

GBRA 5 Week Technician License Class - Week 2 Lesson Plan (Using HF and VHF rigs and Operating Modes)

Operating Modes -

CW

CW (continuous wave) or Morse code (Samuel Morse 1830's)

Draw waveform on white board

Oldest mode

Plain un-modulated RF signal turned on and off by a key or "paddles"

Most basic form of digital communication (only digital mode that does not require a decoder of some type)

Made up of short tones (dots or "dits"), long tones (dashes or "dahs") and spaces

Mixing and matching dits, dahs and spaces produces a "code" that represents letters, digits, punctuation marks or symbols

International Morse (developed in Germany) rather than American Morse developed in US used by railroads

Advantages and practical use of CW in amateur radio -

- 1 - Doesn't require ability to speak English
- 2 - "Gets thru" in poor conditions when voice signals would be too difficult to understand due to fading, static or interfering signals etc.
- 3 - Narrow bandwidth

Most commonly used on HF bands but can be used on VHF and UHF too.

Play WAV files of CW signals

AM

Amplitude modulation (draw waveform on white board)

First mode used to transmit voice. It was the dominate voice mode until the late 1940's and early 1950's when single side band was developed

AM uses a lot of bandwidth

It is seldom used now and has been reduced to a novelty for antique wireless enthusiasts

FM

Frequency modulation (draw waveform on white board)

Most popular mode, used mostly on VHF and UHF

Most popular for tech class on 2 meter band using simplex and repeater operation

FM is also used on the upper end of the 10 meter band (general class or above)

On 2 meters signals are generally line of sight or reflected off of buildings, hillsides etc. thus range is limited but use of repeaters situated at high elevations significantly improves communication range

2 Meter band (144-148 MHz) use allows only CW from 144.0-144.1, SSB is used from 144.1 to about 144.6. Above 144.6 is generally used for FM voice on simplex or repeaters and for digital packet communication

SSB

Suppressed carrier single side band or just single side band (draw waveform on white board and explain how derived from double side band full carrier signal)

Un-necessary information is removed resulting in a narrower bandwidth than AM or FM signal

Receivers add the "carrier" part of the signal back in using what is called a beat frequency oscillator or BFO that allows the signal to be converted into intelligible voice

Popular on HF and 6 meter band (can be used on other VHF and UHF bands too)

Easier to copy weak SSB signals than FM since the receiver isn't required to "capture" the signal

Hams use both upper and lower side bands for SSB

The practice is to use LSB below 10 MHz and USB above 10 MHz

DIGITAL MODES

RTTY

(Pronounced "RITTe") or FSK (frequency shift keying)

RTTY was first used on wired circuits in the 1800's

The military first used it on HF during WWII

Before the advent of personal computers hams used surplus TTY machines

RTTY is slow - transmission rate used in amateur radio is 45.45 baud (compare to a "slow" internet telephone modem of 56,000 baud!)

RTTY uses a 5 bit code known as Baudot (named for the French developer Emile Baudot) to represent letters, numerals and limited punctuation marks (no lower case letters in RTTY)

RTTY signals are produced by shifting the transmitter frequency back and forth between two frequencies called a MARK and SPACE typically 170 Hz apart

RTTY is a very rudimentary form of digital communications. It has no error correcting but it is still very popular on the HF bands with hams

Play WAV files of RTTY signals

AMTOR

Amateur Tele-printing Over Radio (AMTOR)

Similar to RTTY except it includes a form or error correcting

AMTOR is used mainly on HF and is not an especially popular mode

Stations exchange transmissions in a linked mode of communicating with the sending station transmitting short burst of data and the receiving station sending short acknowledgement signals

Characters are sent in groups of 3 with a "bit ratio" included. If the receiving station does not "hear" the correct characters based on the "bit ratio" it sends a NOT ACK signal and the sending station re-sends the information

The process is controlled by computers connected to both stations' transceivers

Play WAV file of AMTOR signal

Packet

Also an error correcting mode used most on 2 meter FM with a computer and a modem connected to the transceiver

Packet uses the complete ASCII character set and can also transmit binary data (e.g. computer files)

Packet signals are also transmitted in bursts of data, called packets

Each packet contains data and other information on routing such as the sending and receiving station identifiers

Two stations sending packet normally operate in a connected or linked mode and use an acknowledge protocol similar to AMTOR

The data "packaging" protocol is very similar to that used on the internet

Packet sees limited use on HF (limited to 300 bits/sec due to bandwidth limits)

On VHF or UHF FM it is commonly sent and received at 1200 bits/sec and often at 9600 bits/sec

There are many 2 meter FM stations operating in automated networks using packet with bulletin board like systems where users can post and retrieve messages

Packet is also used for spotting DX stations - explain DX spotting

Play WAV file of packet signal

PACTOR

Pactor from Latin - mediator

PACTOR is a sort of hybrid of AMTOR and packet

It was invented by 2 German hams

It has a complex error correcting communication scheme similar to AMTOR

It is used almost exclusively on HF

Equipment for advanced forms of PACTOR is proprietary and costly but it is becoming more popular in emergency communications since it was used by many hams successfully during Katrina

Play WAV file of PACTOR signal

PSK 31

PSK 31 is a popular new digital mode for HF

PSK 31 is phase shift keying at 31.25 baud

Stations transmit audio tones from a PC sound card and decode tones with a PC sound card to receive using USB

Several PSK31 signals can occupy the same RF frequency simply by using different audio tones

Play WAV file of PSK31 signals

SSTV

Slow Scan TV

Digital mode of sending still pictures using audio tones (limited to still pictures by bandwidth limits on HF)

Other modes

There are many other modes in use in amateur radio including fast scan TV on UHF and other digital modes are constantly being developed

QUESTIONS???