Colorado QRP Club

The Low Down

Promoting QRP Since 1994

Issue 54 January/February 2005

Club News...

CLUB DUES REDUCED !

With the move to publishing the Low Down as a Web document we will be saving a substantial amount from the club funds. The executives voted to reduces the club subscriptions to $6 a year. Please check the CQC web site for complete details at www.cqc.org

CQC GARAGE SALE AND DONATIONS

Clean out the shack? Please consider donating your unused ham gear to the CQC club. All procedes go to fund QRP activities. Item cam be sent to CQC PO Box 17174. Golden CO 80402-6019.

Our next Regular meeting will take place
Saturday, May 14, 2005 at 10:00 am
Program is the Annual CQC Officer Elections
Meeting Location: Offices of Milestone Technologies
10691 East Bethany Drive, Suite 800
Aurora, Colorado

Low Band Operations presentation by Steve Finch, AI0W, at the Noverber 2004 CQC meeting.
Photo by Vince Kumagai

Inside:

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QRP Information Net: The Colorado QRP Club also meets on the air every Monday evening at 2000 local time on the 147.225 repeater serving the eastern slope of the Rockies from Cheyenne, WY, to Pueblo, CO, with linked repeaters in Boulder (145.46) and Colorado Springs (145.16). Backup frequency: 145.145. The Club's Denver metro simplex liaison frequency is 146.445.

Meeting Dates: 2004 Meetings: Jan. 10, Mar. 13, May 8, July 10, Sept. 11, Nov. 13 at a location to be determined. Annual Picnic: Sat. Sept 18, 2004. Annual Banquet: To Be Announced. Changes will be announced on the Monday evening Net and posted on the WWW,CQC.ORG website, if time permits.

Informal Monthly QRP Gatherings: Members meet informally at a local restaurant -- details on the web-site. **Annual Dues:** $12.00. Join via the internet at WWW.CQC.ORG. Or, send dues and requests for membership applications to: CQC, POB 17174, Golden CO 80402-6019.

Internet: WWW.CQC.ORG. Information, membership, renewals, officers, activities, CQC Swap List and CQC-List subscriptions.

Correspondence: Editor, The Low Down POB 17174. Golden CO 80402-6019.

CQC Logo mugs are back

Don't leave your shack without it!! Vince, our club Secretary, arm-wrestled a half dozen vendors until we got a good deal on a few dozen of these beautiful, cobalt-blue coffee mugs. Get yours while supplies last!!

Photo courtesy Marshall Emm N1FN

$10.00 (Pick one up at our meeting or other gathering)
$4.00 (Shipping and handling if we mail one to you...)
Order from our web site using our PayPal secure service.

Photo courtesy Marshall Emm N1FN

Coming Soon

CQC Logo Tee Shirts

Information will be released on the CQC Web when final details are available.

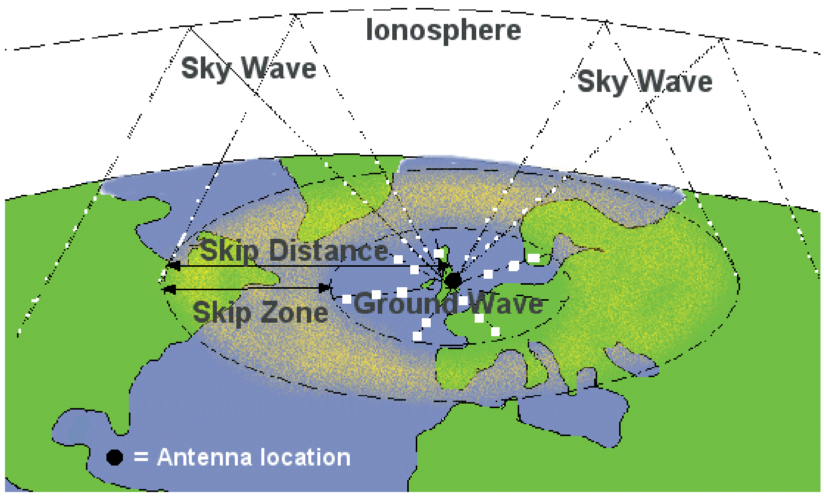
NVIS – Near Vertical Incident Skywave Antenna:
The Emergency Communications Antenna

By Stephen C. Finch, AIØW

This article, Part 1, will address the propagation fundamentals for successful NVIS operation. Part 2 will look more closely at the antennas that work well in NVIS usage..

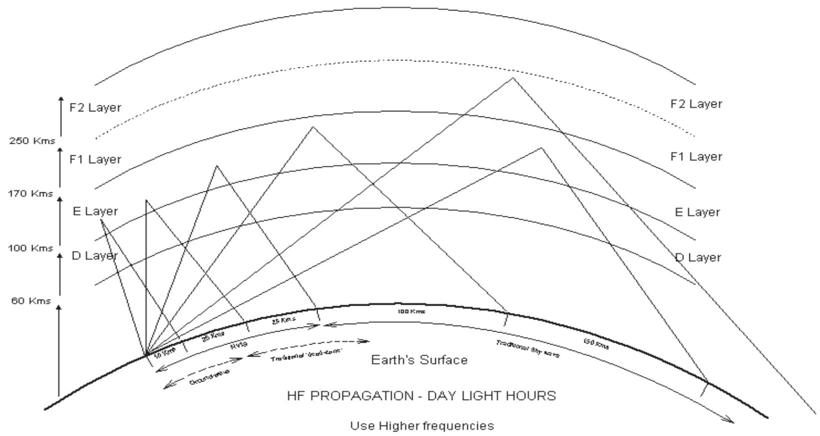
Introduction

The antenna axiom, “the higher, the better,” is true for working distant stations. Generally antennas that are installed physically high up tend to have more of their radiated energy leaving the antenna at a lower angle . This causes the skip distance of our signal to be as far away as possible. Depending on the sunspot cycle, time of day, and transmitter frequency, that distance can be from 300 miles at 3.5 mhz to worldwide communications at 14-28 mhz.



But what if we need reliable communications with a station 25 or 100 miles away. Regardless of frequency, our signal skips over the close-in station and no communication is possible. Yes, there is ground wave, but in our mountainous terrain, ground wave may be only a few miles, and then not very reliable. What do we do to eliminate this “skip zone?”

Our answer is not to increase power, try to set up VHF repeaters, or other drastic measures. The answer is simple, install an NVIS antenna, select the appropriate operating frequency, and reliable communications from 0 to 300 miles becomes very achievable.



As the signals leave the antennas, they travel up and are refracted off the various ionosphere layers. The lower the signal's incident angle and the higher the layer of refraction, the farther away from the transmitter the signal returns to earth.

For most hams' "typical operation," we seldom care where our signal lands. We are interested in communication with anyone. Sometimes, we choose frequencies to increase our chances to "work" a station in a far-distant place. Some hams pour over propagation charts, design elaborate antennas, and operate at all hours of the day and night to "bag that rare one."

When close-in, reliable communications is need, guess-work and luck is not good enough. Our understanding of frequency verses propagation becomes even more critical. What we need is propagation that covers from about 10 miles up to 400 miles with no skip zones.

Hammin' On The Go

Aboard Eagles Flight for the Gold Rush

By Dick Schneider AB0CD, CQC # 155

Continuing in my ongoing life effort of combining recreational pursuits with QRP ham radio, I set up shop last July 18 aboard Eagle's Flight, snugged in its berth at the Cherry Creek Marina in Southeast Denver. It's a joy to be on the water and on the air at the same time. The antenna used for the Great Colorado Gold Rush was my one-quarter-sized G5RV. I run the hot side up the mast using the main halyard, and attach the other end to the stern pulpit. This size wire antenna fits perfectly as a sloper on the boat. I used the FT-817 for the contest and set it up "down below" in the main salon. I just clipped the power lead for the radio to one of the two marine batteries on board. I went with the NORCAL paddle, which was what was in my FT-817 "go pack." I would have like to have my 20-meter Wilderness Radio SST with me, but last year I managed to reverse the power leads. The PA didn't last too long, about a nanoscecond. But that rig has been repaired by Bob Cates of Wilderness Radio and it will be ready to go for some upcoming outing.

Even though I was sitting on water, I am a bit hemmed in while docked at the marina. Cherry Creek Dam looms to the north and several buildings plus the rising basin is on the west. I'm wide open to the water to the east and south, although there are all sorts of aluminum masts around me in the marina. The sloper had an East-West orientation. I also had some maintenance chores to take care of on the boat, so I worked about the first and last half hours of the contest, all on 20 meters, and I don't think the antenna performed very well. I worked only four stations, two from Colorado (W0CQC run by Al Dawkins and former CQC president Vince, KI0RB) and two from Georgia (K4BAI and K4JPN). Next year, if possible, I'm going to try to head out into the middle of the lake and operate from an anchorage. Maybe I'll get a little more oomph off the water.

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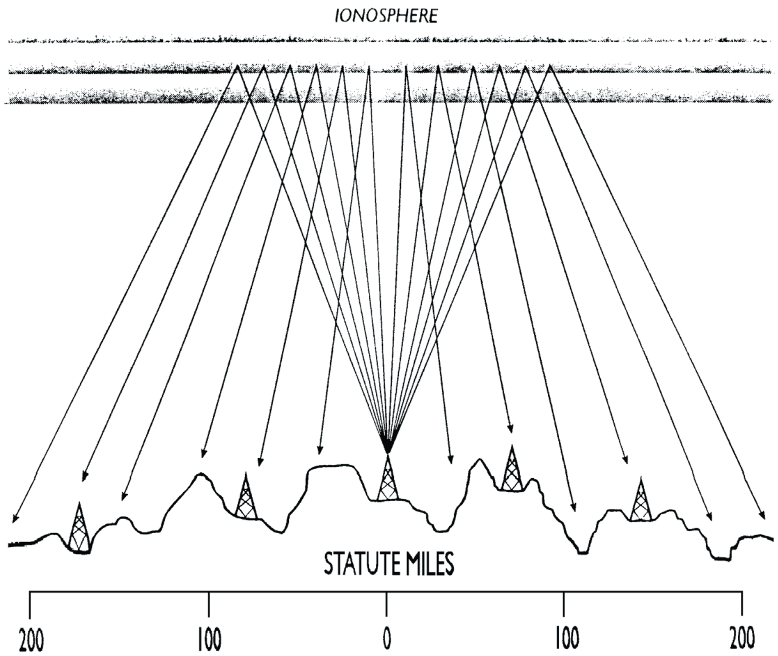
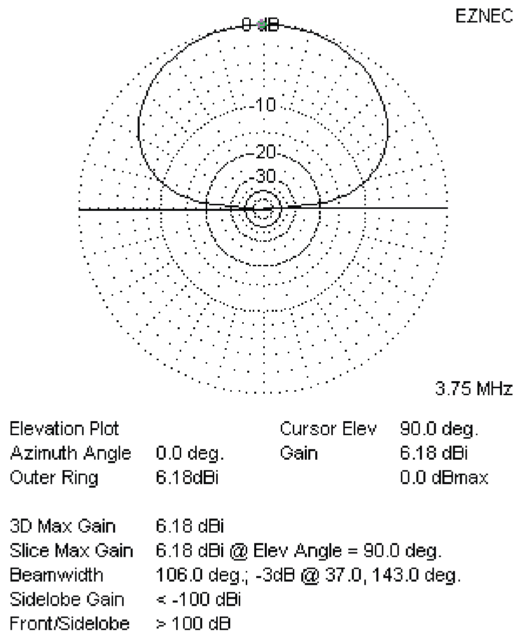


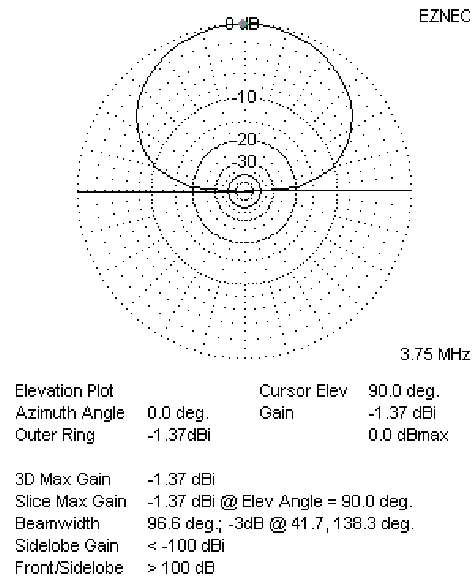
We can see from the diagram to the left, that signals which leave our antenna in a near-vertical direction will travel up to the ionosphere and are reflected back. It is like spraying a hose in a fine droplet pattern, straight-up. The droplets of water fall back to earth in a pattern that covers the ground evenly with moisture close to where we are standing. The pattern from an NVIS antenna does much the same with the transmitted signal. The majority of the signal is transmitted between 75 and 90 degrees straight-up. In fact the 3D antenna pattern looks like a bowl set upside down.

The Antenna



The simplest NVIS antenna is a dipole cut for resonance on the operating frequency and installed at 1/8 wavelength above the ground. For the ARES ssb frequency of 3928 khz, the antenna would be about 120 feet long and mounted at 30 feet. With our rocky, dry ground, lowering the antenna to 20 feet may be advisable as the effective ground lies below the surface of the actual ground. In fact any height from laying the wire on the ground, to an 1/8 wavelength will work. The main difference between the higher antenna and the lower antenna is the gain or loss of the antenna.

The EZNEC pattern shows the radiation pattern for an antenna mounted 1/8 wavelength off the ground. Notice that most of the energy is between about 30 degrees both sides from vertical. This where we want the energy to go. Notice the gain of the antenna is about 6 db. This over perfect ground. It will be less over actual ground, but ant any rate, the antenna will have a positive gain.



With is this diagram, we have lowered the antenna from 1/8 wavelength (32 ft.) to 9 feet. Notice that the pattern is nearly identical. However, the antenna gain has dropped from 6 dbi to -1.37 dbi. This means that the signal radiated off the 9 ft. high antenna is less than 1/4th the signal radiated off the 32.5 ft. high antenna. While this seems significant, the questions is "Is this loss actually significant in received signal strength?"

Path Losses

Lets take a look at the received signal strength as transmitted by different transmitter output levels. The large table, *Very Close-in stations,* shows the received signal strength for both the 1/8 wavelength (32.5 ft.) and the 9 ft. antenna height.

Even with the low antenna of only 9 ft., the received signal strength is still an S7. Most receivers have a noise floor of better than -125 dbm. However, the average noise level of 75/80 meters is about -112 dbm or an S3. That means that for a +10 dbm SNR (signal to noise ratio), the received signal strength must be -102 dbm or an S4-5. Notice that regardless of which antenna is used, the received signal strength is at least -82 dbm or S7 with using one watt at 9 ft. . .So even an inefficient antenna will work quite well for close-in communication.

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Hamming on the go...

I wasn't skunked. I committed ham radio. And I was on my boat, successfully combining a recreational activity with ham radio. So all in all it was a "win." Of course, I submitted my logs for the Portable category LATE! Since there were no entries in that category, I would have won!

The New Home QTH Shapes Up

I now have one of those operating positions like you see in the catalogues. One rig – the Icom IC-740 – set on one portion of my home office desk. I'm going to keep it simple, especially since all of my other ham radio gear is still packed away in boxes. I've got the hand mic because that was packed with the rig. I don't have a clue where my Heil headset is, although I hope to track it down before the ARRL Sweepstakes/Phone contest. Two keys, the straight key is the Hi-Mound HK-708 which reminds me of my Lionel toy train when I was a kid, and the Schurr Profi paddle, which I'd asked my kids to get me for Christmas three years running. I bought it for myself this past summer. Future plans at the QTH include a tower and a beam. But that's for next year.

Distance between Stations in Communication

Both antennas have a -3db bandwidth of approximately 100 degrees or 50 degrees either side of vertical. We can calculate the take-off angles required to communicate with close-in stations at various distances. Once we assume the height of the F2 -layer, simple geometry is all that is needed. The following table summarizes the antenna take-off angles needed when the F2 layer is 250 miles up.

Separation Distance	Take-off Angle
25.0	87.14
50.0	84.29
75.0	81.47
100.0	78.69
125.0	75.96
150.0	73.30
175.0	70.71
200.0	68.20
225.0	65.77
250.0	63.43

For very close-in stations [2]

Transmitter Output, W	db output	Transmitting Antenna Height 32.5 ft. Gain	Total Signal Out	Path Loss [1]	Receiving Antenna Height 32.5 ft. Gain	Signal At Receiver Input	S-Meter Reading	Plus
100.0	50.0	6.2	56.2	-110.0	6.2	-47.6	S9	25
50.0	47.0	6.2	53.2	-110.0	6.2	-50.6	S9	22
25.0	44.0	6.2	50.2	-110.0	6.2	-53.6	S9	19
5.0	37.0	6.2	43.2	-110.0	6.2	-60.6	S9	12
1.0	30.0	6.2	36.2	-110.0	6.2	-67.6	S9	5

Note: -73 db is S9 at 50 ohm input.

[1] As calculated by the "TwoHop" propagation program with my adjustments.

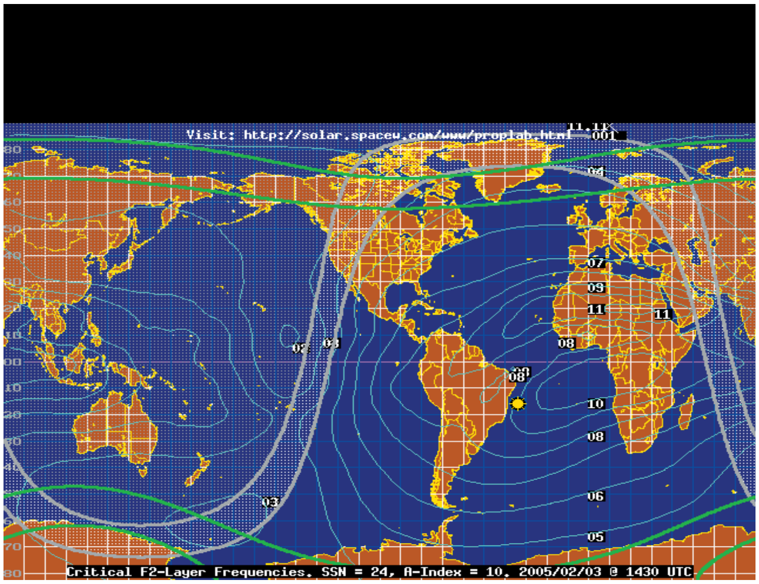
Does not include transmission line losses.

[2] Stations within 50 miles of each other.

Transmitter Output, W	db output	Transmitting Antenna Height 9 ft. Gain	Total Signal Out	Path Loss [1]	Receiving Antenna Height 9 ft. Gain	Signal At Receiver Input	S-Meter Reading	Plus
100.0	50.0	-1.4	48.6	-110.0	-1.4	-62.8	S9	10
50.0	47.0	-1.4	45.6	-110.0	-1.4	-65.8	S9	7
25.0	44.0	-1.4	42.6	-110.0	-1.4	-68.8	S9	4
5.0	37.0	-1.4	35.6	-110.0	-1.4	-75.8	S8	
1.0	30.0	-1.4	28.6	-110.0	-1.4	-82.8	S7	

Selecting the Correct Frequency

Besides having low antenna height, the next most important factor is selection of the proper operating frequency. We need to select a frequency that is reflected by the F2-layer, but is not absorbed or significantly degraded by the D-layer. The higher the frequency, the less the D-layer will affect the signal. However, too high a frequency, and the signal will pass through the F2-layer.



Fortunately, we can determine the best operating frequency from propagation information on the internet and some relatively simple calculations. A good place to find the F2 critical frequency is at *http://www.spacew.com/www/fof2.html*. An example is shown to the left.

This map shows the F2 critical frequency, f_o for the entire world. It is updated every five minutes so the map is very current. Other good URLs for links to many propagation information sites are *http://solar.spacew.com/* and *http://www.qsl.net/va3rj/prop_links.html*.

Once we know the critical frequency, we can determine the proper operating frequency. The theory behind the selection is straight-forward. We need to select the frequency that is the highest possible without passing through the F2-layer. There are three concepts to recognize.

First, the critical frequency for the F2-layer is f_oF2 or just f_o. This is the highest frequency that will be reflected back to earth from the F2-layer when hitting the F2-layer at a perpendicular angle, i.e. the angle of incidence is 0 degrees.. Go higher in frequency and the signal will pass thorough the F2-layer into space and is lost for communications.

Second, MUF, or maximum useable frequency, the highest frequency we can use and still achieve good reflection/refraction off the F2-layer. The formula for MUF is:

$$MUF = f_o/\sin(\alpha)$$

where f_o is the critical frequency and α is the angle of incidence.

The MUF therefore is a function of the critical frequency and the angle at which the signal hits the F2-layer. Note that the frequency can be increased as the angle of incidence is lowered. In NVIS operations, we want the signal to "hit" the F2-layer at nearly a 90 degree angle. The sine of 90 degrees is 1. In fact the sine does not fall below 0.95 until the incident angle is below 72 degrees. Since nearly all the useable radiation falls within

Scratch built hardkine connector using common electrical conuduit pieces. Display items curtesey of Steve Finch, AI0W