An Introduction to HF, Short Wave Listening, and SDR

Short Wave Listening (SWL): Listening in to HF Radio without a radio

The Co Co County EmComm Disaster Preparedness Net meets every Thursday evening on 3893 KHz LSB at 1830 hours local time. All amateurs are very much welcome. The time and frequency is carefully chosen for reasons of best propagation in our Contra Costa County topology. The topic of radio wave properties/characteristics is a large and fascinating study in itself. Only the necessary basics will be discussed here.

Propagation and Antennas
For our purposes we will focus on the two most common and primary modes; i.e., skip (bounce) and ground wave, albeit more arcane modes such as tropospheric propagation, E-layer, meteor scatter, moon bounce, and satellite long distance communications are also used, but less common, most often occur on 50 MHz and above.

Ground wave is our common line of sight phenomenon, albeit HF signals can bend around the earth's curvature on 160 and 80 meters better than VHF/UHF ground wave especially at night. For good ground wave propagation, as well as long distance ionospheric skip, a low angle radiation pattern as close to the horizon is preferred. Low angle radiation is achieved by creative antenna designs. The basic model is a dipole that is ½ wave length above the ground (radiating broadside), multi-element beams/yagis and quads also a ½ wave length above the ground, vertical antennas (radiating broadside equally in all directions, stacked versions of the former antennas, rhombics, V beams, log periodics, magnetic loops, long wires (end fed combinations), dish antennas, cages, discones, trap and coil loaded antennas, and others, all having their own unique characteristics, pros, and cons. Antennas and propagation are fascinating and huge subjects for the average HF operator amateur. Many books and internet pages are dedicated to this topic, so we will not go into any great detail here.

Seasonal, Sunspot Cycle, and Cosmic Geo/electromagnetic Influences
Historically, radio wave lengths above 200 meters or 1.5 MHz, just above the AM broadcast band was considered High Frequency (HF) and short wave. As electronic technology increased, radio communication became enabled on VHF, UHF, microwave, etc.

HF (Short Wave) has a special benefit of being refracted back down to earth by the ionosphere (called bounce or skip), thus acting like a very high reflector/repeater. Think of the ionosphere as a dynamic electrically charged cloud of electrons and electrically charged particles that covers the planet, stretching from a height of 50 km (30 mi) to 1,000 km (600 mi) constantly changing in density and charge according to the whims of old Sol.

For example, in our winter due to a lowered degree of solar ionospheric charges, the ionosphere becomes thinner, and less radio waves are reflected. They pass through

into space. In summer, skip characteristics change as the ionosphere becomes increasingly dense and more radio signals are reflected back down to earth. Similarly, skip properties are at their lowest levels at the bottom of the 11 year sunspot cycle and signals are best at the SS cycle peak. Daytime solar radiation also creates different conditions, after dusk. Choosing the right frequency is also a determining factor, because the bounce characteristics are governed by the interaction of wavelength and ionosphere. There are other factors governing ionospheric propagation, but these four (season, SS cycle, wavelength, and time of day) are the most prominent factors to consider.

In the winter HF ionospheric skip may skip/bounce over close-in stations necessitating the use of relays, because the ionosphere is less dense when a signal hits the ionosphere with a near perpendicular incidence. If the angle of incidence is more horizontal (oblique, tangential, or transverse) the signal travels through more ions and is more likely to be refracted back to the earth, but at a lower angle. As a consequence, distant stations may be much stronger than close-in stations, thus skipping over nearby stations. Skip zones change according to frequency, time of day, season, year (sunspot cycle), and yet to be discovered conditions. For EmComm work we desire close-in communications (short skip within the county and perhaps to Sacramento. Therefore, Near Vertical Incidence Skywave (NVIS) is preferred. See this article on NVIS.

Ambient Noise Levels
Ambient noise levels (QRN) on 160m and 80m may be extremely high thus limiting EmComm communications.

It's the Antenna, Antenna, and Antenna
Antennas govern the noise floor, your angle of radiation, gain, SWR, ERF, and determine whether good communication is possible.

It is not difficult or expensive to build your own effective HF antenna; but be forewarned, many commercial antenna manufacturers unfairly attempt to take advantage of the new urban ham making false claims about their shortened antennas. Most are junk, slightly better than a dummy load, but should propagation conditions become good these compromised "antennas" can appear to function. Beware.

Short Wave Listening (SWL)

Back in the pre-transceiver day, hams had separate receivers and transmitters. Most started off listening to the miracle of radio. Short wave listening was the 20th century miracle after the invention of the automobile and airplane. One might be surprised what is on HF even today. You don't even need a shortwave receiver. Just a computer, a browser program, and an internet connection will allow one to listen to tens of thousands of shortwave stations worldwide in real time.

For HF listening anywhere in the world a newcomer can try out one of the many SDR receivers worldwide over the world-wide net.

You can also monitor your own signal strength and audio quality by accessing any of these SDRs as the delay between your own transmission and the SDR's report via the internet allows for discernment. Are you getting out to Half Moon Bay, Salt Lake City, Point Reyes, Hawaii, the UK, Russia, Germany, Argentina, etc.?

Nearby

KFS Half Moon Bay http://websdr1.kfsdr.com:8901/

Northern Utah http://websdr1.sdrutah.org:8901/index1a.html

KPH Point Reyes http://198.40.45.23:8073/?f=7284.0lsb Courtesy kiwisdr

Phoenix Arizona http://w7rna.com/

Maui Websdr http://mauisdr.wsprdaemon.org:8901/

Pahrump Nevada http://74.82.153.108:8073/ (KiwiSDR)

How to Use Quick Start

Choose Band: 80-75m
Frequency: 3893.00 kHz VFO: A (B: 7272.00 kHz USB) or tune by clicking/dragging/scrollwheel on the frequency scale.
Mode: LSB

If you aren't hearing audio using many modern browsers (Chrome, Firefox, Safari) and Apple devices) try clicking the "Audio Start" button before audio will be heard. Firefox users will need to press the Firefox button.

A List of More stations using WebSDR world-wide

http://websdr.org/

https://rx-tx.info/map-sdr-points

http://wirechief.com/SDR.htm

Similar Web Reporters
See: Reverse Beacon Network (RBN): for Cw, rtty, and psk 63, psk 31
https://www.reversebeacon.net/main.php?rows=100&max_age=10,days&spotted_call=&hide=distance_km

See: https://pskreporter.info/pskmap.html pskreporter for reports of FT8, WSPR, and other digital sightings

Ham Alert ap for hamalert.org push notifications according to your customized priorities. https://hamalert.org/
For Android
https://play.google.com/store/apps/details?id=org.hamalert.app&gl=US&pli=1

For I-phone Apple
https://apps.apple.com/us/app/hamalert/id1200759798

Radiomail for IOs Digital activity like packet, winlink, etc
https://radiomail.app/

Rev: 01-15-2023
NI6A