long CQ will increase the chances of getting a response is wrong. It actually has the opposite effect. If there is anything I have gleaned from ARRL publications, it is to keep CQs short. Two sets of three or four CQs followed by the call sign is plenty, with a "K" at the end to signal go ahead. You can always send another CQ if there is no response. I prefer to answer CQs rather than send them. Again, listening is the name of the game--especially if you are a DXer. Of course if no one ever sent a CQ, there would be no one to call. But entities with large numbers of Amateur Radio operators--such as the USA and Japan--aren't exactly rare, and their operators should use discretion in sending CQs to obtain DX contacts. I probably use CQ most often when I simply feel like ragchewing.

Initial Contact

My understanding of the FCC rules is that I never need to send the other operator's call sign. But I usually send it at least once--except in a DX pile-up--so the other operator knows I copied the call sign correctly. Sending an "R" (received) is a standard way to acknowledge that you copied the transmission. The proper procedure for answering a CQ is to send your call sign, followed by the prosign AR (end of transmission). Sending K is actually improper, because you don't know if you made contact yet, and K means go ahead. The standard information is then given, and although there is no set rule of order, I usually give the RST first, followed by QTH and name. It's the way I was taught to do it.

Q-Signals

I'm annoyed when I hear an operator turn a CW abbreviation into a longer sentence than the one it was designed to shorten. For example, QTH means "my location is...." But some hams may send "My QTH here is ..." Q-signals were designed to *eliminate* words--not *add* to them. All that's needed is "QTH Willmar, MN," or in the case of DX--"QTH Minnesota." The same applies for your name. Use "name Rod" rather than "my name here is...." Send a signal report like "RST 579" rather than "ur sig here is RST...." When describing your rig, send: "rig Knwd 570" instead of "the rig hr is ....."

Many hams seem to over-use words like 'about.' "My antenna is 'about' 30 feet high." No one expects that you know the height of your antenna to the exact fraction of an inch. Sending "ant up 30 ft" is close enough. And you can simply send "age 51" instead of "my age here is...." After sending the standard nuts and bolts of a QSO, you can talk on just about anything and be less formal.

One thing I love about CW is its efficiency and brevity--most of the time. I think many of us fall into the trap of using longer sentences and unnecessary words as filler rather than sticking to essential QSO information. I find that, with practice, I can eliminate a lot of irrelevant words--especially in the basic information that begins all QSOs.

Although the prosign KN (specific station only) should be used if you don't want anyone to break into your QSO when returning it to the other ham, I just use K. I have yet to experience someone cutting into one of my CW QSOs. Actually, I would like to see it happen sometime. Remember, it's only necessary to give your call sign every ten minutes and at the end of the QSO. Some hams use both calls on every exchange. This can make a QSO tedious, and wastes time--especially when QSB (signal fading) and other negative factors are present. Using BK (back) is a quick way to return the QSO to the other operator.

Ending the QSO

When it's time to pull the plug on a QSO, give a cordial send-off and end it. I've heard some hams actually give two or three exchanges of goodbye before finally stopping the QSO. I'm sure I have done similar things on occasion but I try to be conscious of it. Don't send best 73's (which, when translated, would read "best best regards-es.") Simply send 73 (best regards.) The prosign SK should not be used until the end of your final transmission, and then send it before your call sign. If you're leaving the air, you can add CL (clear).

Shave and a Haircut, Two Bits

In 1965--when I was a Novice--it was common for CW operators to tap out the old musical phrase "Shave and a Haircut, Two Bits" (dit-di-di-dit-dit, dit-dit) at the very end of a QSO. When I got back on the air in 1998, I rarely heard the whole musical phrase, but it's now common to send the last two dits (as would be typical of CW hams trying to save time). There are no specific rules or laws for the format of a QSO--except for station identification--so I see no harm in this. I think di-dit has become a symbol of friendliness and thanks worldwide--known only to the fraternity of CW operators. It probably has attained the unofficial stature of 73 or GL (good luck).

Good Fist

An article on CW operating procedures would not be complete without mention of the fist (quality of sending) of an operator. I think we have all heard some operators sending code so fast that they make mistakes. Their transmission is very difficult to copy. Having an electronic keyer is not a license to go nuts. We all suffer from sticky fingers sometimes, no matter how hard we are trying. But we should endeavor to send accurate, clear code that is easily understood.

The motto of the FISTS club is: Accuracy Transcends Speed. I could not agree more. I think the old practice of sending CW at a speed near that of the other operator is a good one. An alternative practice, if you don't want to set your keyer to a lower speed, is to leave longer spaces between letters. No one has ever asked me to QRQ (send faster). I am not a high-speed operator but if anyone asks me to QRS (send slower) I immediately do so. One of the things I enjoy about Amateur Radio is the cooperative spirit of most hams. That makes it a special hobby.

None of us is a perfect CW operator all the time, and usually no two QSOs are exactly the same. We don't always have to use a rigid format. Even I don't always follow the above formats to the letter. But in general, I do try. We can develop--or keep--good fists, use well-known Q-signals and abbreviations, stop using redundant phrases and filler, and always be courteous to our fellow Amateur Radio operators.

ARRL member Rod Vlach, NN0TT, lives in Willmar, Minnesota, where he and his wife Diane are property managers. He's earned DXCC, DXCC Y2K, WAC, WAS and WAZ certificates, all on CW--which he says is the "original" digital mode. You can contact Rod at nn0tt@arrl.net.

Calling CQ

- **CQ** literally means "Seek You".
- Send info **3 times**:
  - CQ CQ CQ DE VO1NO VO1NO VO1NO K
- K means "I have stopped transmitting – you go ahead"
- A station hears my CQ and responds:
  - VO1NO DE P5KJU P5KJU P5KJU K

Al Penney
VO1NO

A BASIC CW OPERATING MANUAL Compiled by Dan Stegner KB0OBU from FISTS CW Club member tips

You are ready to make that first contact. Your palms may be sweating and your heart rate may be racing. That's ok. We've all been there. The first time I called CQ I was very nervous. I didn't think it was possible for fingers to have a stuttering problem but there I was, stuttering with my fingers. Gradually I relaxed and calmed down. The CQ's flowed from my fingertips with fluidity before sailing skyward. "Hey, this is really fun," I thought to myself. Suddenly, the inevitable happened; somebody actually answered! The anxiety returned. "Now, what do I do?" Here is some help with establishing that first contact.

Answering CQ

Let's suppose you're tuning across the bands and you hear a station calling CQ. The station seems to be sending at a speed you can copy: CQ CQ CQ DE WA3XYZ K To answer WA3XYZ you just send the following: WA3XYZ DE (your callsign – lets use mine, KC0OBU, for our examples) AR That's all there is to it. AR is the letters A and R sent with no spaces in between, a procedural signal that means "end of message" or "over."

If the band is noisy or you are running low power, you may want to repeat your call sign twice like so: WA3XYZ DE KC0OBU KC0OBU AR This is a '1x2'. The other station's call sent once, and yours sent twice. This allows the other station double-check to make sure they got your call right. If WA3XYZ was able to copy you, that station will then come back with something like: KC0OBU DE WA3XYZ TNX FER CALL UR RST 559 IN…

If WA3XYZ only copied part of your call sign, you may hear one of the following. The station may or may not add DE WA3XYZ depending on the situation: QRZ? (Who's calling me?) ? ? (Who's there?) KC? (KC something….didn't get the rest of your call sign.) OBU? (Got the suffix, but I missed the prefix) In this case, just send your call sign again.

Calling CQ

If the band seems to be in good shape, but nobody is calling CQ, you can do the following:

1. Find a frequency that seems to be clear, and listen for a few seconds. Listening is very important.
2. If you don't hear anything, send QRL? and listen for a bit more. Make sure you listen slightly up and down from your transmitting frequency as well. QRL is a Q signal that means this frequency is in use. When you send QRL? you are asking if the frequency is in use. If somebody comes back with C, YES, or QRL, then move to another frequency so you don't interfere. No further response is needed.
3. If you did not hear a response, send QRL? again and listen again. Some stations may take a bit to respond.
4. Still nothing? You can assume the frequency is clear. Immediately send your CQ while the frequency is still open. The 3x2 CQ call seems to work well for most situations. Call CQ three times, and then send your call twice: CQ CQ CQ DE KC0OBU KC0OBU K The final K at the end means you're inviting any station to answer you.

After calling CQ, listen, listen, listen. Listen slightly up and down in case the station trying to answer you is slightly off frequency. You can miss a return call if you are not listening carefully. If you hear nothing, send another 3x2 CQ call again, and listen. Repeat until either somebody answers or you want to try in another spot. Pretty easy, huh? The 10x2x3 CQ call (CQ sent 10 times followed by your call sign twice, sent three times in a row) is seldom productive. Normally when stations hear this, they will keep moving up or down the band, and you will be scratching your head wondering why nobody is answering your CQ: CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ DE KC0OBU KC0OBU CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ DE KC0OBU KC0OBU CQ CQ CQ CQ CQ CQ CQ CQ CQ CQ DE

KC0OBU KC0OBU K

The QSO

Basically there are three parts to a QSO: The introduction, the middle, and the conclusion. Almost sounds like a term paper. Let’s take a look at each of these parts.

The Introduction

Once a CQ is answered, the stations first exchange three important pieces of information: RST (a signal report), QTH (location), and Name.

So let’s suppose I am calling CQ and WA3XYZ answers me. I would then send something like this: WA3XYZ DE KC0OBU GM (GA, GE, GN) TNX CALL UR 559 (579,549, etc) 559 IN TRENARY, MI TRENARY, MI NAME DAN DAN HW? AR WA3XYZ DE KC0OBU KN

First I send the other station’s call, then DE (which means from) and then my call sign.

Then I say good morning (GM), afternoon (GA), evening (GE), or night (GN), whichever is appropriate.

Next I say thanks for the call (TNX CALL) and give the RST signal report (UR 559.

I then send my QTH or location followed by my name. You can send ‘QTH’ instead of ‘IN’. But don’t send ‘MY QTH IS’ because that would be redundant….sort of like saying ‘MY MY LOCATION IS IS’. ‘HW?’ is short for ‘How are you copying me?’.

Then I send AR (Over or End of Transmission), WA3XYZ DE KC0OBU (so other stations listening will know who we are) and KN which says go ahead to a specific station, which in this example is WA3XYZ.

The other station will then reply back with its information by sending something like the following: KC0OBU DE WA3XYZ R GM DAN NICE TO MEET U UR RST 579 579 QTH PITTSBURGH, PA PITSBURGH, PA NAME PHIL PHIL HW? AR KC0OBU DE WA3XYZ KN

The R sent after the initial call signs means that the other station copied EVERYTHING that you sent. Don’t send R and then ask the other station to repeat part of the information that was sent. It’s bad form. If you need the other station to repeat something send ‘PSE RPT NAME’, or ‘RST’, or ‘QTH’, etc. You can also send something like ‘NAME?’ or ’RST?’ in your next transmission, and the other station should understand.

The Middle

Now, you chat back and forth about whatever you want: the weather, sports, your rigs, antennas, etc., using a format like the following: WA3XYZ DE KC0OBU R blah, blah, blah, AR WA3XYZ DE KC0OBU KN Then the other station has a turn: KC0OBU DE WA3XYZ R blah, blah, blah, AR KC0OBU DE WA3XYZ KN

Technically, you don't have to send both call signs with each transmission. Some stations just send BK (back to you) and the end of a transmission and then legally identify the station every 30 minutes (Canada). Other stations will send both calls with each transmission so those listening will know who they are.

The Conclusion

To end the QSO just send something like: WA3XYZ DE KC0OBU R blah, blah, blah, OK PHIL TNX NICE QSO HPE CUL 73 GM SK WA3XYZ DE KC0OBU K

I thank Phil for a nice QSO, say hope to see you later (HPE CUL), send best wishes (73), and good morning (GM). The SK procedure signal means that's all I have. Similar to AR except it is only used in the final transmission from your station.

Phil will then send his final transmission: KC0OBU DE WA3XYZ R FB DAN TNX QSO 73 SK KC0OBU DE WA3XYZ CL The CL means that Phil is going to be closing his station and won't be answering any more calls. Phil could also end his call with a "dit dit". I would respond with a single dit. Ending a QSO with the dit dit – dit, or the "shave and a haircut…two bits" is a friendly way of acknowledging that the QSO has ended and you enjoyed the chat. It started back before anyone can remember with one Ham sending 'shave and a haircut' – dahdididahdit - and the other station completing it with 'two bits' – dit dit. It has shortened over the decades to stations sending 'dit dit' and 'dit''.

Please don't fall into the habit of pluralizing. There is no need to send "73s". 73 by itself means "best wishes"; it is not proper to send 73s or 'best wisheses' Another tip to remember is that most Procedural Signs (like QTH) already mean phrases, and are intended to reduce the amount of sending you need to do to make your point. You don't need to use extra words when using prosigns like QTH. QTH PA is sufficient, not MY QTH IS....

A Cheat Sheet

You might find it helpful to use a cheat sheet that you can refer to when your mind suddenly goes blank. So here it is. Just fill in the blanks and replace WA3XYZ with the other station's call sign.

Is this frequency in use? QRL? (then LISTEN)

Calling CQ CQ CQ CQ DE _____________ K

Answering another station's CQ WA3XYZ DE ___________ AR

When another station answer's your CQ WA3XYZ DE __________ GM (GA, GE, GN) TNX CALL UR 559 (or 579, 549, etc.) 559 IN ______________, __ ______________, __ NAME _______ _______ HW? AR WA3XYZ DE __________ KN

To end the QSO WA3XYZ DE __________ R blah, blah, blah, OK TNX NICE QSO HPE CUL VY 73 GM SK WA3XYZ DE __________K

If the other station initiates ending the QSO WA3XYZ DE __________ R OK TNX NICE QSO HPE CUL VY 73 SK WA3XYZ DE __________

A Final Word about Speed

Accuracy transcends speed. Most operators would rather copy slower accurate code with proper spacing than code sent fast with uneven spacing and lots of mistakes. Speed will come with practice.

Rule of thumb for spacing:

The space between letters should be about as long as a dash – which is equal to 3 dits. The space between words should be about as long as two dashes (technically, 7 dits, but it's easier to estimate 'two dashes' since you DON'T want to start counting). Keep in mind that the person on the other end has to decipher your sending, so make it as clear for them as you can. Spacing is just as important as the letters themselves. Without spacing, it's all gibberish!

Space between your letters, and pause ever so slightly between words. It is asking for trouble to call CQ with a speed faster than you can comfortably copy, because that will probably be the speed somebody will use when answering you. Don't get frustrated if the other station doesn't slow down for you, even after you have sent PSE QRS (please send slower). The other station may be pressed for time, in the heat battle during a contest, or has been operating at a fast speed for so long that they have difficulty copying or sending slower. You also need to be courteous. Do not assume that everyone who does not slow down is being a jerk. If you cannot copy the other station, just say SRI TOO FAST, send them a 73 and move on. You are sure to find somebody that you can work.

Calling CQ (2)

- I reply to P5KJU

  P5KJU DE VO1NO

  TNX CALL OM

  RST 599   QTH NOVA SCOTIA

  NAME AL   HW CPI?

  P5KJU DE VO1NO KN

Al Penney
VO1NO

Calling CQ (3)

- If I didn't hear the callsign of the station:

  P5?? DE VO1NO K
- Or, I could send:

  QRZ? QRZ? DE VO1NO K
- In the (unlikely!) event Kim Jong Un transmits too fast to copy, I would send:

  QRS PSE

Al Penney
VO1NO

CW Procedure Signals

- **AR** *End of message*
- **AS** *Wait*
- **BK** *Break*
- **BT** *Separator (a pause)*
- **CQ** *General call for anyone who wants to chat*
- **DE** *This is*
- **K** *Over*
- **KN** *Over (to specific station)*
- **SK** *End of contact*

Al Penney
VO1NO

Notice the line that appears over each one of the two-letter procedure signals. That means you send the two letters as if they are one character. For instance, KN isn't sent as dah-di-dah dah-dit (KN) but dah-di-dah-dah-dit (KN).

•**AR** *End of message:* Send this after you are completely done sending everything — everything, that is, but call signs and KN. If it's your last transmission, use SK instead.

•**AS** *Wait:*You might hear this if you're working an experienced operator. If you hear this, the next thing you hear will probably be silence — maybe he has to answer the phone or something. Or maybe you'll hear him hold his key down while he fiddles with his antenna tuner. Don't start sending — he'll start sending when he's ready. This is a handy procedure sign to know, if you ever need to take a break yourself.

•**BK** *Break:* This might be used by a station who wants to enter an ongoing QSO — he'll send BK between transmissions to see if they'll let him in and turn their QSO into a "roundtable." With the advent of full QSK keying, this also became popular among experienced CW operators who could interrupt one another right in the middle of a transmission (perhaps to answer a question or clarify something). But most commonly BK is used to rapidly turn the conversation over to the other station without sending any call signs. For instance, an operator might send something like “HOW CPY? BK” and then cease his transmission. If this happens to you, reply by simply sending BK and answer his question. You can go back and forth in this manner for as long as you want, but don’t forget to obey the law by identifying yourself with your call sign at least every 10 minutes.

•**BT** *Separator:* Usually used to change the subject, even if it’s just to go from sending RST to sending QTH. (If you hear the other fellow sending BT several times, it’s because he’s trying to think of what he wants to say next!)

•**K** *Over:* This invites anybody listening to reply. Send this after you’re done calling CQ. But if you’re in a QSO, you almost always want to use KN, not K.

•**KN** *Over (to specific station):* Send this after signing over to the other station in a QSO, e.g. NØART DE NØIP KN. KN tells other listeners that they’re not welcome to call you yet — you just want the station you’ve named to reply. Don’t send this after calling CQ — send K instead.

•**SK** *End of contact:* This lets the other operator know that you want to end this QSO, and this is your last transmission. Usually sent in place of AR right before signing over to the other station.

CW Abbreviations (1)

AA - All after (used after question mark to request a repetition)
AB - All before (similarly)
ARRL - American Radio Relay League
ABT - About
ADR - Address
AGN - Again
ANR - Another
ANT - Antenna
ARND - Around
AS - Wait
BCI - Broadcast interference
BCNU - Be seeing you

Al Penney
VO1NO

CW Abbreviations (2)

BK - Break (to pause transmission of a message, say)
BN - All between
BTR - Better
BTU - Back to you
BUG - Semiautomatic mechanical key
BURO - Bureau ("Please send QSL card via my local/national QSL bureau")
B4 - Before
C - Yes; correct
CBA - Callbook address
CFM - Confirm
CK - Check
CL - Clear (I am closing my station)

Al Penney
VO1NO

CW Abbreviations (3)

CLG . . . - Calling
CONDX - Conditions
COS - Because
CQ - Calling ... (calling all stations, any station)
CS - Callsign
CTL - Control
CUD - Could
CUL - See you later
CUZ - Because
CW - Continuous wave (i.e., radiotelegraph)
CX - Conditions
DE - From (or "this is")

Al Penney
VO1NO

CW Abbreviations (4)

DN - Down

DR - Dear

DX - Distance (sometimes refers to long distance contact), foreign countries

EMRG - Emergency

ENUF - Enough

ES - And

FB - Fine business (Analogous to "good")

FER - For

FM - From

FREQ - Frequency

FWD - Forward

GA - Good afternoon or Go ahead (depending on context)

Al Penney
VO1NO

CW Abbreviations (5)

GE - Good evening
GG - Going
GL - Good luck
GM - Good morning
GN - Good night
GND - Ground (ground potential)
GUD - Good
GX - Ground
HEE - Humour intended or laughter - often repeated twice i.e. HEE HEE
HI - Humour intended or laughter
HR - Here, hear
HV - Have

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VO1NO

CW Abbreviations (6)

HW - How; How copy

II - I say again

IMP - Impedance

K - Over

KN - Over; only the station named should respond (e.g. W7PTH DE W1AW KN)

LID - Poor operator

MH - Meters high (antenna height)

MILS - Milliamperes

MNI - Many

MSG - Message

N - No; nine

NIL - Nothing

Al Penney
VO1NO

CW Abbreviations (7)

NR - Number; Near

NW - Now

NX - Noise; noisy

OB - Old boy

OC - Old chap

OK - Okay

OM - Old man (any male amateur radio operator is an OM regardless of age)

OO - Official observer

OP - Operator

OT - Old timer

OTC - Old timers club (ARRL-sponsored org. for radio amateurs first licensed 20 or more years ago)

OOTC - Old old timers club (org. for those whose first 2-way radio contact occurred 40+ years ago)

Al Penney
VO1NO

CW Abbreviations (8)

PLS - Please

PSE - Please

PWR - Power

PX - Prefix

QCWA - Quarter Century Wireless Association (org. for radio amateurs licensed for 25 or more years)

R - Are; received as transmitted (origin of "Roger"), or decimal point (depending on context)

RCVR - Receiver

RFI - Radio-frequency interference

RIG - Radio apparatus

RPT - Repeat or report (depending on context)

RPRT - Report

RST - Signal report format (Readability-Signal Strength-Tone)

Al Penney
VO1NO

CW Abbreviations (9)

RTTY - Radioteletype
RX - Receiver, radio
SAE - Self-addressed envelope
SASE - Self-addressed, stamped envelope
SED - Said
SEZ - Says
SFR - So far (proword)
SIG - Signal or signature
SIGS - Signals
SK - Out (prosign), end of contact
SK - Silent Key (a deceased radio amateur)
SKED - Schedule

Al Penney
VO1NO

CW Abbreviations (10)

SN - Soon
SNR - Signal-to-noise ratio
SRI - Sorry
SSB - Single sideband
STN - Station
T - Zero
TEMP - Temperature
TFC - Traffic
TKS - Thanks
TMW - Tomorrow
TNX - Thanks
TRE - There

Al Penney
VO1NO

CW Abbreviations (11)

TT - That
TY - Thank you
TVI - Television interference
TX - Transmit, transmitter
TXRX - Transceiver, transmitter + receiver
TXT - Text
U - You
UFB - Ultra Fine business (Analogous to "very good")
UR - Your or You're (depending on context) Alt: YR
URS - Yours
VX - Voice; phone + French "Vieux" (Old Man as per English "OM")
VY - Very
W - Watts

Al Penney
VO1NO

CW Abbreviations (12)

WA - Word after
WB - Word before
WDS - Words
WID - With
WKD - Worked
WKG - Working
WL - Will
WUD – Would
WX - Weather
XCVR - Transceiver
XMTR - Transmitter
XYL - Wife (ex-YL) (Extra Young Lady, i.e. wife)
YF - Wife

Al Penney
VO1NO

CW Abbreviations (13)

YL - Young lady (originally an unmarried female operator, now used for any female)

YR - Your or You're (depending on context) Alt: UR

Z - Zulu time i.e. UTC (GMT)

ZX - Zero beat

33 - Used as a greeting between YLs (as half of an 88)

44 - Hand shake, half of 88. Often used in Flora and Fauna connections

55 - Wishing success (originates from German "Viele Punkte" -- Many dots/points)

72 - Best Wishes QRP (Low Power) often used by low power station operators (5W or less)

73 - Best regards

77 - Long Live CW (Morse Code), wishing you many happy CW contacts

88 - Love and kisses

99 - Get lost!

Al Penney
VO1NO

The traffic abbreviation 44 is quite new and it is connected to to the "Flora & Fauna" or WFF amateur radio activities.
They are usually portable operations from natural reservations such as national parks, and they are counted for the
"World Flora Fauna Award"

http://www.wff44.org/program/wff/

44 signifies the four natural elements earth,air,water and fire together with the cardinal points west, north, east and south,
and is often used as an informal greeting among WFF'ers instead or combined by 73.

The WFF activities often take place at 44 kHz +/- QRM up from the lower band edges.

SSB Operating (1)

- **Noise, propagation, language differences**…
- If tuning required, use a **dummy load**.
- Use **standard phonetics**!
- Follow the **Band Plans**.
- Remember also **"gentleman's agreement"** on the use of some parts of the bands.
- Try not to use too many Q signals!

Al Penney
VO1NO

SSB Operating (2)

- To call CQ:

  IS THE FREQUENCY IN USE PLEASE?

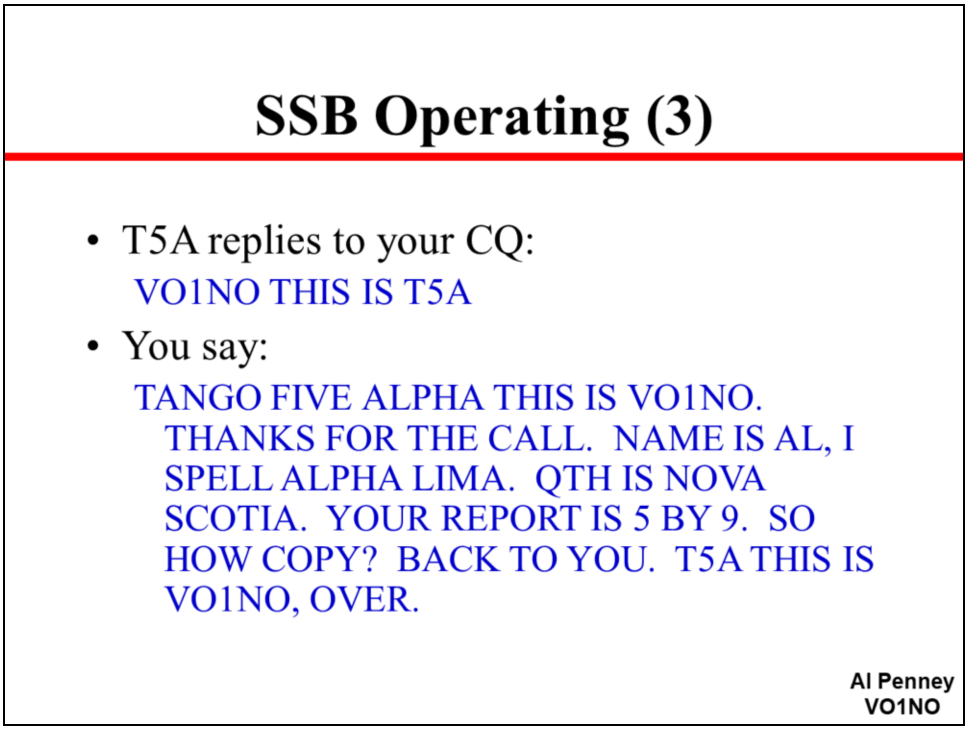
  Assuming it is clear:

  CQ CQ CQ THIS IS VO1NO VO1NO VO1NO OVER

- You can use phonetics for your callsign if the bands are busy or in poor shape.
- If someone replies but you miss his callsign:

  QRZ PLEASE? THIS IS VICTOR OSCAR ONE NOVEMBER OSCAR

Al Penney
VO1NO



SSB Operating (3)
• T5A replies to your CQ:
VO1NO THIS IS T5A
• You say:
TANGO FIVE ALPHA THIS IS VO1NO. THANKS FOR THE CALL. NAME IS AL, I SPELL ALPHA LIMA. QTH IS NOVA SCOTIA. YOUR REPORT IS 5 BY 9. SO HOW COPY? BACK TO YOU. T5A THIS IS VO1NO, OVER.
Al Penney
VO1NO

T5 = Somalia

Nets

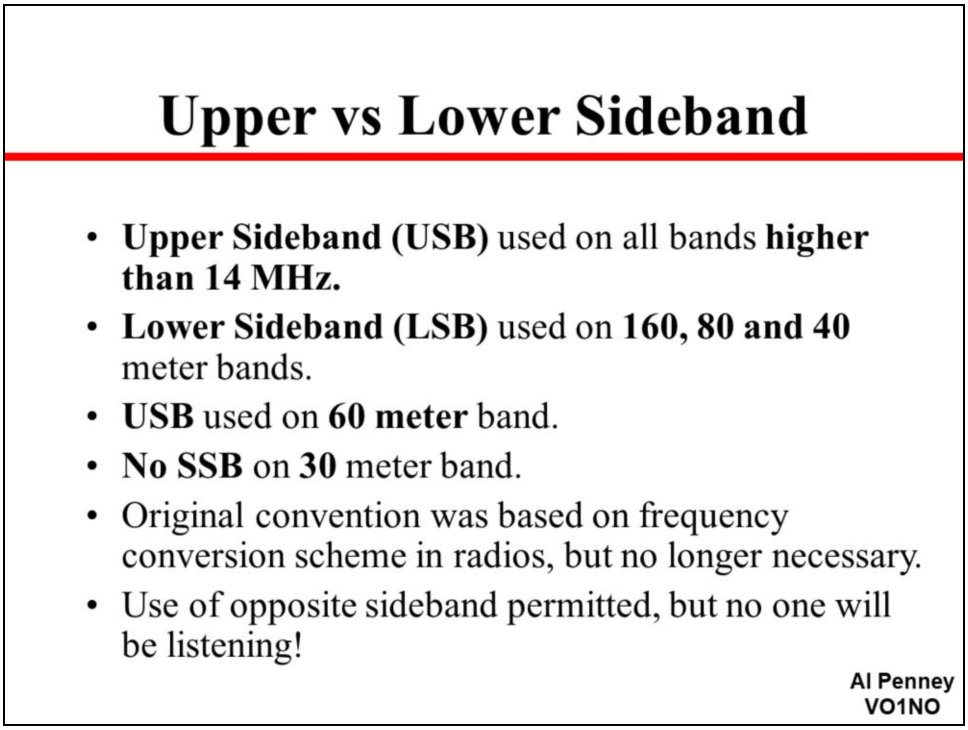
- **Net** = **Network** – a group on the same freq.
- **Net Control Station** (NCS) in charge.
- Give your callsign when invited to.
- NCS will maintain a list, and call you in.
- You can ask NCS about a station you are looking for.
- **Traffic nets** actually pass messages for relay.

Al Penney
VO1NO

Net Frequencies

- Nets generally use the same frequency on a regular schedule.
- No one has a "**right**" to a frequency however!
- If you are NCS, you can ask other station to move, but **he is under no obligation to**.
- In that case, move the net 3-5 kHz away.
- If you are asked to move for a scheduled net, **be nice** and move off the frequency.

Al Penney
VO1NO



Nowadays, most HF amateur operation is single sideband (see below). That means your radio will use either the upper sideband (USB) or the lower sideband (LSB) for a particular contact. You can legally use either on any frequency band. But by convention, some frequency bands use one; some use the other. Why?

Lower sideband (LSB)--The common single-sideband operating mode on the 40, 80 and 160-meter amateur bands.

Upper sideband (USB)--The common single-sideband operating mode on the 60, 20, 17, 15, 12 and 10-meter HF amateur bands, and all the VHF and UHF bands.
[Source for both above: http://www.arrl.org/ham-radio-glossary]

It's a historical oddity. Early amateur SSB rigs used a 9 MHz IF system, and it was easier and cheaper to generate LSB below 9 MHz and USB above 9 MHz. With most designs these days, USB and LSB are equally easy to use, but we keep to the old convention.

Ham Radio Lingo

- **DX** – (noun) distant station; (verb) to contact a distant station
- **Alligator** – All mouth, no ears (as in an operator or repeater)
- **Fox hunt** – contest to find a hidden transmitter
- **Harmonics** – a ham's children
- **Hi hi** – laughter on CW – NOT for voice!
- **HT** – Handi-talkie, or handheld transceiver
- **Lid** – a poor operator or generally unpleasant person
- **OM** – Old man – any male ham
- **Pileup** – multiple stations calling a DX or contest station
- **YL** – Young lady – any single female
- **XYL** – a ham's wife – an ex young lady!
- **Zulu** – Coordinated Universal Time e.g.: 2200Z
- More at **http://www.ac6v.com/jargon.php**

Al Penney
VO1NO

Prowords (1)

- **OUT** - This is the end of my transmission to you and no answer is required or expected.
- **OVER** - This is the end of my transmission to you and a response is necessary. Go ahead, transmit.
- **ROGER** - I have received your last transmission satisfactorily. (Note that it does NOT mean "Yes")

Al Penney
VO1NO

Procedure words or **prowords** are words or phrases limited to radio telephone procedure used to facilitate communication by conveying information in a condensed standard verbal format. Prowords are voice versions of the much older prosigns for Morse code first developed in the 1860s for Morse telegraphy, and their meaning is identical. The NATO communications manual ACP-125 contains the most formal and perhaps earliest modern (post-WW-II) glossary of procedure words, but its definitions have been adopted by many other organizations.

Procedure words are one of several structured parts of radio voice procedures, including Brevity codes and Plain language radio checks. The vast majority of the brevity codes from the U.S. military's Multiservice tactical brevity code are inappropriate for any civilian use, owing to their focus on large weapons (missiles, etc.) and other war-related issues. However, a few are used frequently enough in media to be memorable, including ABORT, BOGEY, BANDIT, FEET WET, FEET DRY, NEGATIVE CONTACT, and NO JOY.

OUT

"This is the end of my transmission to you and no answer is required or expected."

OVER

"This is the end of my transmission to you and a response *is* necessary. Go ahead: transmit."

Contrary to popular belief, "OVER" and "OUT" are **never** used at the same time, since their meanings are mutually exclusive.

ROGER

"I have received your last transmission satisfactorily, radio check is LOUD AND CLEAR."

The term originates from the practice of telegraphers sending an "R" to stand for "received" after successfully getting a message. This was extended into the spoken radio realm during World War II, with the "R" changed to the phonetic alphabet equivalent word "Roger". The modern NATO phonetic alphabet uses the word "Romeo" for "R" instead of "Roger", and "Romeo" is sometimes used for the same purpose as "Roger", mainly in Australian maritime operations.

Prowords (2)

- **I SAY AGAIN** - I am repeating transmission or portion indicated.
- **I SPELL** - I shall spell the next word phonetically.
- **DOUBLING** – Two stations unknowingly transmitting at the same time.
- **AFFIRMATIVE** – Yes.

Al Penney
VO1NO

What is doubling?

When two stations try to talk at the same time the signals mix in the repeater's receiver and results in a buzzing sound or loud squawk. When you are involved in a roundtable discussion (more than two people in the conversation) it is always best to pass off to a specific person rather than leave it up in the air. Example: "KØXYZ to take it, this is WØABC" or "Do you have any comments Joe?" or "Over to you Al". Failing to do so is an invitation to chaos and confusion.

Prowords (3)

- **NEGATIVE** – No
- **NOTHING HEARD** - To be used when no reply is received from a called station.
- **SAY AGAIN** - Repeat all of your last transmission. Followed by identification data means Repeat __ (portion indicated)".
- **THIS IS** - This transmission is from the station whose designator immediately follows.

Al Penney
VO1NO

SAY AGAIN

"I have not understood your message, please SAY AGAIN". Usually used with prowords "ALL AFTER" or "ALL BEFORE". Example: radio working between Solent Coastguard and a motor vessel, call-sign EG 93, where part of the initial transmission is unintelligible

- All stations, all stations, this is Solent Coastguard, Solent Coastguard. Be advised large shipping vessel entering Southampton Water, currently at position [transmission unintelligible] OUT

- Solent Coastguard, Solent Coastguard, this is Echo Golf niner three. SAY AGAIN ALL AFTER position. OVER

At this juncture, Solent Coastguard would reply, giving the position of the shipping vessel preceded with the prowords "I SAY AGAIN":

- All stations, all stations, this is Solent Coastguard. I SAY AGAIN, large shipping vessel entering Southampton water, currently at position one decimal two miles from Calshot Spit on bearing one six five degrees. Vessel restricted in ability to deviate from its course. Do not impede. OUT

The word "REPEAT" should not be used in place of "SAY AGAIN", especially in the vicinity of naval or other firing ranges, as "REPEAT" is an artillery proword defined in ACP 125 U.S. Supp-2(A) with the wholly different meaning of "request for the same volume of fire to be fired again with or without corrections or changes" (e.g., at the same coordinates as the previous round).

ALL AFTER…

Please repeat the message you just sent me beginning after the word or phrase said after this proword.

ALL BEFORE…

Please repeat the message you just sent me ending before the word or phrase said after this proword.

UTC or Zulu Time

- **Coordinated Universal Time** – formerly Greenwich Mean Time (GMT).
- Used as a **universal reference time** to avoid confusion over time zones.
- Remember that UTC could be a different date than your own!
- Use **WWV, WWVH or CHU** for accurate time.

Al Penney
VO1NO

Coordinated Universal Time (UTC), also referred to as Greenwich Mean Time (GMT), Universal Time (UT), or "Zulu" is an international time scale used in Amateur Radio, astronomical aviation publications and applications, weather reporting, the military, NASA, and other organizations and documents.

Most Amateur radio operators refer to it as UTC.

UTC uses 24-hour (military) time notation and is based on the local standard time on the 0? longitude meridian which runs through Greenwich, England, hence, Greenwich Mean Time. Midnight in Greenwich corresponds to 00:00 UTC, noon corresponds to 12:00 UTC, and so on. It is a universal "reference" time so anyone who uses it has a "point in time" reference to a specific location.

Therefore, if you are in a different location than the reference location, your local time would be either earlier or later referenced to that UTC location point.

So in a manner of speaking, everyone using UTC, uses the same clock! The UTC time is the same worldwide and does not vary regarding the time zone or daylight saving time. UTC is a very accurate atomic time standard sustained by atomic clocks located in national standards laboratories.

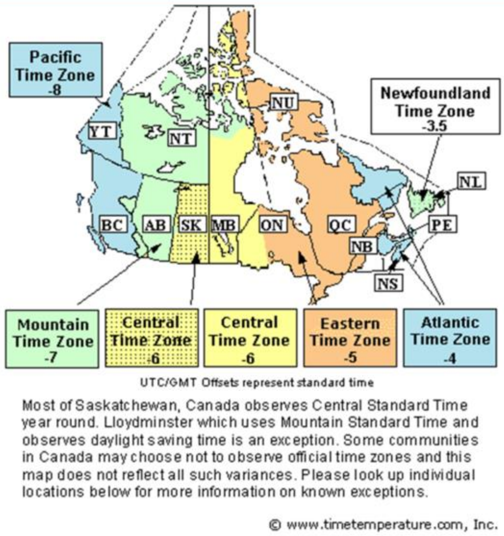
So in other words, it doesn't matter where you travel to, whether you're in a hotel in San Francisco or in one of the many Washington DC hotels, the UTC time is the same. Or for that matter, anywhere on earth, the UTC time is still the same!

How do you know what the correct UTC time is?

Several radio stations worldwide transmit precise time signals on HF bands and other frequencies. NIST (U.S.A.), continuously broadcasts time signals with voice announcements over hf radio frequencies from stations WWV in Fort Collins, Colorado and WWVH in Kauai, Hawaii. Both stations transmit on 2.500, 5.000, 10.000, and 15.000 MHz. WWV also operates on 20.000 MHz.
If your HF transceiver has general coverage, you are in luck...Just tune in one of the frequencies and get the exact time. They transmit on AM and you can use either the AM mode on your receiver or zero beat the frequencies with either the USB or LSB mode to hear the voice modulation.

You can use Canada's Institute for National Measurement station, CHU.
It transmits time signals and voice announcements from Ottawa, Ontario. CHU broadcasts continuously on 3.330, 7.850 MHz, and 14.670 MHz, also AM as with WWV and WWVH.

Canadian Time Zones



NOTE: During Daylight Savings Time (DST) reduce offsets by 1 hour from offsets shown (i.e.: -4 goes to -3.

Al Penney
VO1NO

RST System

- Used to indicate the quality of a station's signal.
- Rating uses 3 parameters:
  - Readability;
  - Strength; and
  - Tone (for CW signals only).

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VO1NO

The **R-S-T system** is used by amateur radio operators, shortwave listeners, and other radio hobbyists to exchange information about the quality of a radio signal being received. The code is a three digit number, with one digit each for conveying an assessment of the signal's readability, strength, and tone. The code was developed in 1934 by Amateur radio operator Arthur W. Braaten, W2BSR, and was similar to that codified in the ITU Radio Regulations, Cairo, 1938.

Readability

The **R** stands for "Readability". Readability is a qualitative assessment of how easy or difficult it is to correctly copy the information being sent during the transmission. In a Morse code telegraphy transmission, readability refers to how easy or difficult it is to distinguish each of the characters in the text of the message being sent; in a voice transmission, readability refers to how easy or difficult it is for each spoken word to be understood correctly. Readability is measured on a scale of 1 to 5.

1. Unreadable
2. Barely readable, occasional words distinguishable

3. Readable with considerable difficulty
4. Readable with practically no difficulty
5. Perfectly readable

Strength

The **S** stands for "Strength". Strength is an assessment of how powerful the received signal is at the receiving location. Although an accurate signal strength meter can determine a quantitative value for signal strength, in practice this portion of the RST code is a qualitative assessment, often made based on the S meter of the radio receiver at the location of signal reception. "Strength" is measured on a scale of 1 to 9.

1. Faint—signals barely perceptible
2. Very weak signals
3. Weak signals
4. Fair signals
5. Fairly good signals
6. Good signals
7. Moderately strong signals
8. Strong signals
9. Extremely strong signals

For a quantitative assessment, quality HF receivers are calibrated so that S9 on the S-meter corresponds to a signal of 50 μV at the antenna standard terminal impedance 50 ohms. One "S" difference should correspond to 6 dB at signal strength (2x voltage = 4x power). On VHF and UHF receivers used for weak signal communications, S9 often corresponds to 5 μV at the antenna terminal 50 ohms. Amateur radio (ham) operators may also use a signal strength of "20 to 60 over 9", or "+20 to +60 over 9." This is in reference to a signal that exceeds S9 on a signal meter on a HF receiver.

Tone

The **T** stands for "Tone" and is measured on a scale of 1 to 9. Tone only pertains to Morse code and other digital transmission modes and is therefore omitted during voice operations. With modern technology, imperfections in the quality of transmitters' digital modulation severe enough to be detected by human ears are rare.

1 - Sixty cycle a.c or less, very rough and broad

2 - Very rough a.c., very harsh and broad

3 - Rough a.c. tone, rectified but not filtered

4 - Rough note, some trace of filtering

5 - Filtered rectified a.c. but strongly ripple-modulated

6 - Filtered tone, definite trace of ripple modulation

7 - Near pure tone, trace of ripple modulation

8 - Near perfect tone, slight trace of modulation

9 - Perfect tone, no trace of ripple or modulation of any kind

Suffixes were historically added to indicate other signal properties, and might be sent as **599K** to indicate a clear, strong signal but with bothersome key clicks.

Suffix code Meaning

A - signal distorted by auroral propagation

C - "chirp" (frequency shift when keying)

K - key clicks

M - signal distorted by multipath propagation

S - signal distorted by scatter propagation

X - stable frequency (crystal control)

Variations

An example RST report for a voice transmission is "59", usually pronounced "five nine" or "five by nine", a report that indicates a perfectly readable and very strong signal. Exceptionally strong signals are designated by the quantitative number of decibels, in excess of "S9", displayed on the receiver's S meter. Example: "Your signal is 30 dB over S9," or more simply, "Your signal is 30 over 9."

Because the N character in Morse code requires less time to send than the 9, during amateur radio contests where the competing amateur radio stations are all using Morse code, the nines in the RST are typically abbreviated to N to read 5NN. In general, this practice is referred to as abbreviated or "cut" numbers.

RST System

No.	Readability	Signal Strength	Tone (Morse Code)
1	Unreadable	Faint	Harsh tone with hum
2	Barely readable	Very weak	Harsh tone with modulation
3	Readable with difficulty	Weak	Rough tone with hum
4	Almost perfectly Readable	Fair	Rough tone with modulation
5	Perfectly Readable	Fairly good	Wavering tone, strong hum
6	-	Good	Wavering tone, strong modulation
7	-	Moderately strong	Good tone, slight hum
8	-	Strong	Good tone, slight modulation
9	-	Very strong	Perfect tone, no hum or modulation

Al Penney
VO1NO

Repeater Signal Reports

- If asked for a signal report on a repeater do not give strength of repeater's signal.
- Listen to amount of **white noise** on other station's signal into the repeater.
- No white noise = **Full quieting**.
- More white noise means a weaker signal into repeater.

Al Penney
VO1NO

Signal reports

If you request a signal report from someone on a repeater remember that all you will get is an indication of how well you are "getting into the repeater". The signal strength report you receive will be a report of the repeater's performance, not yours!

I have actually heard stations say, "You are full scale here", when asked for a signal report. You're not full scale, the repeater is! If you are testing with different radios or antenna systems, you would be better off finding a station to work simplex (direct contact on a single frequency). Then any changes you make while you are testing will be directly reflected in the signal report relative to that station.

What is full quieting?

When you hear a station tell another station that their signal is full quieting it means that they are getting into the repeater with no noise on their signal. You will notice that weaker signals will have what is often described as "white noise" sounds in the background. If your signal is strong enough to fully quiet the repeater's receiver when there is no audio (your voice) then you are full quieting.

Signal Reports on a Repeater

Lots of new hams don't understand that the S meter on their radio is only reporting the relative strength of the repeater system and NOT the signal strength of the station they are talking to unless they are in the simplex mode. When the repeater is transmitting, it may have an output greatly exceeding that of the station IT is listening to. Remember the station it hears on the input frequency of it's receiver may be on a hand held radio and only a few blocks from the "machine" or it could be a mobile radio in a vehicle out on the fringes of the repeater coverage area or a base station running a high gain antenna and 100 watts from the next county or in some cases, the next state. To a third party, (another ham), listening to the machine on the repeater output, all of these stations would have the same S meter reading on his S meter! As long as the repeater can detect the signals and is working properly as it is setup, then all stations, (to the third ham), will "appear" to have the same signal strength on the S meter. Remember, the S meter is only reporting the relative strength of the repeater when it is transmitting and not the individual stations! So all that being said, how do you give an accurate signal report to the station you are talking to?

JUST USE PLAIN ENGLISH!

Listen to the background sounds of his AUDIO coming from your speaker in between words and sentences. Don't even look at your S meter. (Assuming the repeater has a good strong signal into your location).

If there is no noise other than room background, road, passenger or other sounds that could be picked up by his microphone, then he would be said to have a FULL QUIETING signal into the repeater.....receiver. NOT 50 OVER S9, S9, OR ANY COMBINATION on your S meter. The term "Quieting" refers to the carrier level of the transmitter being strong enough to "quiet" the background hiss on the frequency. If some background noise such as the hiss that is commonly heard in an FM receiver is heard on the transmitter signal, then it would not be considered "FULL QUIETING". There are times when either station using a repeater may be getting into the repeater receiver with very little signal and the repeated signal will have lots of noise on it. Although the repeater signal may be full quieting when the weak station stops transmitting, the weak station can not be considered to be full quieting into the repeater so you would give the other station a report on his

signal and not the repeater. Don't get confused with this. If his audio is perfectly understandable with 100 % copy and there is NO "noise" in the background other than the above, then an accurate report for him would be, "You're full quieting and 100 % copy into the repeater. Anything less than the above is usually given in various ways using an exact as possible description of his signal. "Audio" reports are a matter of interpretation by individual ears. We as hams are in the "business" of communications , not HI FI broadcast FM! We can only *sound* as good as the FCC will allow our transmitters to sound! If you are having extreme difficulty copying the other station, he may also be having the same problem with you, but remember he is hearing the repeater signal, not yours direct and so are you. Try to get him to go "simplex" if he is coming closer to you in a few minutes. See hint below. If the transmissions get so ruff that neither can copy the other, then just give your call sign and clear off the repeater for others to use while he gets closer or higher or changes his transmitting setup. Not all conversations are completed to the end under adverse conditions or operating situations....be patient.

Azimuthal Equidistant Map

- All points are **scale distance** from center.
- All points are at **actual azimuth from center**.
- Makes it easy to determine **proper direction** to point directional antennas.
- Long path is **180 degrees** from direct.
- Custom maps available at: https://ns6t.net/azimuth/azimuth.html

Al Penney
VO1NO

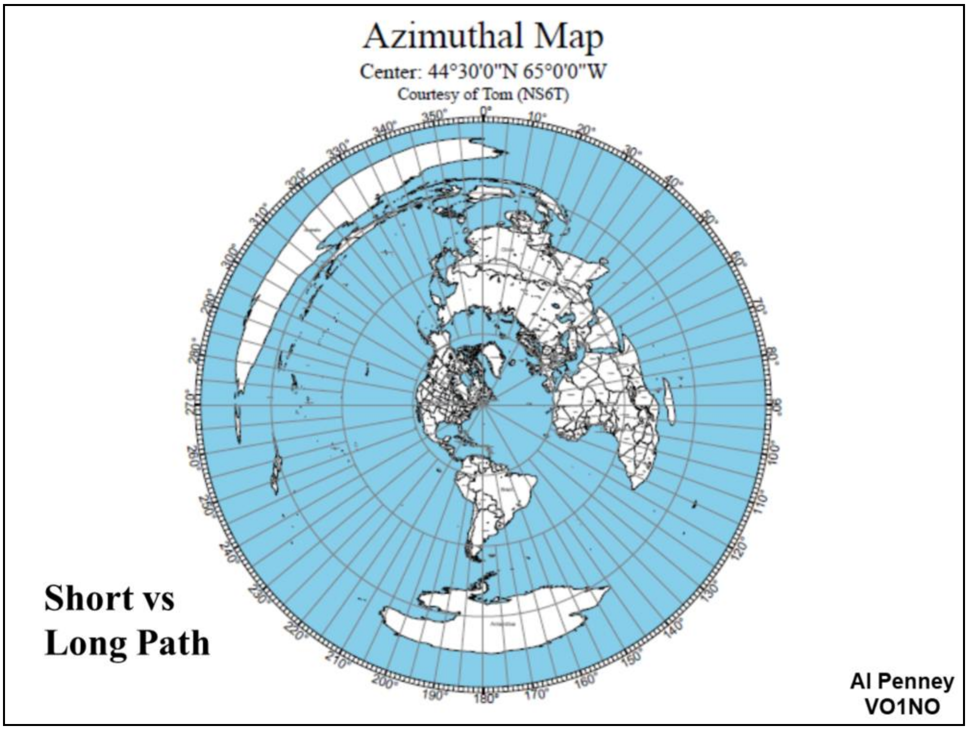
The **azimuthal equidistant projection** is an azimuthal map projection. It has the useful properties that all points on the map are at proportionally correct distances from the center point, and that all points on the map are at the correct azimuth (direction) from the center point. A useful application for this type of projection is a polar projection which shows all meridians (lines of longitude) as straight, with distances from the pole represented correctly

Limitations

With the circumference of the Earth being approximately 40,000 km (24,855 mi), the maximum distance that can be displayed on an azimuthal equidistant projection map is half the circumference, or about 20,000 km (12,427 mi). For distances less than 10,000 km (6,214 mi) distortions are minimal. For distances 10,000–15,000 km (6,214–9,321 mi) the distortions are moderate. Distances greater than 15,000 km (9,321 mi) are severely distorted.

If the azimuthal equidistant projection map is centered about a point whose antipodal point lies on land and the map is extended to the maximum distance of 20,000 km (12,427 mi) the antipode point smears into a large circle

Azimuthal equidistant projection maps can be useful in terrestrial point to point communication. This type of projection allows the operator to easily determine in which direction to point their directional antenna. The operator simply finds on the map the location of the target transmitter or receiver (i.e. the other antenna being communicated with) and uses the map to determine the azimuth angle needed to point the operator's antenna. The operator would use an electric rotator to point the antenna. The map can also be used in one way communication. For example if the operator is looking to receive signals from a distant radio station, this type of projection could help identify the direction of the distant radio station. In order for the map to be useful, the map should be centered as close as possible about the location of the operator's antenna.


Azimuthal Map
Center: 44°30'0"N 65°0'0"W
Courtesy of Tom (NS6T)
Short vs
Long Path
Al Penney
VO1NO

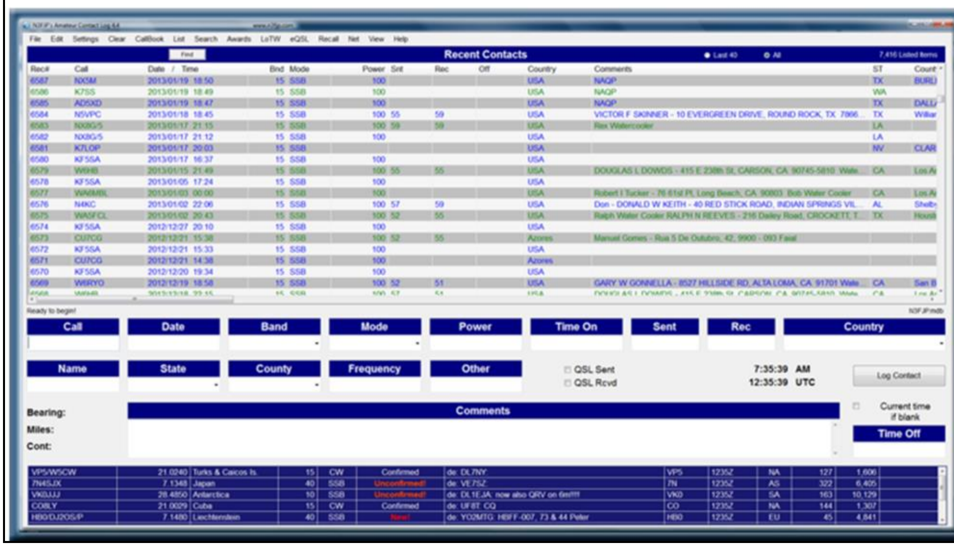
QSO Logging

- **Not** a **legal requirement** in Canada.
- Good idea regardless, for awards, fond memories and especially if you face EMI/RFI complaints.
- Can log on **paper**, or **electronically**.
- Should include times you transmitted but had no replies.

Al Penney
VO1NO

DATE TIME	STATION CALLED	CALLED BY	HIS SIGNAL RST	MY SIGNAL RST	FREQ.	EMISSION TYPE	POWER INPUT WATTS	TIME OF ENDING QSO	OTHER DATA NAME	QSLs S	QSLs R
9/10/78											
14:58	WDØFTR	x	599	599	7.13	A-1	100	14:83	HUGH	X	X
9/19/78											
19:53	WB7WOW	x	599	579	21.14	A-1	60	20:25	BOB	X	
9/23/78											
13:16	KA9CDP	x	579	599	7.13	A-1	100	14:08	BILL	X	X
14:09	WØIYT	x	599	599+	7.13	A-1	100	14:38	JOE	X	X
9/24/78											
21:25	KA8BHL	x	579	589	7.11	A-1	100	21:53	ED	X	X
9/30/78											
07:55	WØIDI	x	589	599	7.1	A-1	100	08:10	ALLEN	X	
10:55	KAØBDE	x	579	599	7.13	A-1	100	10:08	DOUG	X	X
10:08	NØAFY	x	599	599	7.13	A-1	100	10:30	BOB	X	X
13:10	WBØ2CT	x	579	599	7.13	A-1	100	13:25	FRED	X	X
10/1/78											
14:55	WD9IVI	x	589	599	7.12	A-1	100	15:15	GREG	X	X
10/2/78											
16:15	KA9BKJ	x	579	599C	7.14	A-1	100	17:53	TERRY	X	X
18:15	WD4IAG	x	579	459	7.14	A-1	100	18:27	PAUL	X	X
10/3/78											
17:00	KAØADR	x	579	579	7.13	A-1	100	17:15	KELLY	X	X
10/4/78											
17:40	KAØBRL	x	589	599	7.13	A-1	100	17:55	MORGAN	X	
21:00	WD5CRE	x	579	589	21.15	A-1	60	21:20	CHARLES	X	X
10/5/78											
17:45	WB2PJT	x	489	387	21.14	A-1	60	18:03	BRENT		
10/7/78											
10:35	K8KGL	x	589	599	7.12	A-1	100	10:48	GRANT		

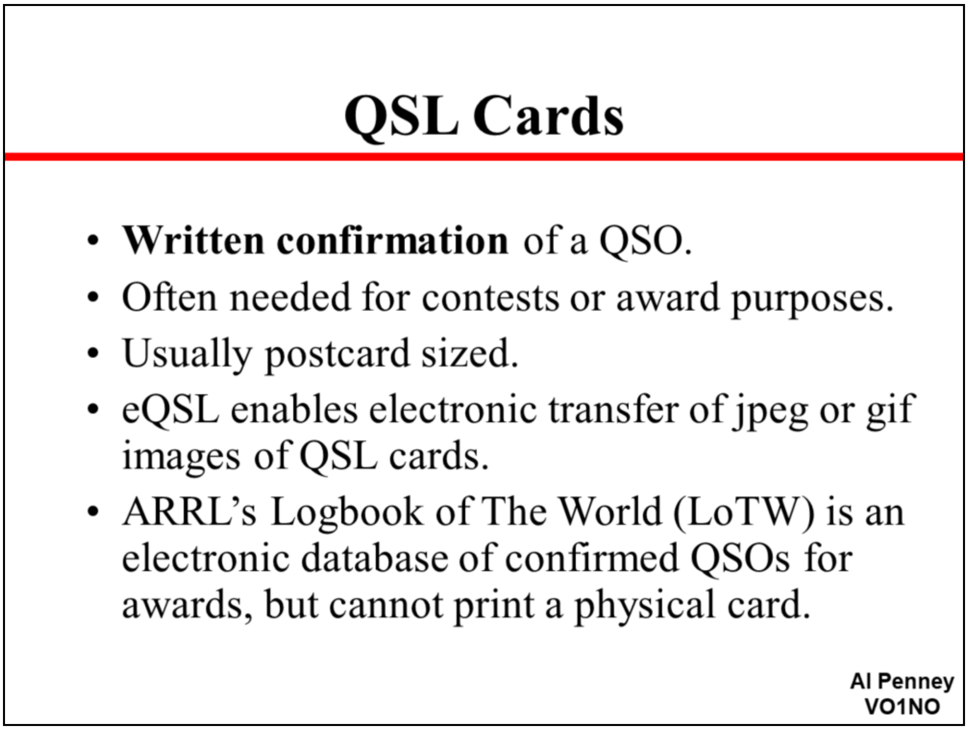
Logging Software



Signal Bandwidth

- Any **modulated signal** occupies a **finite space** in the **EM spectrum** called its **bandwidth.**
- The EM spectrum is a **valuable, finite, resource.**
- In order of bandwidth **(narrow to wide):**
  - **CW** 100 Hz wide 150 – 500 Hz spacing
  - **RTTY** 250 Hz wide 250 – 500 Hz spacing
  - **SSB** 2.7 KHz wide 3 KHz spacing
  - **FM** 15 KHz wide 15 KHz spacing

Al Penney
VO1NO



A **QSL card** is a written confirmation of either a two-way radiocommunication between two amateur radio stations; a one-way reception of a signal from an AM radio, FM radio, television or shortwave broadcasting station; or the reception of a two-way radiocommunication by a third party listener. A typical QSL card is the same size and made from the same material as a typical postcard, and most are sent through the mail as such.

QSL card derived its name from the Q code "QSL". A Q code message can stand for a statement or a question (when the code is followed by a question mark). In this case, 'QSL?' (note the question mark) means "Do you confirm receipt of my transmission?" while 'QSL' (without a question mark) means "I confirm receipt of your transmission.".

Use in amateur radio

Amateur radio operators exchange QSL cards to confirm two-way radio contact between stations. Each card contains details about one or more contacts, the station and its operator. At a minimum, this includes the call sign of both stations participating in the contact, the time and date when it occurred (usually specified in UTC), the radio frequency or band used, the mode of transmission used, and a signal report. The International Amateur Radio Union and its member societies recommend a maximum size of 3½ by 5½ inches (140 mm by 90 mm).

QSL cards are a ham radio operator's calling card and are frequently an expression of individual creativity — from a photo of the operator at their station to original artwork, images of the operator's home town or surrounding countryside, etc. They are frequently created with a good dose of individual pride. Consequently, the collecting of QSL cards of especially interesting designs has become an add-on hobby to the simple gathering of printed documentation of a ham's communications over the course of his or her radio career.

Normally sent using ordinary, international postal systems, QSL cards can be sent either *direct* to an individual's address, or via a country's centralized amateur radio association *QSL bureau*, which collects and distributes cards for that country. This saves postage fees for the sender by sending several cards destined for a single country in one envelope, or large numbers of cards using parcel services. The price for lower postage, however, is a delay in reaching its destination because of the extra handling time involved. In addition to such *incoming* bureaus, there are also *outgoing* bureaus in some countries. These bureaus offer a further postage savings by accepting cards destined for many different countries and repackaging them together into bundles that are sent to specific incoming bureaus in other countries. Most QSL bureaus operated by national amateur radio societies are both incoming and outgoing, with the notable exception of the United States of America, and are coordinated by the International Amateur Radio Union (IARU).

For *rare* countries, that is ones where there are very few amateur radio operators, places with no reliable (or even existing) postal systems, including expeditions to remote areas, a volunteer *QSL manager* may handle the mailing of cards. For expeditions this may amount to thousands of cards, and payment for at least postage is appreciated, and is required for a *direct* reply (as opposed to a return via a bureau).

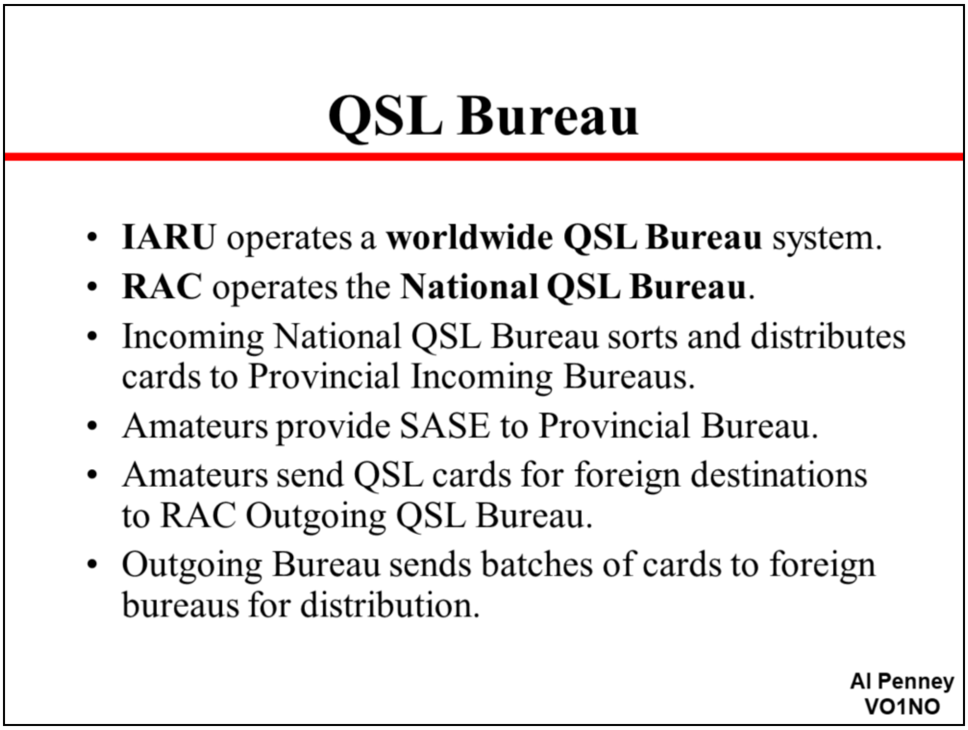
The Internet has enabled electronic notification as an alternative to mailing a physical card. These systems use computer databases to store the same information normally verified by QSL cards, in an electronic format. Some sponsors of amateur radio operating awards, which normally accept QSL cards for proof of contacts, may also recognize a specific electronic QSL system in verifying award applications.

- One such system, called eQSL, enables electronic exchange of QSLs as jpeg or gif images which can then be printed as cards on the recipient's local inkjet or laser printer, or displayed on the computer monitor. Many logging programs now have direct electronic interfaces to transmit QSO details in real-time into the eQSL.cc database. *CQ Amateur Radio* magazine began accepting electronic QSLs from eQSL.cc for its four award programs in January 2009. 10-10 has been accepting eQSLs since 2002.

•Another system, the ARRL's Logbook of The World (LoTW), allows confirmations to be submitted electronically for that organization's DX Century Club and Worked All States awards. Confirmations are in the form of database records, electronically signed with the private key of the sender. This system simply matches database records but does not allow creation of pictorial QSL cards.

Even in the presence of electronic QSLs, physical QSL cards are often fine historical or sentimental keepsakes of a memorable location heard or worked, or a pleasant contact with a new radio friend, and serious hams may have thousands of them. Some cards are plain, while others are multicolored and may be oversized or double paged.


ZA1HA
Albania
CY9CWI
SOUTH POLE
KC4USN
NAVY
SUPPORTS
SCIENTIFIC
RESEARCH
QTH
ANTARCTICA
P4ØAV
ARUBA
"One Happy Island"
JD1BMM
Minami-Torishima Japan
XM2CWI
ZD7MY
ST. HELENA ISLAND
SOUTH ATLANTIC
Western Kiribati DXpedition 2019
T3ØGC
CQ 31 ITU 65 Loc. RJ61ni
Tarawa Atoll



Member societies of the International Amateur Radio Union (IARU) operate a worldwide system of QSL Bureaus. Radio Amateurs of Canada as the Canadian member-society, operates a National Incoming Bureau.

Cards received from IARU member societies by the RAC National Incoming Bureau are sorted and forwarded to the Incoming Bureau in each call area.

All domestic cards (VA-VE-VY) to Canadian Amateurs should be sent directly to the RAC National Incoming Bureau and ***not*** to the Outgoing Bureau. Domestic cards sent to the Outgoing Bureau will experience a delay. Only cards for destinations ***outside*** Canada are to be sent to the Outgoing QSL Bureau.

Note: This QSL service is only available to RAC members and RAC Affiliated Clubs as a benefit of RAC membership.

The RAC Incoming Bureau sorts and distributes QSL cards to all Canadians (members and non-members) via the call area bureaus. However, some Canadian Amateurs, like others around the world, have indicated that they will not accept cards through the QSL

Bureau. Most indicate this on various websites like QRZ.com and others, yet thousands of cards are still sent and received each year incurring unnecessary costs for the bureaus and the amateur. Bureaus in some countries do not accept cards for non-members of their national society and dispose of undeliverable cards. They are not returned to sender for economical and environmental reasons.

SASE = Self-Addressed Stamped Envelope

Station Identification

- By Canadian regulations, stations must transmit identification:
  - **At start of QSO**;
  - **At end of QSO**; and
  - At **intervals not exceeding 30 minutes**.
- Do **NOT** say "This is VEXXXX for ID"!!
- If I hear you saying that on the air, I will smack you with a dirty balun!

Al Penney
VO1NO

Contesting

- Competitive events where Amateurs contact as many other stations as possible.
- Specified entities, dates, times, bands, modes.
- Often includes an exchange e.g.: signal report and QSO serial number,
- Logs submitted to contest sponsor for ranking and awards.

Al Penney
VO1NO

Contesting (also known as *radiosport*) is a competitive activity pursued by amateur radio operators. In a contest, an amateur radio station, which may be operated by an individual or a team, seeks to contact as many other amateur radio stations as possible in a given period of time and exchange information. Rules for each competition define the amateur radio bands, the mode of communication that may be used, and the kind of information that must be exchanged. The contacts made during the contest contribute to a score by which stations are ranked. Contest sponsors publish the results in magazines and on web sites.

Contesting grew out of other amateur radio activities in the 1920s and 1930s. As intercontinental communications with amateur radio became more common, competitions were formed to challenge stations to make as many contacts as possible with amateur radio stations in other countries. Contests were also formed to provide opportunities for amateur radio operators to practice their message handling skills, used for routine or emergency communications across long distances. Over time, the number and variety of radio contests has increased, and many amateur radio operators today pursue the sport as their primary amateur radio activity.

There is no international authority or governance organization for this sport. Each competition is sponsored separately and has its own set of rules. Contest rules do not necessarily require entrants to comply with voluntary international band plans. Participants must, however, adhere to the amateur radio regulations of the country in which they are located. Because radio contests take place using amateur radio, competitors are generally forbidden by their national amateur radio regulations from being compensated financially for their activity. High levels of amateur radio contest activity, and contesters failing to comply with international band plans, can result in friction between contest participants and other amateur radio users of the same radio spectrum.

CQ Worldwide Contest Exchange

Station 1: **CQ contest Mike Two Whiskey, Mike Two Whiskey, contest.**
(Station M2W is soliciting a contact in the contest)

Station 2: **Zulu Lima Six Quebec Hotel**
(The station calling, ZL6QH, gives only his callsign. No more information is needed.)

Station 1: **ZL6QH 59 14 (said as "five nine one four").**
(M2W confirms the ZL6QH call sign, sends a signal report of 59, and is in Zone 14 (Western Europe)).

Station 2: **Thanks 59 32 (said as "five nine three two").**
(ZL6QH confirms reception of M2W's exchange, sends a signal report of 59, and is in Zone 32 (South Pacific).)

Station 1: **73. Mike Two Whiskey QRZ?**
(M2W confirms ZL6QH's exchange, is now listening for new stations.)

Al Penney
VO1NO

Contacts between stations in a contest are often brief. A typical exchange between two stations on voice — in this case between a station in England and one in New Zealand in the CQ World Wide DX Contest — might proceed as above.

Contesting basics

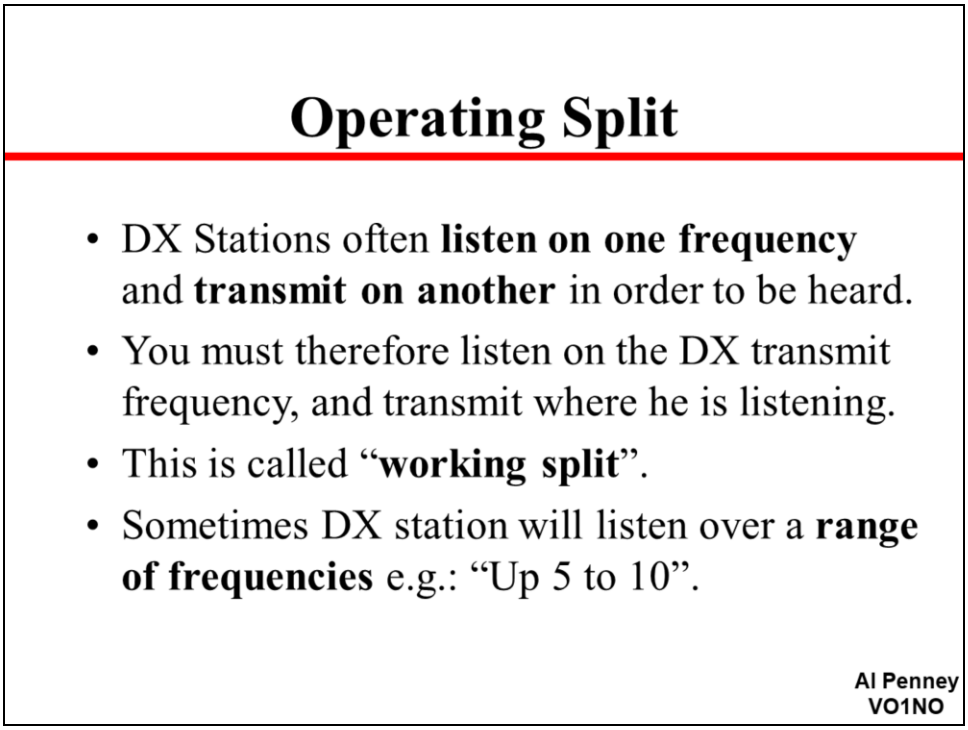
Radio contests are principally sponsored by amateur radio societies, radio clubs, or radio enthusiast magazines. These organizations publish the rules for the event, collect the operational logs from all stations that operate in the event, cross-check the logs to generate a score for each station, and then publish the results in a magazine, in a society journal, or on a web site. Because the competitions are between stations licensed in the Amateur Radio Service (with the exception of certain contests which sponsor awards for shortwave listeners), which prohibits the use of radio frequencies for pecuniary interests, there are no professional radio contests or professional contesters, and any awards granted by the contest sponsors are typically limited to paper certificates, plaques, or trophies.

During a radio contest, each station attempts to establish two-way contact with other licensed amateur radio stations and exchange information specific to that contest. The information exchanged could include an R-S-T system signal report, a name, the national region, i.e. a province or US state, in which the station is located, the geographic zone in which the station is located, the Maidenhead grid locator in which the station is located, the age of the operator, or an incrementing serial number. For each contact, the radio operator must correctly receive the call sign of the other station, as well as the information in the "exchange", and record this data, along with the time of the contact and the band or frequency that was used to make the contact, in a log.

A contest score is computed based on a formula defined for that contest. A typical formula assigns some number of points for each contact, and a "multiplier" based on some aspect of the exchanged information. Often, rules for contests held on the VHF amateur radio bands assign a new multiplier for each new Maidenhead grid locator in the log, rewarding the competitors that make contacts with other stations in the most locations. Many HF contests reward stations with a new multiplier for contacts with stations in each country - often based on the "entities" listed on the DXCC country list maintained by the American Radio Relay League ("ARRL"). Depending on the rules for a particular contest, each multiplier may count once on each radio band or only once during the contest, regardless of the radio band on which the multiplier was first earned. The points earned for each contact can be a fixed amount per contact, or can vary based on a geographical relationship such as whether or not the communications crossed a continental or political boundary. Some contests, such as the Stew Perry Top Band Distance Challenge, award points are scaled to the distance separating the two stations.[4] Most contests held in Europe on the VHF and microwave bands award 1 point per kilometre of distance between the stations making each contact.

After they are received by the contest sponsor, logs are checked for accuracy. Points can be deducted or credit and multipliers lost if there are errors in the log data for a given contact. Depending on the scoring formula used, the resulting scores of any particular contest can be either a small number of points or in the millions of points. Most contests offer multiple entry categories, and declare winners in each category. Some contests also declare regional winners for specific geographic subdivisions, such as continents, countries, U.S. states, or Canadian provinces.

The most common entry category is the single operator category and variations thereof, in which only one individual operates a radio station for the entire duration of the contest. Subdivisions of the single operator category are often made based on the highest power output levels used during the contest, such as a QRP category for single operator stations using no more than five watts of output power, or a High Power category that allows stations to transmit with as much output power as their license permits. Multi-operator categories allow for teams of individuals to operate from a single station, and may either allow for a single radio transmitter or several to be in use simultaneously on different amateur radio bands. Many contests also offer team or club competitions in which the scores of multiple radio stations are combined and ranked.



HAM RADIO 101 - What is Split Operation in Ham Radio?

Posted by OnAllBands on June 24, 2019 at 8:43 pm

Split means transmitting on one frequency and listening on another. This helps everyone hear the DX station better so they can time their calls, follow instructions, and not create unnecessary interference. Expect the DXpedition to operate "split" while the pileups are medium to large, possibly up until the last few days of the operation.

A typical DXpedition might transmit on 14.195 MHz and specify they are listening "from 14.200 to 14.210." Your receiver should be set to receive on 14.195 MHz and transmit somewhere in the 14.2 to 14.21 range. This is typically done by using the VFO A and VFO B settings (VFO stands for variable-frequency oscillator). Most transceivers have a "SPLIT" button or menu item that alternates between the VFO on receive and transmit. The transceiver manual will have instructions on how to do this.

Practice setting your VFOs, say with a friend on the air, and get used to setting the VFO used for transmitting to different frequencies a few kHz away from the DX transmitting frequency. On CW (Morse code) and

RTTY (radioteletype), the typical shift in frequency is 2-5 or 10 kHz. The DX station will send “UP” or something like “UP 2” after completing a contact.

Certain rigs, such as the ICOM **IC-7610 HF/50MHz All Mode Transceiver**, have independent dual receivers, making it convenient to listen to both sides of a DX station running a split. Here’s a video from DX Engineering customer/technical support specialist **Mark W8BBQ on DXing tips**, including how to work split operation.

Operating Split

- Must have **2 VFOs**, one tuned to the **DX stations' TX frequency**, the other to the **DX station's RX frequency**.
- Activate "**Split**" function to RX on one VFO and TX on the other (check manual).
- **PRACTICE** doing this **BEFORE** trying to work the rare DX station!
- Don't give the "frequency cops" an excuse to be Lids!

Al Penney
VO1NO

Operating Split

- VFO A tuned to 14.200 (DX TX frequency)
- VFO B tuned to 14.210 (DX RX frequency)

PTT not pressed:

PTT not pressed 14.200 ⇦A B⇨14.210

PTT pressed:

PTT pressed 14.210 ⇦B A⇨14.200

Al Penney
VO1NO

Digital Modes

- **Digital** refers to a set of points that have **only 2 values** – on/off, 1 and 0, up or down etc.
- In Amateur Radio, this generally refers to **computer to computer**, or at least **terminal to terminal** systems.
- **Characters** are coded with a **series of 1's and 0's** called **bits.**
- A series of **8 related bits** is called a **byte.**

Al Penney
VO1NO

The **byte** is a unit of digital information that most commonly consists of eight bits. Historically, the byte was the number of bits used to encode a single character of text in a computer and for this reason it is the smallest addressable unit of memory in many computer architectures.

Digital Coding

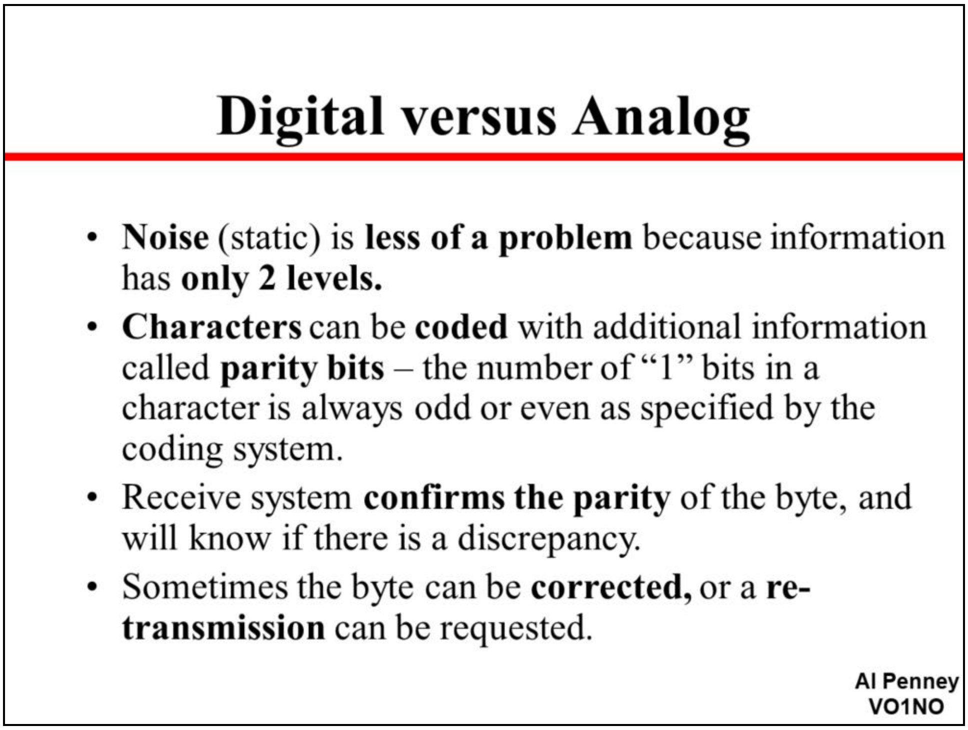
- A **byte** could have up to **256 different values** (2^8 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2).
- The rate of signalling is called the **baud,** which indicates the **number of signal changes per second.**
- **One signal change** could carry **more than one bit of information,** so a signal at 2400 baud could reflect a data transmission rate of 9600 bits per second for example.

Al Penney
VO1NO

In telecommunication and electronics, **baud** is a common measure of symbol rate, which is one of the components that determine the speed of communication over a data channel.

It is the unit for symbol rate or modulation rate in *symbols per second* or *pulses per second*. It is the number of distinct symbol changes (signaling events) made to the transmission medium per second in a digitally modulated signal or a bd rate line code.

Baud is related to gross bit rate, which can be expressed in bits per second. If there are precisely two symbols in the system (typically 0 and 1), then baud and bit per second (bit/s) are equivalent.



Analog and digital signals are different types which are mainly used to carry the data from one apparatus to another. Analog signals are continuous wave signals that change with time period whereas digital is a discrete signal is a nature. The main difference between analog and digital signals is, analog signals are represented with the sine waves whereas digital signals are represented with square waves. Let us discuss some dissimilarity of analog & digital signals. The best example of an analog and digital is electrons because it deals with analog as well as digital signals, input & outputs. In some way, an **electronics project** mainly interacts by the real analog world whereas digital signals with computers, microprocessors, and logic units. These two kinds of signals are similar to different electronic languages. As some of the other languages can only recognize as well as speak one of the two. This article discusses an overview of both analog as well as digital signals, and comparison between them.

What is Analog and Digital Signal?

An analog signal is one type of continuous time-varying signals, and these are classified into composite and simple signals. A simple type of analog signal is nothing but a sine wave, and that can't be decomposed, whereas a composite type analog signal can be decomposed into numerous sine waves. An analog signal can be defined by using amplitude, time period otherwise frequency, & phase. Amplitude streaks the highest height of the signal, frequency streaks the rate at which an analog signal is varying, and phase streaks the signal position with respect to time nothing. An analog signal is not resistant toward the noise, therefore; it faces distortion as well as reduces the transmission quality. The analog signal value range cannot be fixed.

Digital signals are more resistant toward the noise; therefore, it barely faces some distortion. These waves are simple in transmitting as well as more dependable while contrasted to analog waves. Digital signals include a limited variety of values which lies among 0-to-1.

Analog signal is a continuous signal in which one time-varying quantity represents another time-based variable. These kind of signals works with physical values and natural phenomena such as earthquake, frequency, volcano, speed of wind, weight, lighting, etc.

What is a Digital Signal?

A digital signal is a signal that is used to represent data as a sequence of separate values at any point in time. It can only take on one of a fixed number of values. This type of signal represents a real number within a constant range of values.

Characteristics OF Analog Signal

Here, are essential characteristics of Analog Signal

•These type of electronic signals are time-varying

•Minimum and maximum values which is either positive or negative.

•It can be either periodic or non-periodic.

•Analog Signal works on continuous data.

•The accuracy of the analog signal is not high when compared to the digital signal.

•It helps you to measure natural or physical values.

•Analog signal output form is like Curve, Line, or Graph, so it may not be meaningful to all.

Characteristics of Digital Signals

Here, are essential characteristics of Digital signals

•Digital signal are continuous signals

•This type of electronic l signals can be processed and transmitted better compared to analog signal.

•Digital signals are versatile, so it is widely used.

•The accuracy of the digital signal is better than that of the analog signal.

Advantages of Analog Signals

Here, are pros/benefits of Analog Signals

•Easier in processing

•Best suited for audio and video transmission.

•It has a low cost and is portable.

•It has a much higher density so that it can present more refined information.

•Not necessary to buy a new graphics board.

•Uses less bandwidth than digital sounds

•Provide more accurate representation of a sound

•It is the natural form of a sound.

Advantages of Digital Signals

Here, are pros/advantages of Digital Signals:

•Digital data can be easily compressed.

•Any information in the digital form can be encrypted.

•Equipment that uses digital signals is more common and less expensive.

•Digital signal makes running instruments free from observation errors like parallax and approximation errors.

•A lot of editing tools are available

•You can edit the sound without altering the original copy

•Easy to transmit the data over networks

Disadvantages of Analog Signals

Here are cons/drawback of Analog Signals:

•Analog tends to have a lower quality signal than digital.

•The cables are sensitive to external influences.

•The cost of the Analog wire is high and not easily portable.

•Low availability of models with digital interfaces.

•Recording analog sound on tape is quite expensive if the tape is damaged

•It offers limitations in editing

•Tape is becoming hard to find

•It is quite difficult to synchronize analog sound

•Quality is easily lost

•Data can become corrupted

•Plenty of recording devices and formats which can become confusing to store a digital signal

•Digital sounds can cut an analog sound wave which means that you can't get a perfect reproduction of a sound

•Offers poor multi-user interfaces

Disadvantage of Digital Signals

•Sampling may cause loss of information.

•A/D and D/A demands mixed-signal hardware

•Processor speed is limited

•Develop quantization and round-off errors

•It requires greater bandwidth

•Systems and processing is more complex.

KEY DIFFERENCES:

•An analog signal is a continuous signal whereas Digital signals are time separated signals.

•Analog signal is denoted by sine waves while It is denoted by square waves

•Analog signal uses a continuous range of values that help you to represent information on the other hand digital signal uses discrete 0 and 1 to represent information.

•The analog signal bandwidth is low while the bandwidth of the digital signal is high.

•Analog instruments give considerable observational errors whereas Digital instruments never cause any kind of observational errors.

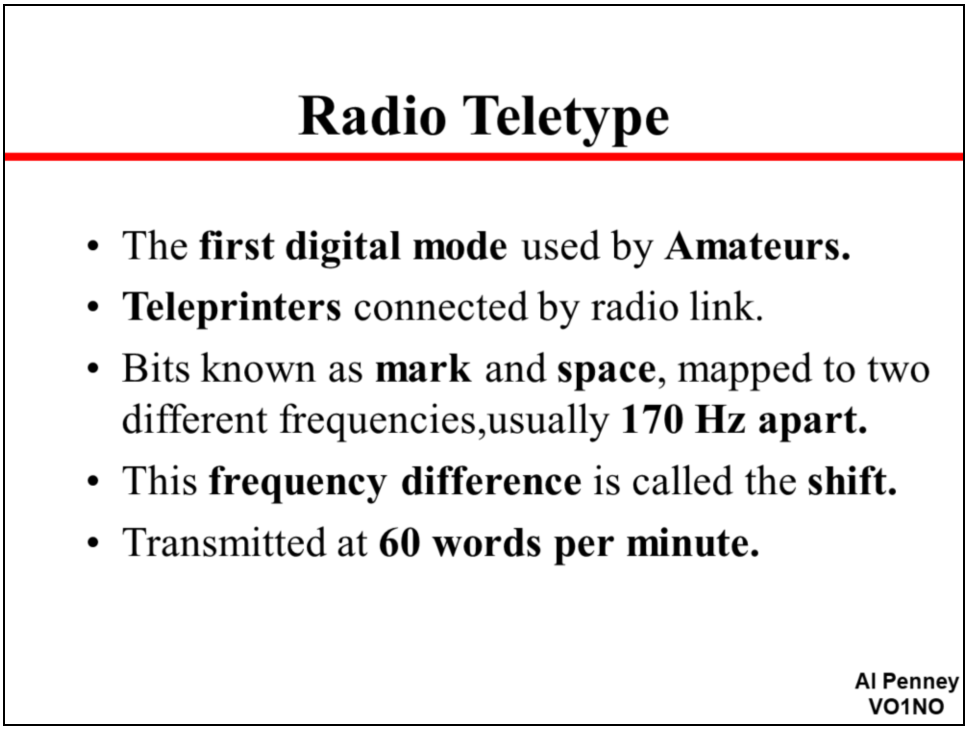
•Analog hardware never offers flexible implementation, but Digital hardware offers flexibility in implementation.

•Analog signals are suited for audio and video transmission while Digital signals are suited for Computing and digital electronics.

Parity Bits

A **parity bit**, or **check bit**, is a bit added to a string of binary code. Parity bits are used as the simplest form of error detecting code. Parity bits are generally applied to the smallest units of a communication protocol, typically 8-bit octets (bytes), although they can also be applied separately to an entire message string of bits.

The parity bit ensures that the total number of 1-bits in the string is even or odd. Accordingly, there are two variants of parity bits: **even parity bit** and **odd parity bit**. In the case of even parity, for a given set of bits, the occurrences of bits whose value is 1 are counted. If that count is odd, the parity bit value is set to 1, making the total count of occurrences of 1s in the whole set (including the parity bit) an even number. If the count of 1s in a given set of bits is already even, the parity bit's value is 0. In the case of odd parity, the coding is reversed. For a given set of bits, if the count of bits with a value of 1 is even, the parity bit value is set to 1 making the total count of 1s in the whole set (including the parity bit) an odd number. If the count of bits with a value of 1 is odd, the count is already odd so the parity bit's value is 0.



Radioteletype (**RTTY**) is a telecommunications system consisting originally of two or more electromechanical teleprinters in different locations connected by radio rather than a wired link. These machines were superseded by personal computers (PCs) running software to emulate teleprinters. Radioteletype evolved from earlier landline teleprinter operations that began in the mid-1800s. The US Navy Department successfully tested printing telegraphy between an airplane and ground radio station in 1922. Later that year, the Radio Corporation of America successfully tested printing telegraphy via their Chatham, Massachusetts, radio station to the R.M.S. Majestic. Commercial RTTY systems were in active service between San Francisco and Honolulu as early as April 1932 and between San Francisco and New York City by 1934. The US military used radioteletype in the 1930s and expanded this usage during World War II. From the 1980s, teleprinters were replaced by computers running teleprinter emulation software.

The term radioteletype is used to describe both the original radioteletype system, sometimes described as "Baudot", as well as the entire family of systems connecting two or more teleprinters or PCs using software to emulate teleprinters, over radio, regardless of alphabet, link system or modulation.

In some applications, notably military and government, radioteletype is known by the acronym RATT (Radio Automatic Teletype).

Technical description

A radioteletype station consists of three distinct parts: the Teletype or teleprinter, the modem and the radio.

The Teletype or teleprinter is an electromechanical or electronic device. The word *Teletype* was a trademark of the Teletype Corporation, so the terms "TTY", "RTTY", "RATT" and "teleprinter" are usually used to describe a generic device without reference to a particular manufacturer.

Electromechanical teleprinters were heavy, complex and noisy, and have been replaced with electronic units. The teleprinter includes a keyboard, which is the main means of entering text, and a printer or visual display unit (VDU). An alternative input device is a perforated tape reader and, more recently, computer storage media (such as floppy disks). Alternative output devices are tape perforators and computer storage media.

The line output of a teleprinter can be at either digital logic levels (+5 V signifies a logical "1" or *mark* and 0 V signifies a logical "0" or *space*) or line levels (−80 V signifies a "1" and +80 V a "0"). When no traffic is passed, the line idles at the "mark" state.

Baudot Code

- Uses **5 bit groups**, so only **32 unique characters** are possible (2^5).
- In order to include the alphabet, numbers and special characters, the **code set is used twice**, with an "**upper**" and "**lower**" character used to switch between the two sets.
- Baud rate is 45.5

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The **Baudot code** [bodo] is an early character encoding for telegraphy invented by Émile Baudot in the 1870s. It was the predecessor to the International Telegraph Alphabet No. 2 (ITA2), the most common teleprinter code in use until the advent of ASCII. Each character in the alphabet is represented by a series of five bits, sent over a communication channel such as a telegraph wire or a radio signal. The symbol rate measurement is known as baud, and is derived from the same name.

When a key of the teleprinter keyboard is pressed, a 5-bit character is generated. The teleprinter converts it to serial format and transmits a sequence of a *start bit* (a logical 0 or space), then one after the other the 5 data bits, finishing with a *stop bit* (a logical 1 or mark, lasting 1, 1.5 or 2 bits). When a sequence of start bit, 5 data bits and stop bit arrives at the input of the teleprinter, it is converted to a 5-bit word and passed to the printer or VDU. With electromechanical teleprinters, these functions required complicated electromechanical devices, but they are easily implemented with standard digital electronics using shift registers. Special integrated circuits have been developed for this function, for example the Intersil 6402 and 6403. These are stand-alone UART devices, similar to computer serial port peripherals.

The 5 data bits allow for only 32 different codes, which cannot accommodate the 26 letters, 10 figures, space, a few punctuation marks and the required control codes, such as carriage return, new line, bell, etc. To overcome this limitation, the teleprinter has two *states*, the *unshifted* or *letters* state and the *shifted* or *numbers* or *figures* state. The change from one state to the other takes place when the special control codes *LETTERS* and *FIGURES* are sent from the keyboard or received from the line. In the *letters* state the teleprinter prints the letters and space while in the shifted state it prints the numerals and punctuation marks. Teleprinters for languages using other alphabets also use an additional *third shift* state, in which they print letters in the alternative alphabet.

The modem is sometimes called the terminal unit and is an electronic device which is connected between the teleprinter and the radio transceiver. The transmitting part of the modem converts the digital signal transmitted by the teleprinter or tape reader to one or the other of a pair of audio frequency tones, traditionally 2295/2125 Hz (US) or 2125/1955 Hz (Europe). One of the tones corresponds to the *mark* condition and the other to the *space* condition. These audio tones, then, modulate an SSB transmitter to produce the final audio-frequency shift keying (AFSK) radio frequency signal. Some transmitters are capable of direct frequency-shift keying (FSK) as they can directly accept the digital signal and change their transmitting frequency according to the *mark* or *space* input state. In this case the transmitting part of the modem is bypassed.

On reception, the FSK signal is converted to the original tones by mixing the FSK signal with a local oscillator called the BFO or *beat frequency oscillator*. These tones are fed to the demodulator part of the modem, which processes them through a series of filters and detectors to recreate the original digital signal. The FSK signals are audible on a communications radio receiver equipped with a BFO, and have a distinctive "beedle-eeeedle-eedle-eee" sound, usually starting and ending on one of the two tones ("idle on mark").

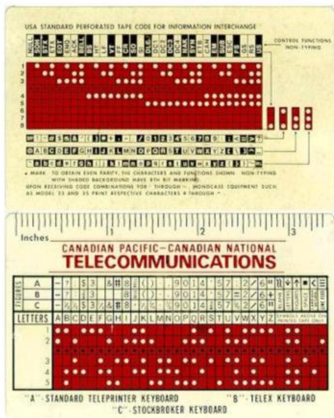
The transmission speed is a characteristic of the teleprinter while the shift (the difference between the tones representing mark and space) is a characteristic of the modem. These two parameters are therefore independent, provided they have satisfied the minimum shift size for a given transmission speed. Electronic teleprinters can readily operate in a variety of speeds, but mechanical teleprinters require the change of gears in order to operate at different speeds.

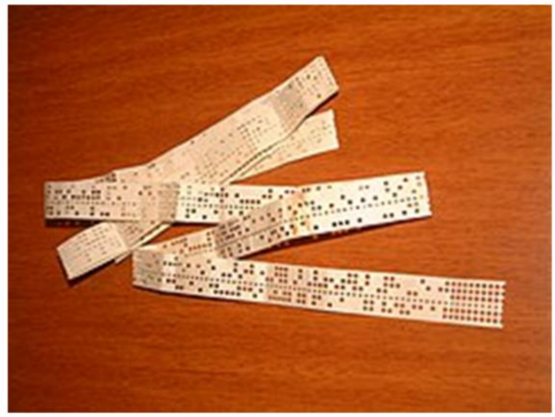
Today, both functions can be performed with modern computers equipped with digital signal processors or sound cards. The sound card performs the functions of the modem and the CPU performs the processing of the digital bits. This approach is very common in amateur radio, using specialized computer programs like fldigi, MMTTY or MixW.

Before the computer mass storage era, most RTTY stations stored text on paper tape using paper tape punchers and readers. The operator would type the message on the TTY keyboard and punch the code onto the tape. The tape could then be transmitted at a steady, high rate, without typing errors. A tape could be reused, and in some cases - especially for use with ASCII on NC Machines - might be made of plastic or even very thin metal material in order to be reused many times.

The most common test signal is a series of "RYRYRY" characters, as these form an alternating tone pattern exercising all bits and are easily recognized. Pangrams are also transmitted on RTTY circuits as test messages, the most common one being "The quick brown fox jumps over the lazy dog", and in French circuits, "Voyez le brick géant que j'examine près du wharf"

Baudot Code





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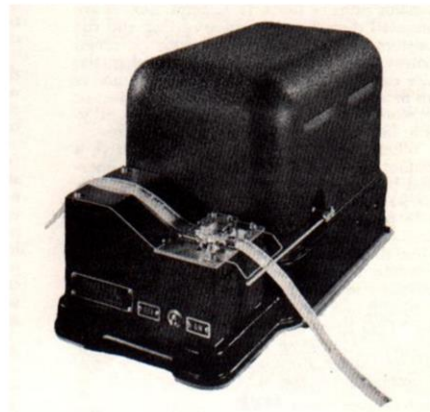
Punched tape or **perforated paper tape** is a form of data storage that consists of a long strip of paper in which holes are punched. Now effectively obsolete, it was widely used during much of the 20th century for teleprinter communication, for input to computers of the 1950s and 1960s, and later as a storage medium for minicomputers and CNC machine tools.

Punched tape was used as a way of storing messages for teletypewriters. Operators typed in the message to the paper tape, and then sent the message at the maximum line speed from the tape. This permitted the operator to prepare the message "off-line" at the operator's best typing speed, and permitted the operator to correct any error prior to transmission. An experienced operator could prepare a message at 135 words per minute (WPM) or more for short periods.

The line typically operated at 75WPM, but it operated continuously. By preparing the tape "off-line" and then sending the message with a tape reader, the line could operate continuously rather than depending on continuous "on-line" typing by a single operator. Typically, a single 75WPM line supported three or more teletype operators working offline. Tapes punched at the receiving end could be used to relay messages to another station. Large store and forward networks were developed using these techniques.

Model 19 Teletype Set



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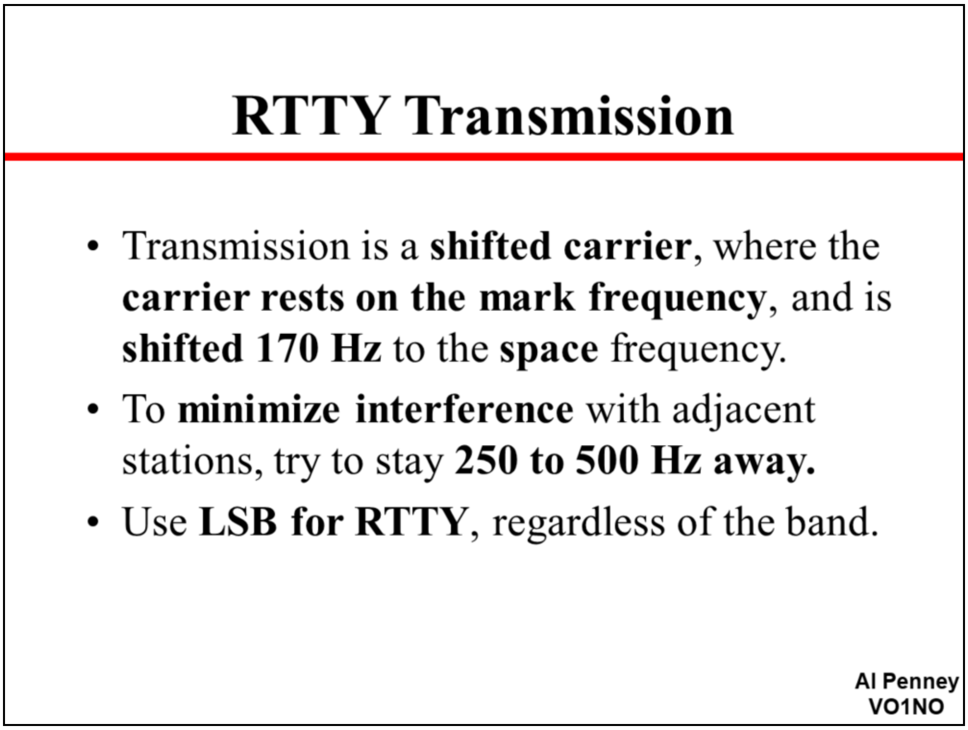
Standard Model: 19
Military Models: TT-7/FG, TT-8/FG
Design Relatives: M15-KSR, M14-TD, M14-ROTR?
Manufactured: 1942-1950?
Units Produced: ??
Units Remaining: ?? (estimated)
Dimensions (inches): 38L x 24W x 27H
Weight (pounds): ??

Keyboard: 3-row with spring-cushioned green keycaps
Code: 5-level baudot (ustty or ita2) at 60 wpm (45.5 baud)
Interface: 60-mA current loop (@120VDC typical)
Full- or Half-Duplex; 60/20-mA selectable on later models
Motors: 115-VAC Synchronous, or Governed
Options: Line relay; Polar-line relay; Motor-control relay;
Line-Break/Keyboard-Lockout; RFI-Suppression; Remote bell;
Auto-Carriage-Return/Line-Feed; Tabulator; Sprocket-feed paper drive.



RTTY basics

RTTY uses a form of transmission known as frequency shift keying. The code representing the letters consists of a series of bits represented by high and low voltages. In turn these are represented on the radio signal by a shift between two frequencies, one frequency signifying a mark or high voltage and another frequency representing a space of a low voltage.

On the HF bands the carrier for the RTTY signal is shifted between two frequencies, and this gives rise to differing audio tones when a beat frequency oscillator or BFO is used. At VHF and above a frequency modulated signal is generally used for RTTY and this is modulated by an audio tone that changes.

RTTY Transmission

- **Mark frequency is 2125 Hz, Space is 2295 Hz** (away from the frequency displayed by the radio's readout).
- **Some** systems will **key the transmitter directly**, alternating directly between the mark and space. This is called **FSK (Frequency Shift Keying).**
- Most Hams use a **computer soundcard** connected to the **microphone input** of the radio.
- **Two tones**, corresponding to mark and space, are **sent to the mic input** when the radio is keyed. This is called **Audio Frequency Shift Keying (AFSK),** but is indistinguishable from FSK.

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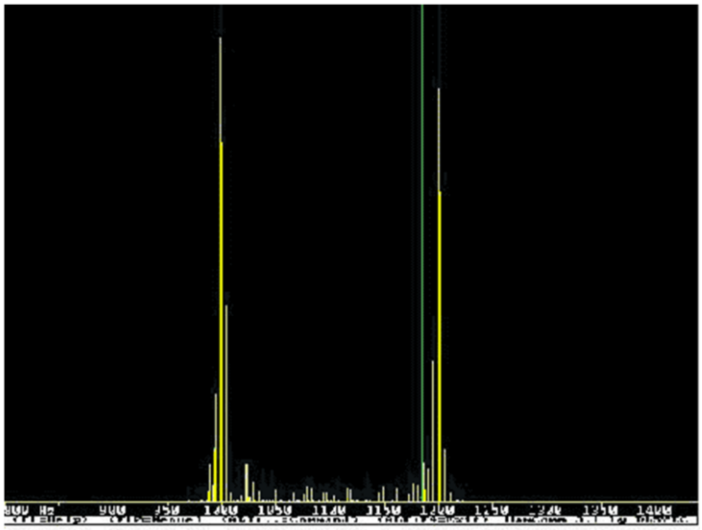
Teletype on the Air

To send teletype signals on the air, the transmitter generates a continuous carrier that is shifted slightly between two different frequencies that correspond to the mark or space states. This technique is known as "frequency shift keying" or FSK. Nowadays FSK transmission is normally achieved by feeding an audio tone generator (or, more usually, a computer sound card) into an SSB or FM transmitter. This technique is known as AFSK (audio frequency shift keying).

On the receiving end, RTTY stations originally used decoders known as "terminal units". The terminal unit would decode the incoming audio from the receiver and convert the two-tone signal to a series of pulses that were then sent to the teleprinter. Nowadays the decoding can be done by a computer sound card, so there is no need for a separate terminal unit.

RTTY Tuning Aid



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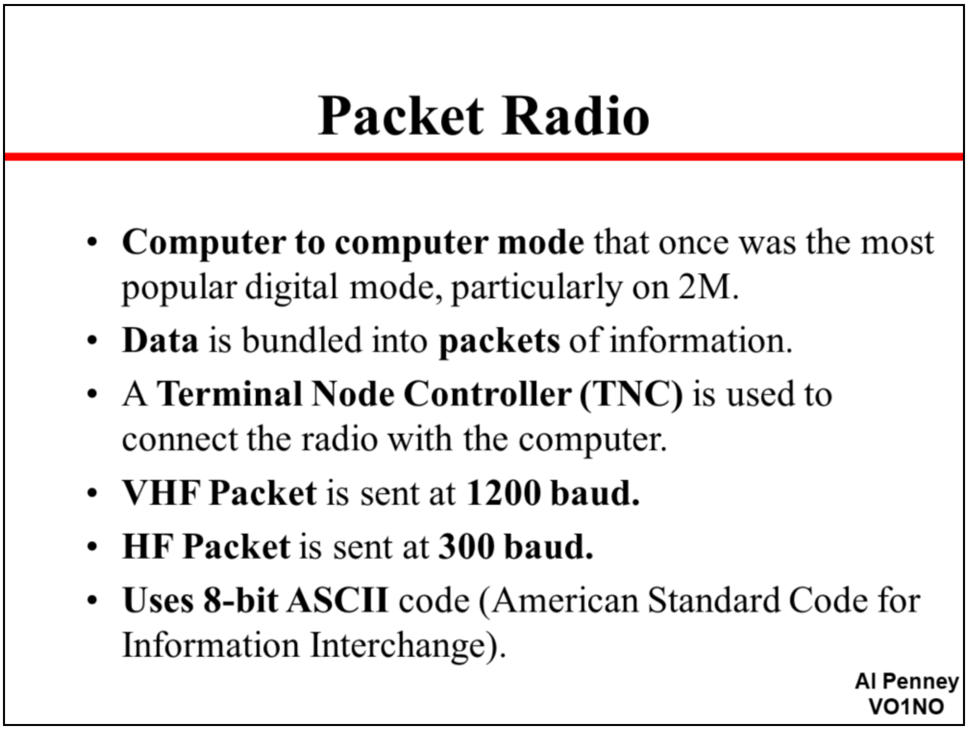


Packet radio was widely used on the amateur bands, particularly on frequencies above 30 MHz where it was well established and forming one of the mainstays of communications within the amateur community. The basic system allows modern day computer technology to be used to enable error free communication combined with many useful facilities, making it a mode that is compatible with many computer style applications, and allows people to combine the hobby of amateur radio with computer technology.

Fortunately it is not difficult to convert an existing amateur radio station to be able to transmit packet radio. Typically most VHF / UHF FM equipment is capable of transmitting amateur radio packet signals. Even many small handheld radios provide an excellent means of communicating via this means. As many people already have computers, the investment required is often minimal.

Packet radio basics

As the name implies this mode of transmission splits the data to be sent up into a series of packets which can be sent one at a time. As messages are usually much longer than the amount of data which can be sent in one packet, it takes several packets to complete the message.

One of the advantages of amateur packet radio is that one channel can be used by several amateur radio stations at the same time. This means that when sending data any station has to wait until the channel is clear. Once the frequency is free the first packet can be sent, and the receiving station will return an acknowledgement to say that all the data has been received correctly. If this acknowledgement is not received the transmitting station waits for the frequency to clear and re-sends the data. This process is repeated until the data has been correctly received. Once the first packet has been transferred, the second, and subsequent ones are all transmitted in the same way.

As the receiving radio station checks for errors and the transmitter repeats the data until it has been correctly received the system is very resilient and gives very high levels of accuracy. The other advantage is that the approach of waiting until the frequency is clear before transmitting allows many stations to use the same frequency, providing an efficient utilisation of the available spectrum. Nevertheless traffic is often high and as a result several channels may be allocated for amateur packet radio on a given band.

Details for amateur packet radio transmissions

Like other data modes or digimodes, packet radio uses frequency shift keying. A transmission speed of 1200 baud with tone frequencies of 2200 Hz for the space and 1200 Hz for the mark condition have been adopted for VHF. On HF where conditions are a little more difficult a speed of 300 baud with a 200 Hz shift is generally employed.

The format for each data packet is accurately defined so that the receiver can decipher the incoming data. Data is sent using ASCII (American Standard Code for Information Interchange) and each packet has five different elements or sections. There are flags at the beginning and end of each packet, an address, control information, a frame check sequence, and the data itself.

The flag at the beginning of the packet is used to allow the receiving decoder to synchronise to the incoming data. This is followed by a station address. This is used to define the callsign of the station to whom the data is being sent. Also included is the source or sending station callsign, and the callsigns of any repeaters or digipeaters which are to be used to relay the message. This means that any other station using the frequency will be able to ignore the data and only receive the signals intended for it.

The element within the data packet is the control byte. This is used to signal acknowledgements and requests to repeat transmissions. This is followed by the data itself. The length of this can be up to 256 bytes. Once it is complete the frame check sequence or FCS is sent. This is a check-sum whose value is calculated from the data. It is used by the receiving station to check that all the data has been correctly received. Only when the receiver is able to generate an identical code to match the received one is an acknowledgement sent.

The final part of the packet radio transmission is the terminating flag. This recognised by the receiver as the end of the message and enables it to check the data and send its acknowledgement.

Amateur packet radio features

Packet radio is able to utilise a number of features which were not present in previous types of data communication. One of the most widely used is the ability for other stations to relay messages, so that much greater distances can be covered. Stations which relay messages in this way are called digital repeaters or digipeaters for short.

Packet radio transmissions take place on a single frequency. This means that digipeaters have to receive and transmit on a single frequency. For them to be able to relay the messages, the message must first be received in full, stored and then transmitted. Once the final station in the chain has received the message the acknowledgement is sent back along the chain to the first station. This is known as an end to end acknowledgement. Only then is the next packet sent. This means that when a message is sent over a long path using several stations as repeaters, the message can take a very long time to get through, especially if any packets have to be repeated.

One powerful facility which amateur packet radio offers is the ability to read data from a mailbox. Sometimes called a bulletin board system (BBS), it enables messages to be sent to a particular mailbox and left for collection by a particular station. In many respects it is like a radio e-mail system.

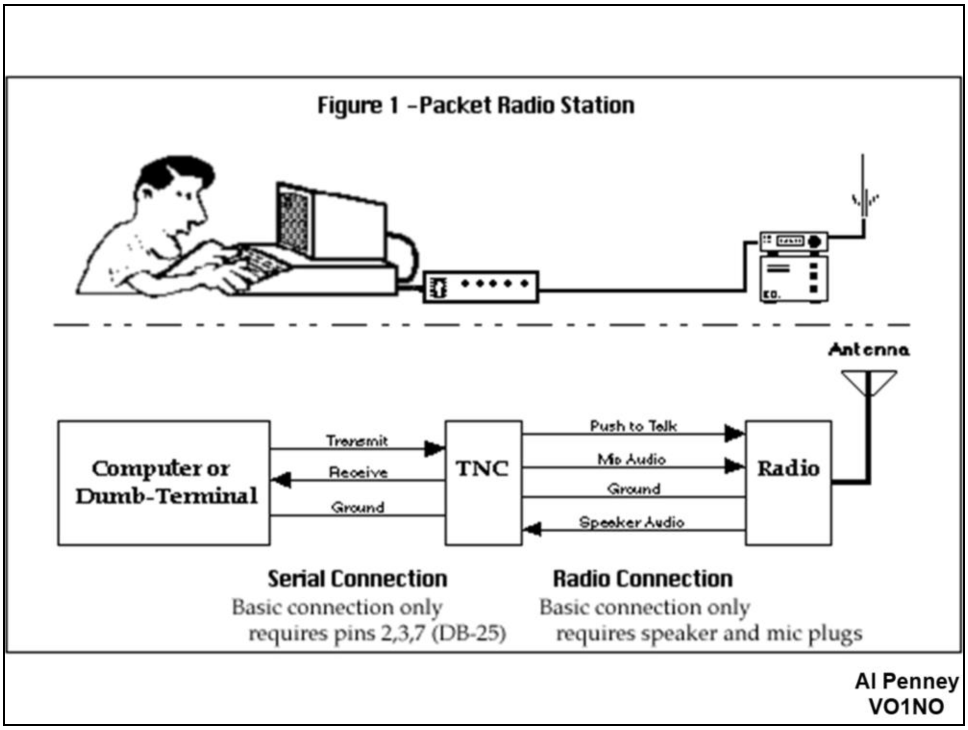
A message is sent to the local mailbox. Once received it is stored and then it is passed on via a network of mailbox stations until the required destination mailbox is reached. The message is stored at this mailbox until it is read by the recipient station. The advantage of using the mailbox system is that it is not necessary to know the route required to be taken by the message. This is worked out by the system, as it has a knowledge of the stations and works out a suitable route. Data is generally sent at periods of low activity, often at night, and this means that messages can take a few days to arrive. However as many links exist between countries it is possible to send messages around the world.

In addition to the basic mail facility, many items of general interest are stored and can be accessed by any station.

Although much of the initial experimental and practical work regarding packet radio was carried out by radio amateurs many commercial packet systems are now in use around the world. They are particularly useful where a large number of users have to send small amounts of data at intervals which would not demand a separate frequency for each separate user. For example packet radio is ideal for monitoring systems where each outpost has to be polled or accessed at intervals, or where it periodically reports a status or other information to the main station.

ASCII abbreviated from **American Standard Code for Information Interchange**, is a character encoding standard for electronic communication. ASCII codes represent text in computers, telecommunications equipment, and other devices. Most modern character-encoding schemes are based on ASCII, although they support many additional characters.

Originally based on the English alphabet, ASCII encodes 128 specified characters into seven-bit integers. Ninety-five of the encoded characters are printable: these include the digits *0* to *9*, lowercase letters *a* to *z*, uppercase letters *A* to *Z*, and punctuation symbols. In addition, the original ASCII specification included 33 non-printing control codes which originated with Teletype machines; most of these are now obsolete, although a few are still commonly used, such as the carriage return, line feed and tab codes.



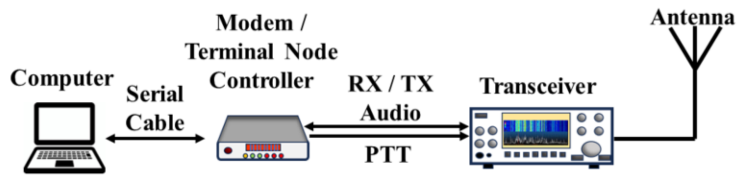
WHAT IS A TNC?

A "Terminal Node Controller" (TNC) is similar to the modem you use when connecting to the internet. One difference is; The TNC is used to interface our terminal or computer into the "RF" or radio (wireless) medium. There is one other, *very* significant difference; Inside the TNC we have added some internal firmware called a "PAD." The pad or "Packet assembler/disassembler" captures incoming and out-going data and assembles it into "packets" of data that can be sent to and from a data radio or transceiver.

In addition to the data stream conversion to and from packets, the PAD also enables the Push-To-Talk (PTT) circuits of the radio transceiver. When you press the enter key of your computer keyboard, the typed in data is sent out over the air to the target station or a nearby "store-and-forward" device known as a "node."

Incoming (received) data from the transceiver is also converted within the PAD, from Packets of data into a stream of usable data and sent to the TNC/modem. Here the data stream is sent to the serial comport of the computer for display on the screen, or manipulated by a resident terminal program into on-screen text, pictures, or save-to-disk processing.

Legacy Digital Modes



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Packet Radio

- Stations are linked by the **Connected** mode, ensuring that packets are re-transmitted if not received properly.
- **Each packet** requires an **"Acknowledgement".**
- You can **see what traffic is being sent** without being connected by using the **"Monitor" mode.**
- Repeaters called **Digipeaters** are used to **receive, store and re-transmit packets marked for re-transmission** in order to extend the range, sometimes into a **network of digipeaters.**
- The **protocol** used to transmit **Packet data** is called **AX.25.**

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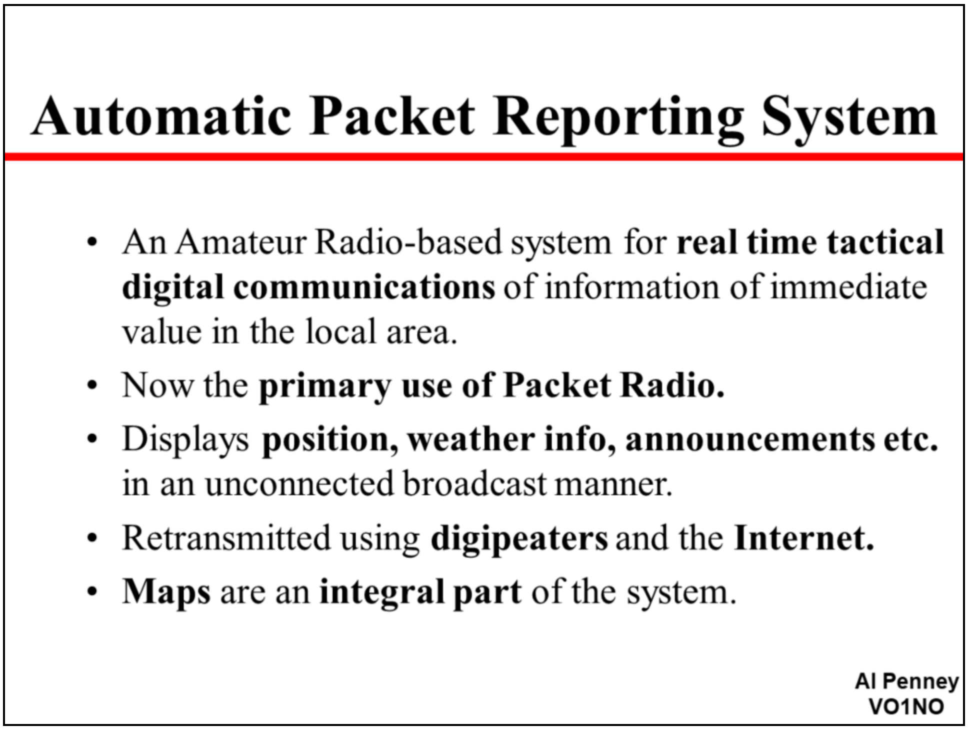
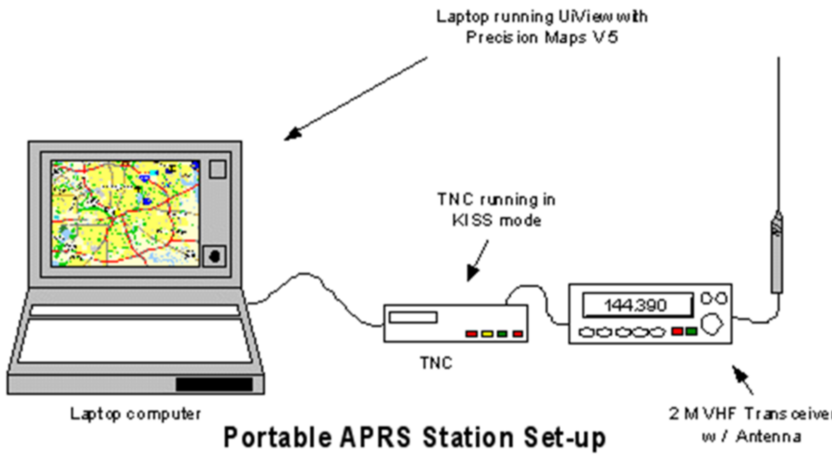
"Digipeater" is short for "Digital Repeater"; a repeater for packet data rather than voice. Unlike the standard voice repeater that receives on one frequency and retransmits what it hears simultaneously on another frequency, the usual digipeater is a single frequency device. It receives a packet of data, stores it in internal memory and then a moment later retransmits it on the SAME frequency.



Automatic Packet Reporting System (**APRS**) is an amateur radio-based system for real time digital communications of information of immediate value in the local area. Data can include object Global Positioning System (GPS) coordinates, weather station telemetry, text messages, announcements, queries, and other telemetry. APRS data can be displayed on a map, which can show stations, objects, tracks of moving objects, weather stations, search and rescue data, and direction finding data.

APRS data is typically transmitted on a single shared frequency (depending on country) to be repeated locally by area relay stations (digipeaters) for widespread local consumption. In addition, all such data are typically ingested into the APRS Internet System (APRS-IS) via an Internet-connected receiver (IGate) and distributed globally for ubiquitous and immediate access. Data shared via radio or Internet are collected by all users and can be combined with external map data to build a shared live view.

APRS has been developed since the late 1980s by Bob Bruninga, call sign WB4APR, currently a senior research engineer at the United States Naval Academy. He still maintains the main APRS Web site. The initialism "APRS" was derived from his call sign.



Portable APRS Station Set-up

* Transceiver and TNC need +12 VDC power.

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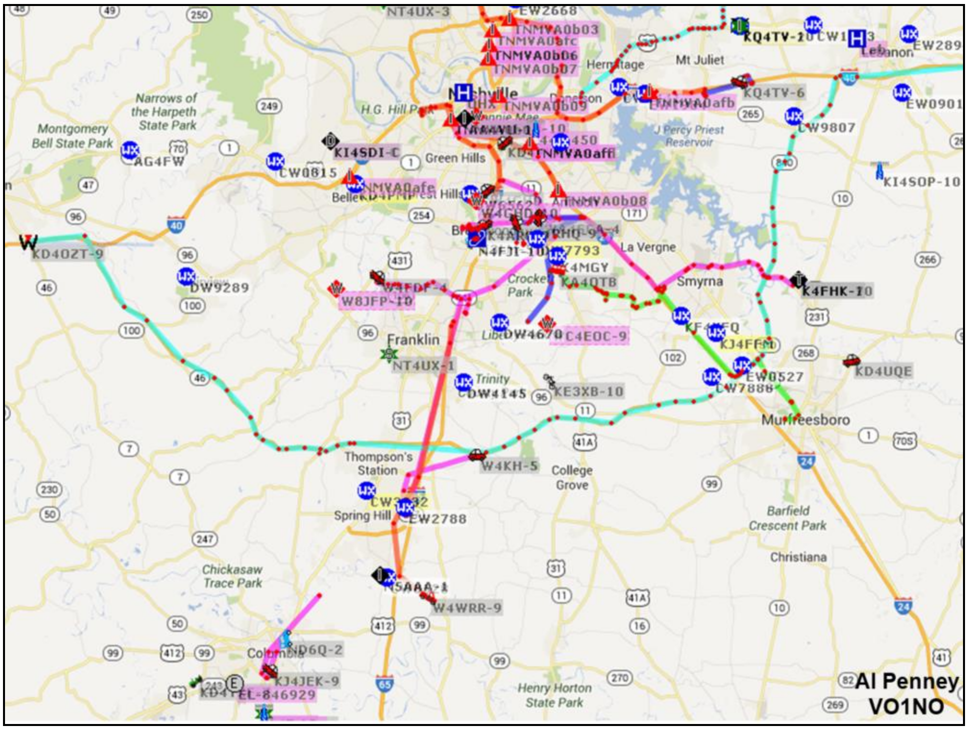
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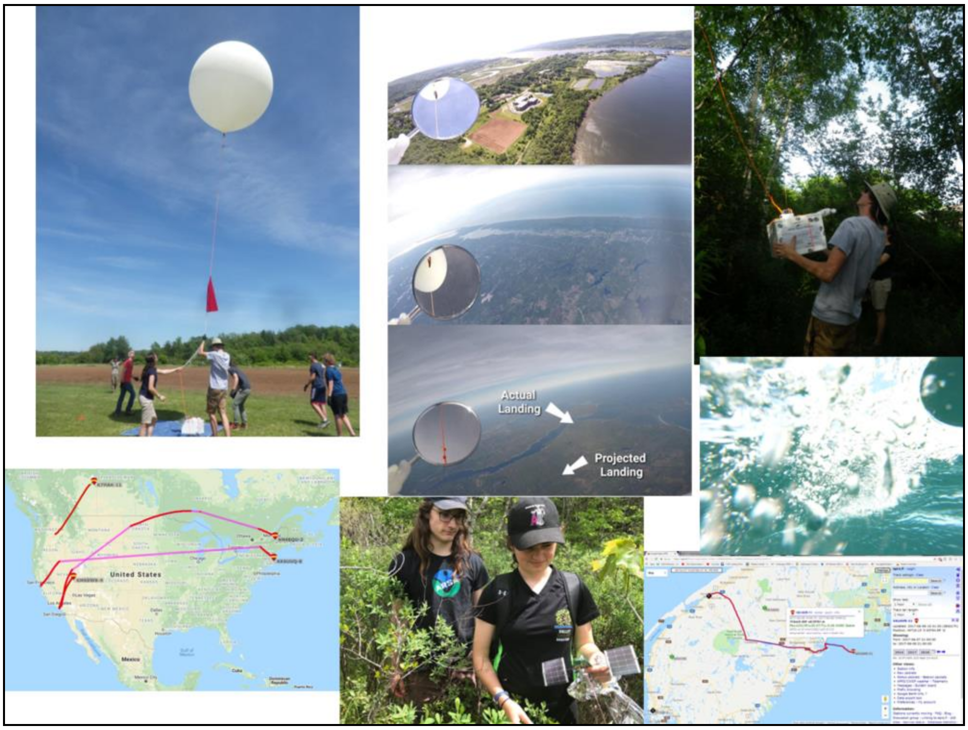
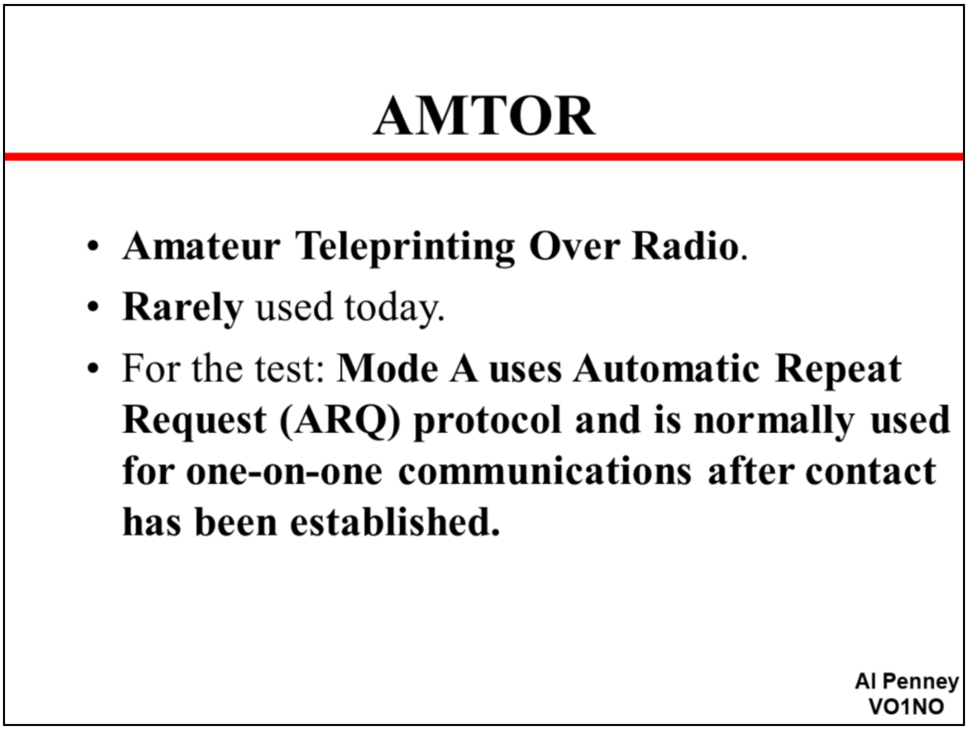

Actual Landing
Projected Landing
United States
Mexico



AMTOR (**Amateur Teleprinting Over Radio**) is a type of telecommunications system that consists of two or more electromechanical teleprinters in different locations that send and receive messages to one another. AMTOR is a specialized form of RTTY protocol. The term is an acronym for Amateur Teleprinting Over Radio[1] and is derived from ITU-R recommendation 476-1 and is known commercially as SITOR (Simplex Telex Over radio) developed primarily for maritime use in the 1970s.[2] AMTOR was developed in 1978 by Peter Martinez, G3PLX, with the first contact taking place in September 1978 with G3YYD on the 2m Amateur band. It was developed on homemade Motorola 6800-based microcomputers in assembler code. It was used extensively by amateur radio operators in the 1980s and 1990s but has now fallen out of use as improved PC-based data modes are now used and teleprinters became out of fashion.

AMTOR improves on RTTY by incorporating error detection or error correction techniques. The protocol remains relatively uncomplicated and AMTOR performs well even in poor and noisy HF conditions. AMTOR operates in one of two modes: an error detection mode and an automatic repeat request (ARQ) mode.

The AMTOR protocol utilizes a 7-bit code for each character, with each code-word having four mark and three space bits. If the received code does not match a four-to-three (4:3) ratio, the receiver assumes an error has occurred. In error detection mode, the code word will be dropped; in automatic repeat request mode, the receiver requests that the original data be resent. AMTOR also supports FEC in which simple bit-errors can be corrected.

AMTOR utilizes FSK, with a frequency shift of 170 Hz, and a symbol rate of 100 Baud.

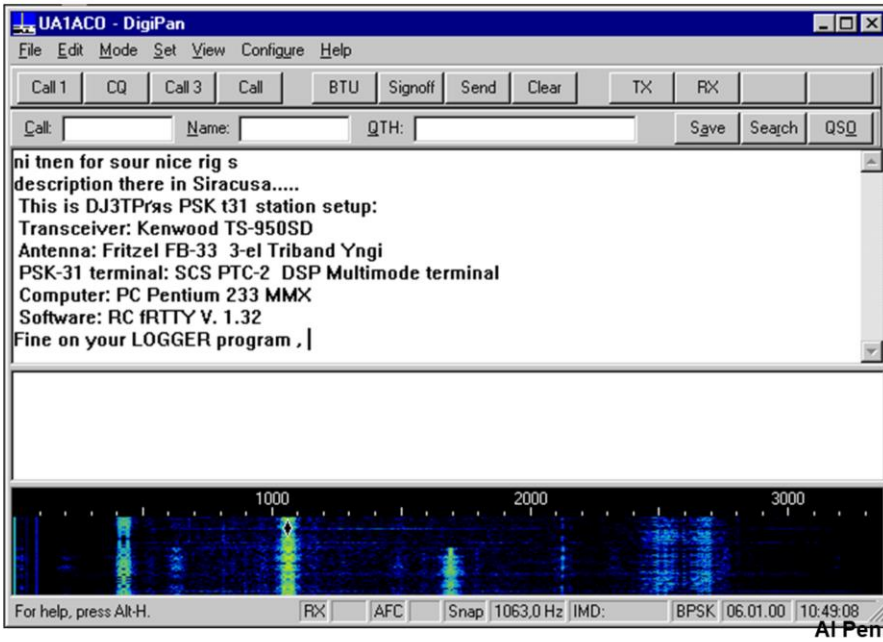
AMTOR is rarely used today, as other protocols such as PSK31 are becoming favoured by amateur operators for real-time text communications

Phase Shift Keying 31 (PSK 31)

- Was the **most popular HF digital mode until FT8**.
- It combines the advantages of a simple **variable length text code** with a narrow bandwidth **phase-shift keying (PSK)** signal using DSP techniques.
- Uses a **simple interface** between the **radio and computer sound card.**
- **Excellent low power capabilities.**

Al Penney
VO1NO

PSK31 or "Phase Shift Keying, 31 Baud", also **BPSK31** and **QPSK31**, is a popular computer-sound card-generated radioteletype mode, used primarily by amateur radio operators to conduct real-time keyboard-to-keyboard chat, most often using frequencies in the high frequency amateur radio bands (near-shortwave). PSK31 is distinguished from other digital modes in that it is specifically tuned to have a data rate close to typing speed, and has an extremely narrow bandwidth, allowing many conversations in the same bandwidth as a single voice channel. This narrow bandwidth makes better use of the RF energy in a very narrow space thus allowing relatively low-power equipment (5 watts) to communicate globally using the same skywave propagation used by shortwave radio stations.

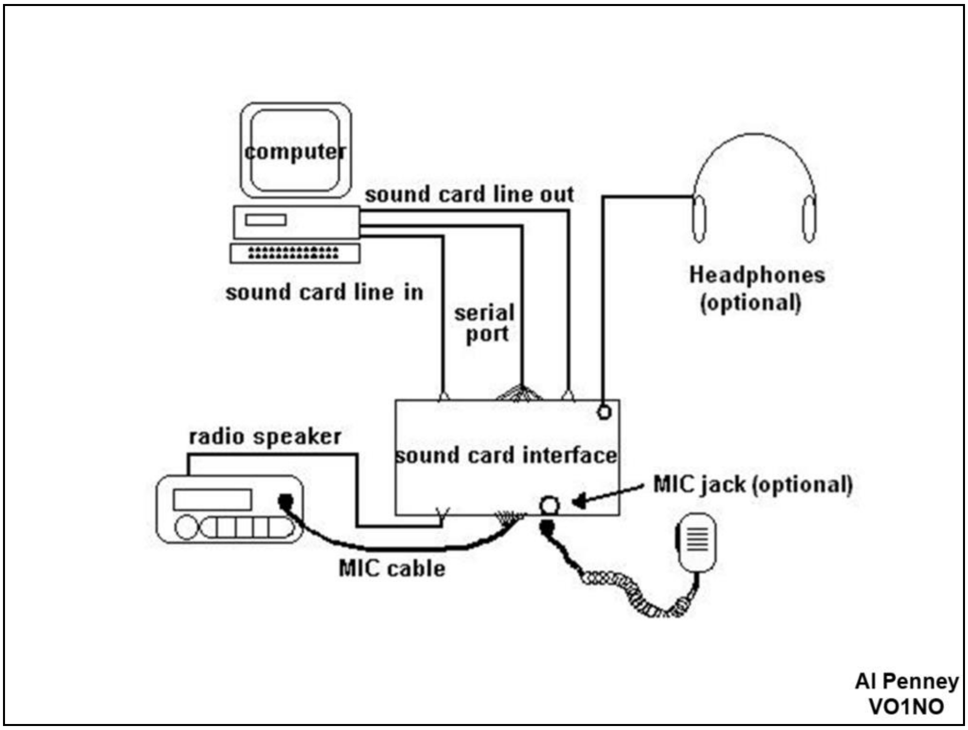


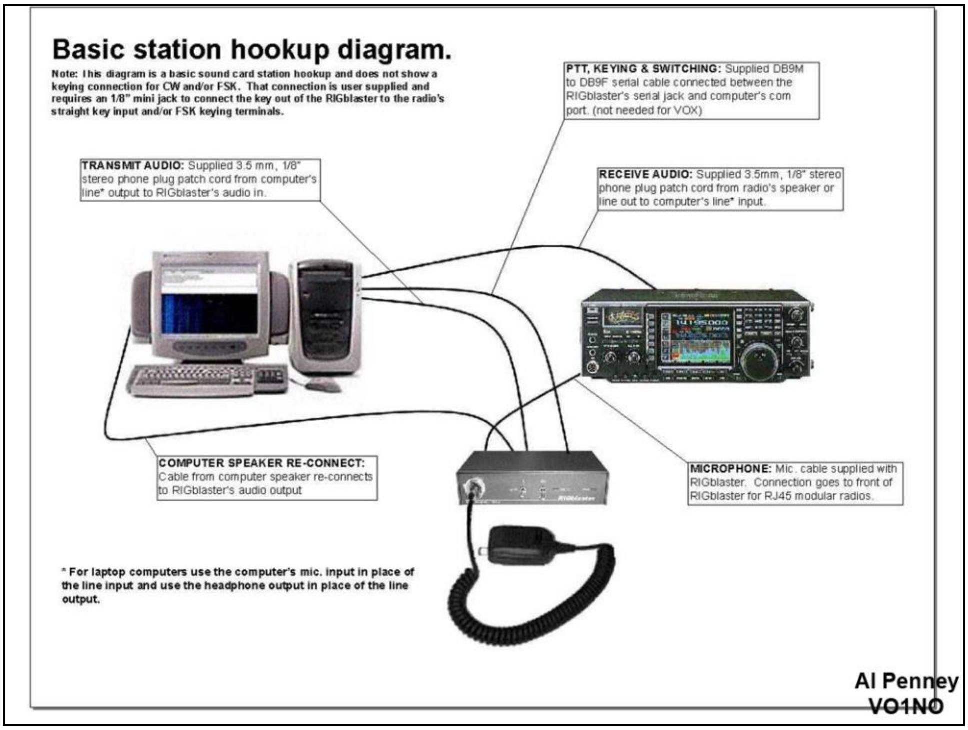
Al Penney
VO1NO

Sound Card Modes

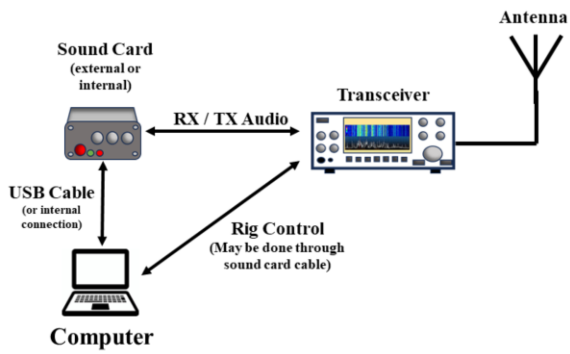
- The introduction of **simple interfaces** between computers and radios has **revolutionized** Amateur Radio digital modes.
- As **new modes** are developed, they can be **downloaded free** of charge.

Al Penney
VO1NO


computer
sound card line out
sound card line in
serial
port
Headphones
(optional)
radio speaker
sound card interface
MIC jack (optional)
MIC cable
Al Penney
VO1NO


Basic station hookup diagram.
Note: This diagram is a basic sound card station hookup and does not show a keying connection for CW and/or FSK. That connection is user supplied and requires an 1/8" mini jack to connect the key out of the RIGblaster to the radio's straight key input and/or FSK keying terminals.
PTT, KEYING & SWITCHING: Supplied DB9M to DB9F serial cable connected between the RIGblaster's serial jack and computer's com port. (not needed for VOX)
TRANSMIT AUDIO: Supplied 3.5 mm, 1/8" stereo phone plug patch cord from computer's line* output to RIGblaster's audio in.
RECEIVE AUDIO: Supplied 3.5mm, 1/8" stereo phone plug patch cord from radio's speaker or line out to computer's line* input.
COMPUTER SPEAKER RE-CONNECT: Cable from computer speaker re-connects to RIGblaster's audio output
MICROPHONE: Mic. cable supplied with RIGblaster. Connection goes to front of RIGblaster for RJ45 modular radios.
* For laptop computers use the computer's mic. input in place of the line input and use the headphone output in place of the line output.
Al Penney
VO1NO

Current Digital Modes

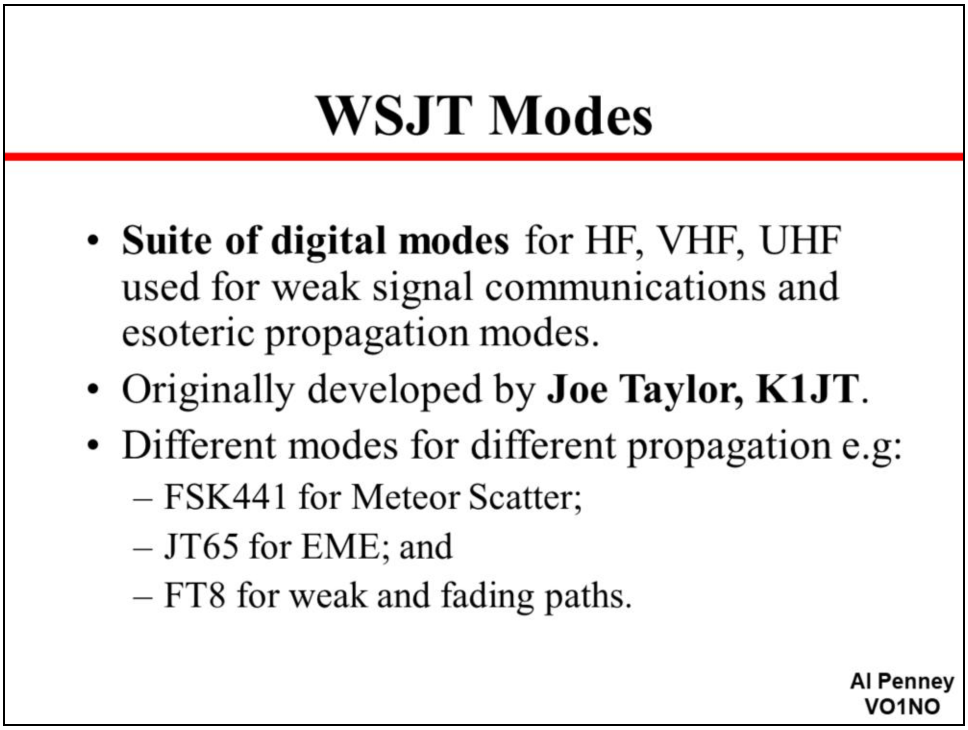


Al Penney
VO1NO

Sound Card Modes

- PSK31
- WSJT
- RTTY
- Hellschreiber
- MT63
- Throb
- MFSK16
- Etc. Etc. Etc.

Al Penney
VO1NO



WSJT is a computer program used for weak-signal radio communication between amateur radio operators. The program was initially written by Joe Taylor, K1JT, but is now open source and is developed by a small team. The digital signal processing techniques in WSJT make it substantially easier for amateur radio operators to employ esoteric propagation modes, such as high speed meteor scatter and moonbounce.

Communication modes provided

The software carries a general emphasis on weak-signal operation and advanced DSP techniques; however, the communication modes rely upon different ionospheric propagation modes and may be used on many different bands.

WSJT's communication modes can be divided into fast and slow modes. While fast modes send character-by-character without error correction, the slow modes aim to optimize for minimal QRO (high-power) use. As of WSJT10, supported fast modes are JTMS, FSK441, ISCAT, and JT6M, and the slow modes are JT65 and JT4. WSJT-X 1.8 additionally implements the "slow" JT9, FT8, and QRA64. Some modes have derived submodes with larger tone spacing. Two other modes, WSPR and Echo are included for measuring propagation and testing moon bounce echo.

FSK441

FSK441, introduced in 2001 as the first communications mode included with WSJT, is designed to support communication using streaks of radio-reflecting ions created in the ionosphere by the trails of meteors entering the Earth's atmosphere. The bursts of signal created by such trails are commonly referred to as “pings”, due to their characteristic sound. Such pings may be as short as a tenth of a second and carry enough information to complete at least one stage of a contact. FSK441 employs multi-frequency shift keying using four tones, at a data rate of 441 baud. Because of the choice of character codes in the protocol, it is self-synchronizing and does not require an explicit synchronization tone. FSK441 is generally used on the 2-meter and 70-centimeter amateur bands. Contacts may be made at almost any time (that is, a meteor shower is not required to be in progress) at distances of up to 1400 miles (2250 km).

When transmitted messages include at least one space, the FSK441 decoding algorithm uses that space character as a syncword for zero-overhead synchronization.

JT6M

JT6M, introduced in late 2002, is intended for meteor scatter and other ionospheric scattering of signals, and is especially optimized for the 6-meter band. The mode also employs multiple frequency-shift keying, but at 44 tones. One of the tones is a synchronization tone, leaving 43 tones to carry data (one tone per character in the character set, which includes alphanumerics and some punctuation). The symbol rate is 21.53 baud; the actual data rate as encoded for transmit is 14.4 characters per second. The mode is known for sounding "a bit like piccolo music".

JT65

JT65, developed and released in late 2003, is intended for extremely weak but slowly varying signals, such as those found on troposcatter or Earth-Moon-Earth (EME, or "moonbounce") paths. It can decode signals many decibels below the noise floor in a 2500 Hz band (note that SNR in a 2500 Hz band is approximately 28 dB lower than SNR in a 4 Hz band, which is closer to the channel bandwidth of an individual JT65 tone), and can often allow amateurs to successfully exchange contact information without signals being audible to the human ear. Like the other modes, multiple-frequency shift keying is employed; unlike the other modes, messages are transmitted as atomic units after being compressed and then encoded with a process known as forward error correction (or "FEC"). The FEC adds redundancy to the data, such that all of a message may be successfully recovered even if some bits are not received by the receiver. (The particular code used for JT65 is Reed-Solomon.) Because of this FEC process, messages are either decoded correctly or not decoded at all, with very high probability. After messages are encoded, they are transmitted using MFSK with 65 tones.

Operators have also begun using the JT65 mode for contacts on the HF bands, often using QRP (very low transmit power); while the mode was not originally intended for such use, its popularity has resulted in several new features being added to WSJT in order to facilitate HF operation.

JT9

JT9, intended for MF and HF use, was introduced in an experimental version of WSJT, known as **WSJT-X**. It uses the same logical encoding as JT65, but modulates to a 9-FSK signal. With 1-minute transmission intervals, JT9 occupies less than 16 Hz bandwidth. JT9 also has versions designed for longer transmission intervals of 2 minutes, 5 minutes, 10 minutes or 30 minutes. These extended versions take increasingly less bandwidth and permit reception of even weaker signals.

FT8

Joe Taylor, K1JT, announced on June 29, 2017 the availability of a new mode in the WSJT-X software, FT8. FT8 stands for "Franke-Taylor design, 8-FSK modulation" and was created by Joe Taylor, K1JT and Steve Franke, K9AN. It is described as being designed for "multi-hop Es where signals may be weak and fading, openings may be short, and you want fast completion of reliable, confirmable QSO's".

According to Taylor, the important characteristics of FT8 are —

•T/R sequence length: 15 s

•Message length: 75 bits + 12-bit CRC

•FEC code: (174,87)LDPC

•Modulation: 8-FSK, keying rate = tone spacing = 6.25 Hz

•Waveform: Continuous phase, constant envelope

•Occupied bandwidth: 50 Hz

•Synchronization: three 7x7 Costas arrays (start, middle, end of transmission)

•Transmission duration: 79*1920/12000 = 12.64 s

•Decoding threshold: -20 dB (perhaps -24 dB with *a priori* decoding, TBD)

•Operational behavior: similar to HF usage of JT9, JT65

•Multi-decoder: finds and decodes all FT8 signals in passband

•Auto-sequencing after manual start of QSO

Compared to the so-called "slow modes" (JT9, JT65, QRA64), FT8 is a few decibels less sensitive, but allows completion of QSOs four times faster. Bandwidth is greater than JT9, but about one-quarter of JT65A and less than one-half of QRA64. Compared with the "fast modes" (JT9E-H), FT8 is significantly more sensitive, has much narrower bandwidth, uses the vertical waterfall, and offers multi-decoding over the full displayed passband. Features not yet implemented include signal subtraction, two-pass decoding, and use of *a priori* (already known) information as it accumulates during a QSO."

FT4

In 2019, Taylor, et al, introduced FT4, an experimental protocol which is similar to FT8 but has a shorter T/R sequence length for faster contest exchanges.

Al Penney
VO1NO

Slow Scan TV (SSTV)

- Unlike commercial TV which requires up to 6 MHz of bandwidth, **SSTV** transmits pictures using the **same bandwidth as an SSB voice signal** (2.7 kHz).
- The **cost** is the **rate** at which pictures are transmitted – it takes **8 seconds/frame** for the fastest mode, and up to **72 seconds/frame** for more detailed, colour pictures.

Al Penney
VO1NO

Slow Scan television (**SSTV**) is a picture transmission method used mainly by amateur radio operators, to transmit and receive static pictures via radio in monochrome or color.

A literal term for SSTV is narrowband television.
Analog broadcast television requires at least 6 MHz wide channels, because it transmits 25 or 30 picture frames per second (in the NTSC, PAL or SECAM color systems), but SSTV usually only takes up to a maximum of 3 kHz of bandwidth. It is a much slower method of still picture transmission, usually taking from about eight seconds to a couple of minutes, depending on the mode used, to transmit one image frame.

Since SSTV systems operate on voice frequencies, amateurs use it on shortwave (also known as HF by amateur radio operators), VHF and UHF radio.

Al Penney
VO1NO

Fast Scan TV

- More frequently called **ATV (Amateur TV).**
- Uses the same **NTSC format** that regular (non-HD) TV uses.
- Because of the **bandwidth requirements,** it is **limited to the 70cm band and higher.**
- ATV Repeaters can be found in the 903 MHz and 1.2 GHz bands.
- Video signal is AM, while audio is FM.

Al Penney
VO1NO

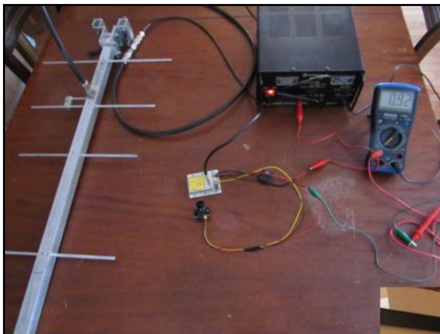
Amateur television (**ATV**) is the transmission of broadcast quality video and audio over the wide range of frequencies of radio waves allocated for radio amateur (Ham) use. ATV is used for non-commercial experimentation, pleasure, and public service events. Ham TV stations were on the air in many cities before commercial television stations came on the air. Various transmission standards are used, these include the broadcast transmission standards of NTSC in North America and Japan, and PAL or SECAM elsewhere, utilizing the full refresh rates of those standards. ATV includes the study of building of such transmitters and receivers, and the study of radio propagation of signals travelling between transmitting and receiving stations.

ATV is an extension of amateur radio. It is also called HAM TV or fast-scan TV (FSTV), as opposed to slow-scan television (SSTV).

The 70-centimeter band (420-450 MHz) is the most commonly used ham band for ATV. Signals transmitted on this band usually propagate longer distances than on higher frequency bands, for a given transmitter power and antenna gain. The band falls between broadcast TV channels 13 and 14, which are 210–216 MHz and 470–476 MHz respectively. Propagation is similar to the lowest UHF TV Broadcast channels.

Additionally, this band can be easily received by simply tuning any cable-ready analog television or cable-box to the cable TV channels below and connecting an outdoor TV antenna. Amateur TV signals are much weaker than broadcast TV, so a preamplifier is often used to improve reception.


VA6DX
Amateur Television
Miquelon Lake
Alberta
Al Penney
VO1NO



Al Penney
VO1NO

Distress and Urgency Signals

- Distress and Urgency signals are internationally recognized prowords that indicate **situations of distress or urgency**.
- Include:
  - **Mayday**;
  - **Pan Pan**; and
  - **Securite**.

Al Penney
VO1NO

A **distress signal**, also known as a **distress call**, is an internationally recognized means for obtaining help. Distress signals are communicated by transmitting radio signals, displaying a visually observable item or illumination, or making a sound audible from a distance.

A distress signal indicates that a person or group of people, ship, aircraft, or other vehicle is threatened by serious and/or imminent danger and requires immediate assistance.[1]:PCG D−3 Use of distress signals in other circumstances may be against local or international law.

An urgency signal is available to request assistance in less critical situations.

In order for distress signalling to be the most effective, two parameters must be communicated:

•Alert or notification of a distress in progress

•Position or location (or localization or pinpointing) of the party in distress.

MAYDAY (SOS in CW)

- International **Distress** Signal
- Threatened by **grave and imminent danger** to life and property
- Require **immediate assistance**
- Transmitted **three times**.
- ***All traffic*** will cease and all stations will monitor.
- Any station in a position to render assistance will do so and all other stations will continue to monitor until the situation is rectified and the frequency is released for normal use.

Al Penney
VO1NO

MAYDAY: This signal, referred to as the "International Distress Signal" indicates that a station is threatened by grave and imminent danger to life and property, and requires immediate assistance. In radiotelephone (voice), the word "MAYDAY" will be transmitted three times. After the distress signal is sent ***all traffic*** will cease and all stations will monitor. Any station in a position to render assistance will do so and all other stations will continue to monitor until the situation is rectified and the frequency is released for normal use.

Mayday is an emergency procedure word used internationally as a distress signal in voice-procedure radio communications.
It is used to signal a life-threatening emergency primarily by aviators and mariners, but in some countries local organizations such as firefighters, police forces, and transportation organizations also use the term. Convention requires the word be repeated three times in a row during the initial emergency declaration ("Mayday mayday mayday") to prevent it being mistaken for some similar-sounding phrase under noisy conditions, and to distinguish an *actual* mayday call from a message *about* a mayday call.

History
The "mayday" procedure word was originated in 1921, by a senior radio officer at Croydon Airport in London. The officer, Frederick Stanley Mockford, was asked to think of a word that would indicate distress and would easily be

understood by all pilots and ground staff in an emergency. Since much of the traffic at the time was between Croydon and Le Bourget Airport in Paris, he proposed the expression "mayday" from the French *m'aider* ('help me'), a shortened form of *venez m'aider* ('come and help me'). It is unrelated to the holiday May Day.

Before the voice call "mayday", SOS was the Morse code equivalent of the mayday call. In 1927, the International Radiotelegraph Convention of Washington adopted the voice call mayday as the radiotelephone distress call in place of the SOS radiotelegraph (Morse code) call.

Use of Mayday

A Mayday message consists of the word "mayday" spoken three times in succession, which is the distress signal, followed by the distress message, which should include:

•Name of the vessel or ship in distress

•Its position (actual, last known or estimated expressed in lat./long. or in distance/bearing from a specific location)

•Nature of the vessel distress condition or situation (e.g. on fire, sinking, aground, taking on water, adrift in hazardous waters)

•Number of persons at risk or to be rescued; grave injuries

•Type of assistance needed or being sought

•Any other details to facilitate resolution of the emergency such as actions being taken (e.g. abandoning ship, pumping flood water), estimated available time remaining afloat

PAN PAN

- International **Urgency** Signal
- A very urgent message concerning the **safety** of a ship, aircraft or other vehicle and/or the safety of a person or persons.
- The words "**PAN PAN**" are transmitted **three times**.
- All traffic will cease. All stations will continue to monitor until the situation is rectified and the frequency is released for normal usage.

Al Penney
VO1NO

PAN PAN: This signal, referred to as the "International Urgency Signal", indicates the calling station has a very urgent message concerning the safety of a ship, aircraft or other vehicle and/or the safety of a person or persons. In radiotelephone mode (voice) the word "PAN" is transmitted three times. All traffic will cease. All stations will continue to monitor until the situation is rectified and the frequency is released for normal usage.

The radiotelephony message **PAN-PAN** is the international standard urgency signal that someone aboard a boat, ship, aircraft, or other vehicle uses to declare that they have a situation that is urgent, but for the time being, does not pose an immediate danger to anyone's life or to the vessel itself. This is referred to as a state of "urgency". This is distinct from a mayday call (distress signal), which means that there is imminent danger to life or to the continued viability of the vessel itself. Radioing "pan-pan" informs potential rescuers (including emergency services and other craft in the area) that an urgent problem exists, whereas "mayday" calls on them to drop all other activities and immediately begin a rescue.

Usage

To declare pan-pan correctly, the caller repeats it three times: "Pan-pan, pan-pan, pan-pan," then states the intended recipient, either "all stations, all stations, all stations," or a specific station, e.g. "Victoria Coast Guard Radio, Victoria Coast Guard Radio, Victoria Coast Guard Radio." Then the caller states their craft's identification, position, nature of the problem, and the type of assistance or advice they require, if any. An equivalent Morse code signal was "X X X", with each letter sent distinctly. It is also correct to use "pan-pan" as a preface if relaying a "mayday" call from another station that is out of range of the station they are trying to contact. This is common in aviation VHF communications but not in nautical VHF communications.

Examples of the correct use of a "pan-pan" call from a boat or ship may include cases where the skipper or master remains confident they can handle the situation, and that there is no current danger to the life of any person or to the safety of the vessel. Once the urgent situation that led to the pan-pan broadcast is resolved or contended with, conventional practice is for the station that initiated the pan-pan call to make a followup broadcast to all stations, declaring that the urgent situation no longer exists.

A call that originates as a "pan-pan" signal might be followed by a Mayday distress signal if the situation deteriorates to the point of "grave and imminent danger," thus warranting immediate action (intervention, assistance, response) on the part of listeners in accordance with standard operating practices for distress signaling.

SÉCURITÉ

- International **Safety** Signal
- Indicates that a station is going to transmit a message concerning the safety of navigation or send important meteorological warnings that will, or can, affect ships, aircraft or persons.
- The word "**SÉCURITÉ**" (pronounced "SEE CURI TAY") will be sent three times.
- All traffic will cease. All stations will monitor until the frequency is clear.

Al Penney
VO1NO

Sécurité is a procedure word used in the Maritime radio service that warns the crew that the following message is important safety information. The most common use of this is by coast radio stations before the broadcast of navigational warnings and meteorological information.

Navigational warnings are issued regularly and usually give information about people or vessels in distress and objects or events that can be an immediate danger to people at sea and how they are navigating.

Meteorological information is information that is about the marine atmosphere. These meteorological advisories include the development of weather systems such as and not limited to, rain squalls, big tidal drops, major current shifts, lightning storms, hurricane and tsunami warnings, high winds, and cyclones.

It is normal practice to broadcast the Sécurité call itself on a distress and listening frequency such as VHF Channel 16 or MF 2182 kHz, and then change frequency to a working channel for the body of the messages. An equivalent Morse code signal is TTT, with each letter sent distinctly.

Although mostly used by coast radio stations, there is nothing to stop individual craft broadcasting their own Sécurité messages where appropriate, for example, a yacht becalmed (rendered motionless for lack of wind), or any vessel adrift or unable to manoeuvre near other craft or shipping lanes.

Sambro light buoy HE7

Making a MAYDAY Call

- **MAYDAY, MAYDAY, MAYDAY,**
- **This is** (name of vessel or your name repeated three times)
- **MAYDAY, MY POSITION IS** (give your GPS latitude and longitude or compass bearing from a well known object)
- **I AM** (state problem such as on fire, sinking, etc.) **WITH** (number of) **PERSONS ON BOARD, I REQUIRE IMMEDIATE ASSISTANCE**

Al Penney VO1NO

Use of Mayday

A Mayday message consists of the word "mayday" spoken three times in succession, which is the distress signal, followed by the distress message, which should include:

•Name of the vessel or ship in distress

•Its position (actual, last known or estimated expressed in lat./long. or in distance/bearing from a specific location)

•Nature of the vessel distress condition or situation (e.g. on fire, sinking, aground, taking on water, adrift in hazardous waters)

•Number of persons at risk or to be rescued; grave injuries

•Type of assistance needed or being sought

•Any other details to facilitate resolution of the emergency such as actions being taken (e.g. abandoning ship, pumping flood water), estimated available time remaining afloat

SS Minnow, ashore on an uncharted island, stranded with 7 persons on board

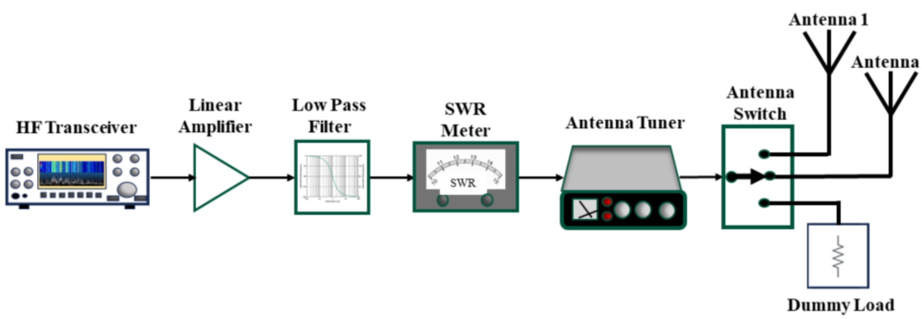
For Next Class:

- Review Chapter 12 of Basic Study Guide;
- Read Chapter 13 of Basic Study Guide; and
- Start the practice tests!

Al Penney
VO1NO


Questions?
HEiL

Typical HF Installation



Al Penney
VO1NO

Review Question 1

If an amateur pretends there is an emergency and transmits the word “MAYDAY,” what is this called?

- An emergency test transmission
- Nothing special: “MAYDAY” has no meaning in an emergency
- False or deceptive signals
- A traditional greeting in May

Al Penney
VO1NO

Review Question 1

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- Nothing special: “MAYDAY” has no meaning in an emergency
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- A traditional greeting in May

< False or deceptive signals >

Al Penney
VO1NO

Review Question 2

What are the restrictions on the use of abbreviations or procedural signals in the amateur service?

- Only "10 codes" are permitted
- They may be used if the signals or codes are not secret
- There are no restrictions
- They are not permitted because they obscure the meaning of a message to government monitoring stations

Al Penney
VO1NO

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< They may be used if the signals or codes are not secret >

Al Penney
VO1NO

Review Question 3

How often must an amateur station be identified?

- At least once during each transmission
- At the beginning and end of each transmission
- At least every thirty minutes, and at the beginning and at the end of a contact
- At the beginning of a contact and at least every thirty minutes after that

Al Penney
VO1NO

Review Question 3

How often must an amateur station be identified?

• At least once during each transmission

• At the beginning and end of each transmission

• At least every thirty minutes, and at the beginning and at the end of a contact

• At the beginning of a contact and at least every thirty minutes after that

< At least every thirty minutes, and at the beginning and at the end of a contact >

Al Penney
VO1NO

Review Question 4

What identification, if any, is required when two amateur stations begin communications?

- No identification is required
- Both stations must transmit both call signs
- One of the stations must give both stations' call signs
- Each station must transmit its own call sign

Al Penney
VO1NO

Review Question 4

What identification, if any, is required when two amateur stations begin communications?

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- One of the stations must give both stations' call signs
- Each station must transmit its own call sign

< Each station must transmit its own call sign >

Al Penney
VO1NO

Review Question 5

What is the longest period of time an amateur station can transmit, without transmitting its call sign?

- 20 minutes
- 15 minutes
- 10 minutes
- 30 minutes

Al Penney
VO1NO

Review Question 5

What is the longest period of time an amateur station can transmit, without transmitting its call sign?

- 20 minutes
- 15 minutes
- 10 minutes
- 30 minutes

<30 minutes >

Al Penney
VO1NO

Review Question 6

Which of the following answers is NOT correct? Based on the bandwidth required, the following modes may be transmitted on these frequencies:

- AMTOR on 14.08 MHz
- 300 bps packet on 10.145 MHz
- fast-scan television (ATV) on 440 MHz
- fast-scan television (ATV) on 145 MHz

Al Penney
VO1NO

Review Question 6

Which of the following answers is NOT correct? Based on the bandwidth required, the following modes may be transmitted on these frequencies:

- AMTOR on 14.08 MHz
- 300 bps packet on 10.145 MHz
- fast-scan television (ATV) on 440 MHz
- fast-scan television (ATV) on 145 MHz

< fast-scan television (ATV) on 145 MHz >

Al Penney
VO1NO

Review Question 7

What is a good way to make contact on a repeater?

• Say the other operator's name, then your call sign three times

• Say, "Breaker, breaker"

• Say the call sign of the station you want to contact three times

• Say the call sign of the station you want to contact, then your call sign

Al Penney
VO1NO

Review Question 7

What is a good way to make contact on a repeater?

• Say the other operator's name, then your call sign three times

• Say, "Breaker, breaker"

• Say the call sign of the station you want to contact three times

• Say the call sign of the station you want to contact, then your call sign

< Say the call sign of the station you want to contact, then your call sign >

Al Penney
VO1NO

Review Question 8

What is the main purpose of a repeater?

• To retransmit weather information during severe storm warnings

• To make local information available 24 hours a day

• To increase the range of portable and mobile stations

• To link amateur stations with the telephone system

Al Penney
VO1NO

Review Question 8

What is the main purpose of a repeater?

• To retransmit weather information during severe storm warnings

• To make local information available 24 hours a day

• To increase the range of portable and mobile stations

• To link amateur stations with the telephone system

< To increase the range of portable and mobile stations >

Al Penney
VO1NO

Review Question 9

What is the purpose of a repeater time-out timer?

- It tells how long someone has been using a repeater
- It interrupts lengthy transmissions without pauses
- It lets a repeater have a rest period after heavy use
- It logs repeater transmit time to predict when a repeater will fail

Al Penney
VO1NO

Review Question 9

What is the purpose of a repeater time-out timer?

• It tells how long someone has been using a repeater

• It interrupts lengthy transmissions without pauses

• It lets a repeater have a rest period after heavy use

• It logs repeater transmit time to predict when a repeater will fail

< It interrupts lengthy transmissions without pauses >

Al Penney
VO1NO

Review Question 10

What is a CTCSS tone?

- A sub-audible tone that activates a receiver audio output when present
- A tone used by repeaters to mark the end of a transmission
- A special signal used for telemetry between amateur space stations and Earth stations
- A special signal used for radio control of model craft

Al Penney
VO1NO

Review Question 10

What is a CTCSS tone?

• A sub-audible tone that activates a receiver audio output when present

• A tone used by repeaters to mark the end of a transmission

• A special signal used for telemetry between amateur space stations and Earth stations

• A special signal used for radio control of model craft

< A sub-audible tone that activates a receiver audio output when present >

Al Penney
VO1NO

Review Question 11

How do you call another station on a repeater if you know the station's call sign?

- Say "CQ" three times, then say the station's call sign
- Wait for the station to call "CQ", then answer it
- Say the station's call sign, then identify your own station
- Say "break, break 79," then say the station's call sign

Al Penney
VO1NO

Review Question 11

How do you call another station on a repeater if you know the station's call sign?

- Say "CQ" three times, then say the station's call sign
- Wait for the station to call "CQ", then answer it
- Say the station's call sign, then identify your own station
- Say "break, break 79," then say the station's call sign

< Say the station's call sign, then identify your own station >

Al Penney
VO1NO

Review Question 12

Why should you pause briefly between transmissions when using a repeater?

- To check the SWR of the repeater
- To reach for pencil and paper for third-party communications
- To dial up the repeater's autopatch
- To listen for anyone else wanting to use the repeater

Al Penney
VO1NO

Review Question 12

Why should you pause briefly between transmissions when using a repeater?

• To check the SWR of the repeater

• To reach for pencil and paper for third-party communications

• To dial up the repeater's autopatch

• To listen for anyone else wanting to use the repeater

< To listen for anyone else wanting to use the repeater >

Al Penney
VO1NO

Review Question 13

Why should you keep transmissions short when using a repeater?

- To give any listening non-hams a chance to respond
- To see if the receiving station operator is still awake
- A long transmission may prevent someone with an emergency from using the repeater
- To keep long-distance charges down

Al Penney
VO1NO

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• To keep long-distance charges down

< A long transmission may prevent someone with an emergency from using the repeater >

Al Penney
VO1NO

Review Question 14

What is the proper way to break into a conversation on a repeater?

- Say your call sign during a break between transmissions
- Wait for the end of a transmission and start calling the desired party
- Shout, ”break, break!” to show that you’re eager to join the conversation
- Turn on an amplifier and override whoever is talking

Al Penney
VO1NO

Review Question 14

What is the proper way to break into a conversation on a repeater?

• Say your call sign during a break between transmissions

• Wait for the end of a transmission and start calling the desired party

• Shout, "break, break!" to show that you're eager to join the conversation

• Turn on an amplifier and override whoever is talking

< Say your call sign during a break between transmissions >

Al Penney
VO1NO

Review Question 15

What is the accepted way to ask someone their location when using a repeater?

- What is your 12?
- Where are you?
- What is your 20?
- Locations are not normally told by radio

Al Penney
VO1NO

Review Question 15

What is the accepted way to ask someone their location when using a repeater?

- What is your 12?
- Where are you?
- What is your 20?
- Locations are not normally told by radio

< Where are you? >

Al Penney
VO1NO

Review Question 16

FM repeater operation on the 2 metre band uses one frequency for transmission and one for reception. The difference in frequency between the transmit and receive frequency is normally:

- 400 kHz
- 600 kHz
- 800 kHz
- 1000 kHz

Al Penney
VO1NO

Review Question 16

FM repeater operation on the 2 metre band uses one frequency for transmission and one for reception. The difference in frequency between the transmit and receive frequency is normally:

- 400 kHz
- 600 kHz
- 800 kHz
- 1000 kHz

< 600 kHz >

Al Penney
VO1NO

Review Question 17

To make your call sign better understood when using voice transmissions, what should you do?

- Talk louder
- Turn up your microphone gain
- Use Standard International Phonetics for each letter of your call sign
- Use any words which start with the same letters as your call sign for each letter of your call sign

Al Penney
VO1NO

Review Question 17

To make your call sign better understood when using voice transmissions, what should you do?

• Talk louder

• Turn up your microphone gain

• Use Standard International Phonetics for each letter of your call sign

• Use any words which start with the same letters as your call sign for each letter of your call sign

< Use Standard International Phonetics for each letter of your call sign >

Al Penney
VO1NO

Review Question 18

What is the correct way to call “CQ” when using voice?

• Say “CQ” at least five times, followed by “this is,” followed by your call sign spoken once

• Say “CQ” at least ten times, followed by “this is,” followed by your call sign spoken once

• Say “CQ” three times, followed by “this is,” followed by your call sign spoken three times

• Say ”CQ” once, followed by “this is,” followed by your call sign spoken three times

Al Penney
VO1NO

Review Question 18

What is the correct way to call “CQ” when using voice?

• Say “CQ” at least five times, followed by “this is,” followed by your call sign spoken once

• Say “CQ” at least ten times, followed by “this is,” followed by your call sign spoken once

• Say “CQ” three times, followed by “this is,” followed by your call sign spoken three times

• Say ”CQ” once, followed by “this is,” followed by your call sign spoken three times

< Say “CQ” three times, followed by “this is,” followed by your call sign spoken three times >

Al Penney
VO1NO

Review Question 19

How should you answer a voice CQ call?

• Say the other station's call sign at least three times, followed by "this is," and your call sign at least five times phonetically

• Say the other station's call sign at least ten times, followed by "this is," then your call sign at least twice

• Say the other station's call sign once, followed by "this is," then your call sign given phonetically

• Say the other station's call sign at least five times phonetically, followed by "this is," then your call sign twice

Al Penney
VO1NO

Review Question 19

How should you answer a voice CQ call?

• Say the other station's call sign at least three times, followed by "this is," and your call sign at least five times phonetically

• Say the other station's call sign at least ten times, followed by "this is," then your call sign at least twice

• Say the other station's call sign once, followed by "this is," then your call sign given phonetically

• Say the other station's call sign at least five times phonetically, followed by "this is," then your call sign twice

< Say the other station's call sign once, followed by "this is," then your call sign given phonetically >

Al Penney
VO1NO

Review Question 20

What is simplex operation?

- Transmitting one-way communications
- Transmitting and receiving on the same frequency
- Transmitting and receiving over a wide area
- Transmitting on one frequency and receiving on another

Al Penney
VO1NO

Review Question 20

What is simplex operation?

- Transmitting one-way communications
- Transmitting and receiving on the same frequency
- Transmitting and receiving over a wide area
- Transmitting on one frequency and receiving on another

< Transmitting and receiving on the same frequency >

Al Penney
VO1NO

Review Question 21

When should you use simplex operation instead of a repeater?

- When an emergency telephone call is needed
- When you are traveling and need some local information
- When signals are reliable between communicating parties without using a repeater
- When the most reliable communications are needed

Al Penney
VO1NO

Review Question 21

When should you use simplex operation instead of a repeater?

- When an emergency telephone call is needed
- When you are traveling and need some local information
- When signals are reliable between communicating parties without using a repeater
- When the most reliable communications are needed

< When signals are reliable between communicating parties without using a repeater >

Al Penney
VO1NO

Review Question 22

Why should local amateur communications use VHF and UHF frequencies instead of HF frequencies?

- Because signals are stronger on VHF and UHF frequencies
- To minimize interference on HF bands capable of long-distance communication
- Because greater output power is permitted on VHF and UHF
- Because HF transmissions are not propagated locally

Al Penney
VO1NO

Review Question 22

Why should local amateur communications use VHF and UHF frequencies instead of HF frequencies?

- Because signals are stronger on VHF and UHF frequencies
- To minimize interference on HF bands capable of long-distance communication
- Because greater output power is permitted on VHF and UHF
- Because HF transmissions are not propagated locally

< To minimize interference on HF bands capable of long-distance communication >

Al Penney
VO1NO

Review Question 23

Why should we be careful in choosing a simplex frequency when operating VHF and UHF FM?

- Implanted medical devices share the same spectrum
- Some frequencies are designated for narrow band FM and others for wideband FM
- You may inadvertently choose a channel that is an input to a local repeater
- Interference may be caused to unlicensed devices operating in the same band

Al Penney
VO1NO

Review Question 23

Why should we be careful in choosing a simplex frequency when operating VHF and UHF FM?

- Implanted medical devices share the same spectrum
- Some frequencies are designated for narrow band FM and others for wideband FM
- You may inadvertently choose a channel that is an input to a local repeater
- Interference may be caused to unlicensed devices operating in the same band

< You may inadvertently choose a channel that is an input to a local repeater >

Al Penney
VO1NO

Review Question 24

If you are talking to a station using a repeater, how would you find out if you could communicate using simplex instead?

- See if you can clearly receive a more distant repeater
- See if you can clearly receive the station on a lower frequency band
- See if you can clearly receive the station on the repeater's input frequency
- See if a third station can clearly receive both of you

Al Penney
VO1NO

Review Question 24

If you are talking to a station using a repeater, how would you find out if you could communicate using simplex instead?

• See if you can clearly receive a more distant repeater

• See if you can clearly receive the station on a lower frequency band

• See if you can clearly receive the station on the repeater's input frequency

• See if a third station can clearly receive both of you

< See if you can clearly receive the station on the repeater's input frequency >

Al Penney
VO1NO

Review Question 25

Which sideband is commonly used for 20-metre phone operation?

- Lower
- FM
- Double
- Upper

Al Penney
VO1NO

Review Question 25

Which sideband is commonly used for 20-metre phone operation?

- Lower
- FM
- Double
- Upper

< Upper >

The convention is to use lower sideband on the 160 m, 80 m and 40 m bands and upper sideband for the 20m, 15 m and 10 m bands. You can use the other sideband, but there may not be anybody there listening.

Al Penney
VO1NO

Review Question 26

Which sideband is commonly used on 3755 kHz for phone operation?

- FM
- Double
- Upper
- Lower

Al Penney
VO1NO

Review Question 26

Which sideband is commonly used on 3755 kHz for phone operation?

- FM
- Double
- Upper
- Lower

< Lower >

The convention is to use lower sideband on the 160 m, 80 m and 40 m bands and upper sideband for the 20m, 15 m and 10 m bands. You can use the other sideband, but there may not be anybody there listening.

Al Penney
VO1NO

Review Question 27

What is the best method to tell if a band is “open” for communication with a particular distant location?

• Ask others on your local 2 metre FM repeater

• Telephone an experienced local amateur

• Look at the propagation forecasts in an amateur radio magazine

• Listen for signals from that area from an amateur beacon station or a foreign broadcast or television station on a nearby frequency

Al Penney
VO1NO

Review Question 27

What is the best method to tell if a band is “open” for communication with a particular distant location?

• Ask others on your local 2 metre FM repeater

• Telephone an experienced local amateur

• Look at the propagation forecasts in an amateur radio magazine

• Listen for signals from that area from an amateur beacon station or a foreign broadcast or television station on a nearby frequency

< Listen for signals from that area from an amateur beacon station or a foreign broadcast or television station on a nearby frequency >

Al Penney
VO1NO

Review Question 28

What should you do before you transmit on any frequency?

• Listen to make sure that someone will be able to hear you

• Listen to make sure others are not using the frequency

• Check your antenna for resonance at the selected frequency

• Make sure the SWR on your antenna transmission line is high enough

Al Penney
VO1NO

Review Question 28

What should you do before you transmit on any frequency?

• Listen to make sure that someone will be able to hear you

• Listen to make sure others are not using the frequency

• Check your antenna for resonance at the selected frequency

• Make sure the SWR on your antenna transmission line is high enough

< Listen to make sure others are not using the frequency >

Al Penney
VO1NO

Review Question 29

If you are the net control station of a daily HF net, what should you do if the frequency on which you normally meet is in use just before the net begins?

• Increase your power output so that net participants will be able to hear you over the existing activity

• Cancel the net for that day

• Call and ask the occupants to relinquish the frequency for the scheduled net operations, but if they are not agreeable conduct the net on a frequency 3 to 5 kHz away from the regular net frequency

• Reduce your output power and start the net as usual

Al Penney
VO1NO

Review Question 29

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• Reduce your output power and start the net as usual

< Call and ask the occupants to relinquish the frequency for the scheduled net operations, but if they are not agreeable conduct the net on a frequency 3 to 5 kHz away from the regular net frequency >

Al Penney
VO1NO

Review Question 30

If a net is about to begin on a frequency which you and another station are using, what should you do?

- Transmit as long as possible on the frequency so that no other stations may use it
- Turn off your radio
- As a courtesy to the net, move to a different frequency
- Increase your power output to ensure that all net participants can hear you

Al Penney
VO1NO

Review Question 30

If a net is about to begin on a frequency which you and another station are using, what should you do?

• Transmit as long as possible on the frequency so that no other stations may use it

• Turn off your radio

• As a courtesy to the net, move to a different frequency

• Increase your power output to ensure that all net participants can hear you

< As a courtesy to the net, move to a different frequency >

Al Penney
VO1NO

Review Question 31

When selecting a single-sideband phone transmitting frequency, what minimum frequency separation from a contact in progress should you allow (between suppressed carriers) to minimize interference?

- Approximately 10 kHz
- Approximately 3 kHz
- 150 to 500 Hz
- Approximately 6 kHz

Al Penney
VO1NO

Review Question 31

When selecting a single-sideband phone transmitting frequency, what minimum frequency separation from a contact in progress should you allow (between suppressed carriers) to minimize interference?

- Approximately 10 kHz
- Approximately 3 kHz
- 150 to 500 Hz
- Approximately 6 kHz

< Approximately 3 kHz >

Al Penney
VO1NO

Review Question 32

Before transmitting, the first thing you should do is:

• make an announcement on the frequency indicating that you intend to make a call

• decrease your receiver's volume

• listen carefully so as not to interrupt communications already in progress

• ask if the frequency is occupied

Al Penney
VO1NO

Review Question 32

Before transmitting, the first thing you should do is:

• make an announcement on the frequency indicating that you intend to make a call

• decrease your receiver's volume

• listen carefully so as not to interrupt communications already in progress

• ask if the frequency is occupied

< listen carefully so as not to interrupt communications already in progress >

Al Penney
VO1NO

Review Question 33

What is the correct way to call "CQ" when using Morse code?

• Send the letters "CQ" over and over

• Send the letters "CQ" three times, followed by "DE", followed by your call sign sent three times

• Send the letters "CQ" three times, followed by "DE", followed by your call sign sent once

• Send the letters "CQ" ten times, followed by "DE", followed by your call sign sent once

Al Penney
VO1NO

Review Question 33

What is the correct way to call "CQ" when using Morse code?

• Send the letters "CQ" over and over

• Send the letters "CQ" three times, followed by "DE", followed by your call sign sent three times

• Send the letters "CQ" three times, followed by "DE", followed by your call sign sent once

• Send the letters "CQ" ten times, followed by "DE", followed by your call sign sent once

< Send the letters "CQ" three times, followed by "DE", followed by your call sign sent three times >

Al Penney
VO1NO

Review Question 33A

How should you answer a routine Morse code “CQ” call?

• Send your call sign four times

• Send the other station’s call sign once, followed by “DE”, followed by your call sign four times

• Send your call sign followed by your name, station location and a signal report

• Send the other station’s call sign twice, followed by “DE”, followed by your call sign twice

Al Penney
VO1NO

Review Question 33A

How should you answer a routine Morse code "CQ" call?

• Send your call sign four times

• Send the other station's call sign once, followed by "DE", followed by your call sign four times

• Send your call sign followed by your name, station location and a signal report

• Send the other station's call sign twice, followed by "DE", followed by your call sign twice

< Send the other station's call sign twice, followed by "DE", followed by your call sign twice >

Al Penney
VO1NO

Review Question 34

At what speed should a Morse code CQ call be transmitted?

- At any speed below 5 w.p.m.
- At the highest speed your keyer will operate
- At the highest speed at which you can control the keyer
- At any speed which you can reliably receive

Al Penney
VO1NO

Review Question 34

At what speed should a Morse code CQ call be transmitted?

- At any speed below 5 w.p.m.
- At the highest speed your keyer will operate
- At the highest speed at which you can control the keyer
- At any speed which you can reliably receive

< At any speed which you can reliably receive >

Al Penney
VO1NO

Review Question 35

What is the meaning of the procedural signal "K"?

- Any station please reply
- End of message
- Called station only transmit
- All received correctly

Al Penney
VO1NO

Review Question 35

What is the meaning of the procedural signal “K”?

- Any station please reply
- End of message
- Called station only transmit
- All received correctly

< Any station please reply >

Al Penney
VO1NO

Review Question 36

What is meant by the term "DX"?

- Distant station
- Calling any station
- Go ahead
- Best regards

Al Penney
VO1NO

Review Question 36

What is meant by the term “DX”?

- Distant station
- Calling any station
- Go ahead
- Best regards

< Distant station >

Al Penney
VO1NO

Review Question 37

When selecting a CW transmitting frequency, what minimum frequency separation from a contact in progress should you allow to minimize interference?

- 5 to 50 Hz
- 1 to 3 kHz
- 3 to 6 kHz
- 150 to 500 Hz

Al Penney
VO1NO

Review Question 37

When selecting a CW transmitting frequency, what minimum frequency separation from a contact in progress should you allow to minimize interference?

- 5 to 50 Hz
- 1 to 3 kHz
- 3 to 6 kHz
- 150 to 500 Hz

< 150 to 500 Hz >

Al Penney
VO1NO

Review Question 38

What is the meaning of: "Your signal report is 3 3"?

- The station is located at latitude 33 degrees
- The contact is serial number 33
- Your signal is readable with considerable difficulty and weak in strength
- Your signal is unreadable, very weak in strength

Al Penney
VO1NO

Review Question 38

What is the meaning of: "Your signal report is 3 3"?

• The station is located at latitude 33 degrees

• The contact is serial number 33

• Your signal is readable with considerable difficulty and weak in strength

• Your signal is unreadable, very weak in strength

< Your signal is readable with considerable difficulty and weak in strength >

Al Penney
VO1NO

Review Question 39

A distant station asks for a signal report on a local repeater you monitor. What fact affects your assessment?

- The repeater gain affects your S-meter reading
- You need to listen to the repeater input frequency for an accurate signal report
- Signal reports are only useful on simplex communications
- The other operator needs to know how well he is received on the repeater, not how well you receive the repeater

Al Penney
VO1NO

Review Question 39

A distant station asks for a signal report on a local repeater you monitor. What fact affects your assessment?

• The repeater gain affects your S-meter reading

• You need to listen to the repeater input frequency for an accurate signal report

• Signal reports are only useful on simplex communications

• The other operator needs to know how well he is received on the repeater, not how well you receive the repeater

< The other operator needs to know how well he is received on the repeater, not how well you receive the repeater >

Signal reports on a repeater tend to be anecdotal. Such phrases as "full quieting into the repeater", "solid copy", or "noisy" are used instead.

Al Penney
VO1NO

Review Question 40

What does "RST 579" mean in a Morse code contact?

- Your signal is perfectly readable, moderately strong, and with perfect tone
- Your signal is perfectly readable, weak strength, and with perfect tone
- Your signal is fairly readable, fair strength, and with perfect tone
- Your signal is barely readable, moderately strong, and with faint ripple

Al Penney
VO1NO

Review Question 40

What does “RST 579” mean in a Morse code contact?

• Your signal is perfectly readable, moderately strong, and with perfect tone

• Your signal is perfectly readable, weak strength, and with perfect tone

• Your signal is fairly readable, fair strength, and with perfect tone

• Your signal is barely readable, moderately strong, and with faint ripple

< Your signal is perfectly readable, moderately strong, and with perfect tone >

Al Penney
VO1NO

Review Question 41

What is the proper Q signal to use to see if a frequency is in use before transmitting on CW?

- QRZ?
- QRL?
- QRV?
- QRU?

Al Penney
VO1NO

Review Question 41

What is the proper Q signal to use to see if a frequency is in use before transmitting on CW?

- QRZ?
- QRL?
- QRV?
- QRU?

< QRL? >

Al Penney
VO1NO

Review Question 42

If you are in contact with another station and you hear an emergency call for help on your frequency, what should you do?

• Immediately stop your contact and acknowledge the emergency call

• Tell the calling station that the frequency is in use

• Direct the calling station to the nearest emergency net frequency

• Call your local police station and inform them of the emergency call

Al Penney
VO1NO

Review Question 42

If you are in contact with another station and you hear an emergency call for help on your frequency, what should you do?

• Immediately stop your contact and acknowledge the emergency call

• Tell the calling station that the frequency is in use

• Direct the calling station to the nearest emergency net frequency

• Call your local police station and inform them of the emergency call

< Immediately stop your contact and acknowledge the emergency call >

Al Penney
VO1NO

Review Question 43

What is the proper distress call to use when operating CW?

- QRRR
- MAYDAY
- SOS
- CQD

Al Penney
VO1NO

Review Question 43

What is the proper distress call to use when operating CW?

- QRRR
- MAYDAY
- SOS
- CQD

< SOS >

Al Penney
VO1NO

Review Question 44

What is the most important accessory to have for a hand-held radio in an emergency?

- An extra antenna
- A portable amplifier
- A microphone headset for hands-free operation
- Several sets of charged batteries

Al Penney
VO1NO

Review Question 44

What is the most important accessory to have for a hand-held radio in an emergency?

- An extra antenna
- A portable amplifier
- A microphone headset for hands-free operation
- Several sets of charged batteries

< Several sets of charged batteries >

Al Penney
VO1NO

Review Question 45

If you hear distress traffic and are unable to render assistance you should:

- take no action
- tell all other stations to cease transmitting
- contact authorities and then maintain watch until you are certain that assistance will be forthcoming
- enter the details in the log book and take no further action

Al Penney
VO1NO

Review Question 45

If you hear distress traffic and are unable to render assistance you should:

• take no action

• tell all other stations to cease transmitting

• contact authorities and then maintain watch until you are certain that assistance will be forthcoming

• enter the details in the log book and take no further action

< contact authorities and then maintain watch until you are certain that assistance will be forthcoming >

Al Penney
VO1NO

Review Question 46

What is an azimuthal map?

- A map that shows the angle at which an amateur satellite crosses the equator
- A map that shows the number of degrees longitude that an amateur satellite appears to move westward at the equator
- A map projection centered on a particular location, used to determine the shortest path between points on the Earth's surface
- A map projection centered on the North Pole

Al Penney
VO1NO

Review Question 46

What is an azimuthal map?

• A map that shows the angle at which an amateur satellite crosses the equator

• A map that shows the number of degrees longitude that an amateur satellite appears to move westward at the equator

• A map projection centered on a particular location, used to determine the shortest path between points on the Earth's surface

• A map projection centered on the North Pole

< A map projection centered on a particular location, used to determine the shortest path between points on the Earth's surface >

Al Penney
VO1NO

Review Question 47

A directional antenna pointed in the long-path direction to another station is generally oriented how many degrees from its short-path heading?

- 270 degrees
- 180 degrees
- 45 degrees
- 90 degrees

Al Penney
VO1NO

Review Question 47

A directional antenna pointed in the long-path direction to another station is generally oriented how many degrees from its short-path heading?

- 270 degrees
- 180 degrees
- 45 degrees
- 90 degrees

<180 degrees>

Al Penney
VO1NO

Review Question 48

Which statement about recording all contacts and unanswered “CQ calls” in a station logbook or computer log is NOT correct?

• A log is important for handling neighbour interference complaints

• A logbook is required by Industry Canada

• A log is important for recording contacts for operating awards

• A well-kept log preserves your fondest amateur radio memories for years

Al Penney
VO1NO

Review Question 48

Which statement about recording all contacts and unanswered “CQ calls” in a station logbook or computer log is NOT correct?

• A log is important for handling neighbour interference complaints

• A logbook is required by Industry Canada

• A log is important for recording contacts for operating awards

• A well-kept log preserves your fondest amateur radio memories for years

< A logbook is required by Industry Canada >

Al Penney
VO1NO

Review Question 49

When referring to contacts in the station log, what do the letters UTC mean?

- Unlimited Time Capsule
- Universal Time Coordinated (formerly Greenwich Mean Time - GMT)
- Universal Time Constant
- Unlisted Telephone Call

Al Penney
VO1NO

Review Question 49

When referring to contacts in the station log, what do the letters UTC mean?

• Unlimited Time Capsule

• Universal Time Coordinated (formerly Greenwich Mean Time - GMT)

• Universal Time Constant

• Unlisted Telephone Call

< Universal Time Coordinated (formerly Greenwich Mean Time - GMT) >

Al Penney
VO1NO

Review Question 50

What does "monitoring" mean on a packet-radio frequency?

• Industry Canada is monitoring all messages

• A receiving station is displaying messages that may not be sent to it, and is not replying to any message

• A member of the Amateur Auxiliary is copying all messages

• A receiving station is displaying all messages sent to it, and replying that the messages are being received correctly

Al Penney
VO1NO

Review Question 50

What does "monitoring" mean on a packet-radio frequency?

• Industry Canada is monitoring all messages

• A receiving station is displaying messages that may not be sent to it, and is not replying to any message

• A member of the Amateur Auxiliary is copying all messages

• A receiving station is displaying all messages sent to it, and replying that the messages are being received correctly

< A receiving station is displaying messages that may not be sent to it, and is not replying to any message >

Al Penney
VO1NO

Review Question 51

What does “network” mean in packet radio?

• The connections on terminal-node controllers

• The programming in a terminal-node controller that rejects other callers if a station is already connected

• A way of connecting packet-radio stations so data can be sent over long distances

• A way of connecting terminal-node controllers by telephone so data can be sent over long distances

Al Penney
VO1NO

Review Question 51

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< A way of connecting packet-radio stations so data can be sent over long distances >

Al Penney
VO1NO

Review Question 52

When selecting a RTTY transmitting frequency, what minimum frequency separation from a contact in progress should you allow (center to center) to minimize interference?

- Approximately 6 kHz
- Approximately 3 kHz
- 60 Hz
- 250 to 500 Hz

Al Penney
VO1NO

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Al Penney
VO1NO

Review Question 53

With a digital communication mode based on a computer sound card, what is the result of feeding too much audio in the transceiver?

- Power amplifier overheating
- Splatter or out of channel emissions
- Higher signal-to-noise ratio
- Lower error rate

Al Penney
VO1NO

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Al Penney
VO1NO

Review Question 54

FM receivers perform in an unusual manner when two or more stations are present. The loudest signal, even though it is only two or three times as stronger than the other signals, will be the only transmission demodulated. This is called:

- attach effect
- interference effect
- surrender effect
- capture effect

Al Penney
VO1NO

Review Question 54

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< capture effect >

Al Penney
VO1NO

Review Question 55

What does “connected” mean in an AX.25 packet-radio link?

• A telephone link is working between two stations

• A message has reached an amateur station for local delivery

• A transmitting and receiving station are using a digipeater, so no other contacts can take place until they are finished

• A transmitting station is sending data to only one receiving station; it replies that the data is being received correctly

Al Penney
VO1NO

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Al Penney
VO1NO

Review Question 56

What is a digipeater?

- A repeater built using only digital electronics parts
- A repeater that changes audio signals to digital data
- A station that retransmits any data that it receives
- A station that retransmits only data that is marked to be retransmitted

Al Penney
VO1NO

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Al Penney
VO1NO

Review Question 57

Digital transmissions use signals called to transmit the states 1 and 0

- dot and dash
- mark and space
- packet and AMTOR
- Baudot and ASCII

Al Penney
VO1NO

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< mark and space >

Al Penney
VO1NO

Review Question 58

How would you modulate a 2 meter FM transceiver to produce packet-radio emissions?

• Connect a terminal-node controller to the transceiver's microphone input

• Connect a terminal-node controller to interrupt the transceiver's carrier wave

• Connect a keyboard to the transceiver's microphone input

• Connect a DTMF keypad to the transceiver's microphone input

Al Penney
VO1NO

Review Question 58

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< Connect a terminal-node controller to the transceiver's microphone input >

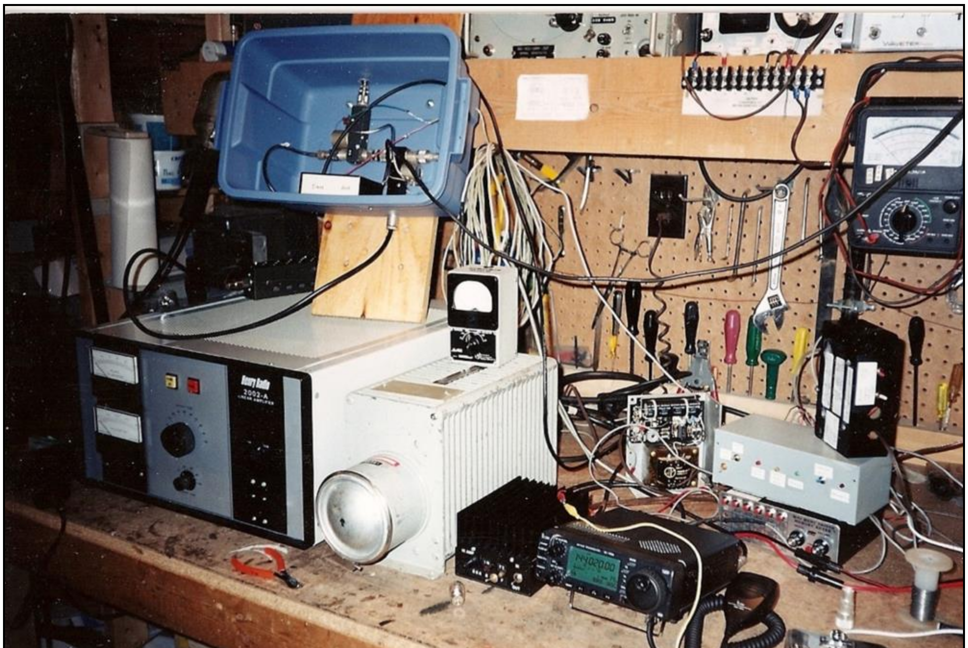
Al Penney
VO1NO


Questions?
HEIL

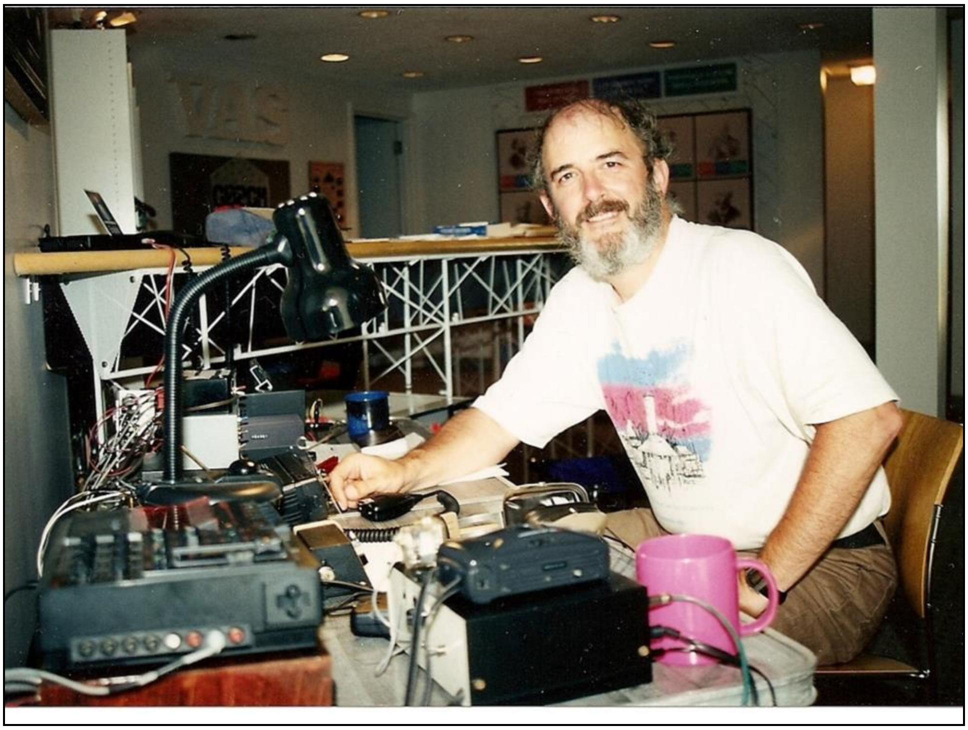
In the summer of 1996, Fred and I made our first two Meter Trans-Atlantic attempt. Along with two other Amateurs, we operated from the Marconi National Historic Site in Glace Bay, Nova Scotia.

Our antenna was a 42 element rope yagi suspended at 10 meters between two towers. Located atop a cliff overlooking the Atlantic, it had a clear shot to Europe. Well, other than Newfoundland, it was a clear shot!

The yagi was developed by Fred VE1FA from the 33 element design described by N6JF in the March 1995 issue of QST Magazine. Using EZNEC 1 software, the design took many hours to optimize.



Seen here is VE1FA's test-bench setup. An Icom 706 fed a small brick which in turn drove the Henry 2002A linear amplifier. Output was limited to 600 watts CW. The transmitting arrangement was a typical Ham setup! A 1 revolution per minute clock motor turned a circular piece of plastic – the bottom of one of Fred's petri dishes! Half of the dish was blackened with a marker. A photodiode sensed the clear and dark portions of the dish, which keyed a homebrew sequencer for the transmitter and amplifiers, and operated a memory keyer sending CQ and our callsign.



We operated continuously for a week…

We did take a few moments to relax periodically. One evening we shared a beer with Marconi himself! If you look closely, you'll see a paper cutout beer bottle that we placed in Marconi's hand. It was still there several days later when we left. I wonder if the museum staff ever found it!

Of course, listening to 30 seconds of CW followed by 30 seconds of white noise is bound to take its toll on the sanity of even the most dedicated Ham after a week! Tired and each of us in need of a good razor, we shared our frustration at not hearing a reply by adopting the same pose as Marconi!

We set up the same station later that summer during our DX'pedition to Seal Island off the south coast of Nova Scotia for the July IOTA contest, as seen in this photo. The following summer we operated a much more modest station from Fogo Island in Newfoundland, again during our annual IOTA DX'pedition. It boasted 150 watts CW into a 13 element yagi, but instead of a petri dish, we used an MFJ 1278 multi-mode data controller!

Unfortunately, none of these attempts yielded success. Fred and I vowed to keep trying.


Questions?
HEiL