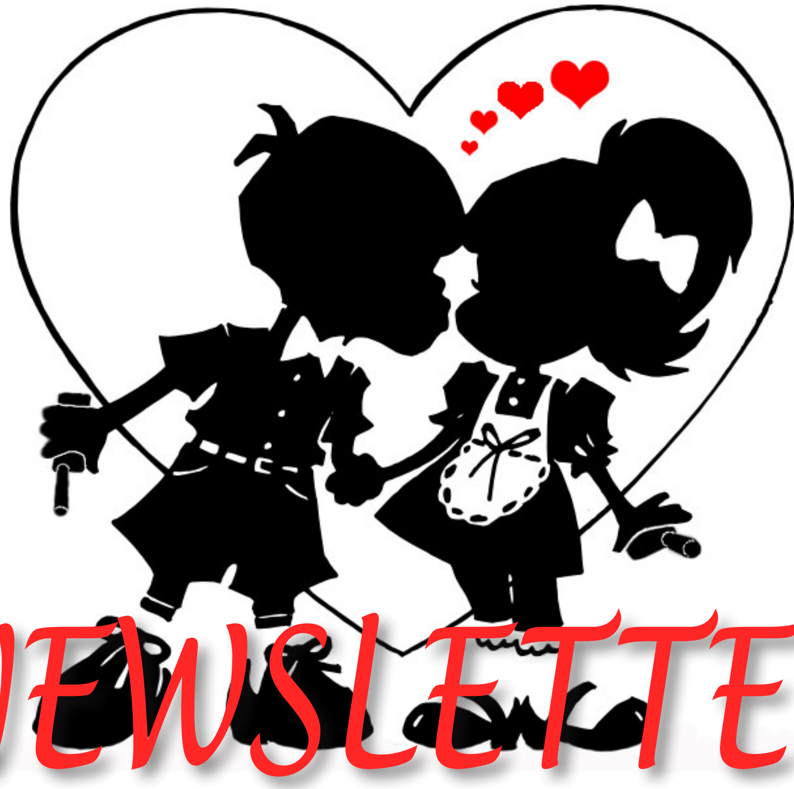

NEWSLETTER

FEBRUARY 2009 VOLUME 9, No. 2

Mercury Amateur Radio Association - MARA - North America - North East

CONTENTS

OTHER STUFF

E-mail your comments, ideas, or submissions to marane@mara.net

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VIEW FROM THE TOWER

ADVENTURES OF A NEW HAM
by BRUCE, N3IA

Bruce is still tied up with family concerns and was unable to provide us with his article for this month. We know he is still around as his voice appears on the Saturday morning net, every now and then!

PROPAGATION BETWEEN NOT-TOO-CLOSE RADIO STATIONS
by DAN, AA3LS

To properly introduce this topic, I want to make the point that some things we've been taught as "gospel" may not be quite as critical as we thought. Further, some of them may actually detract from the results we may obtain.

For example, I have a home station with a Kenwood TS-850S/AT transceiver that feeds an 80-meter dipole whose center is about 40 feet in the air, while its ends are about 30 feet up (solely for the convenience of using existing supports). Some would call this an "Inverted-Vee" antenna, but it is really just a dipole. The antenna center is supported by a tower, while the ends are tied off to the peak of the house at one end and another support at the other. Further complicating this is that the ground between the tower and house is level, while the other support's base is 15 feet higher up the hill, and there is a 25x35 foot steel arch barn right next to the tower, but not directly under the antenna. The feed line totals about 200 feet of RG-213 type coax.

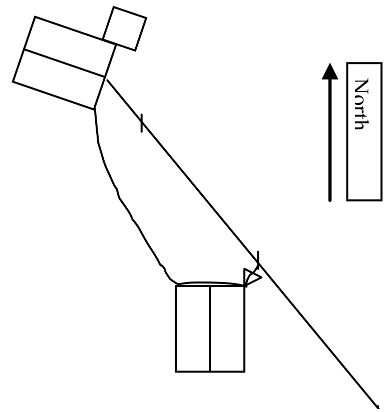

Figure 1 - Location and orientation of Dan's antenna.

As it turns out, this dipole antenna (if it were in free space) would radiate toward the north-east (where VE1VQ resides) and the south-west (pretty much down the I-81 highway corridor in western Virginia's Shenandoah Valley.

But, as I mentioned earlier, this dipole is low (about 35 – 40 feet high) and there is that big steel barn. As a result, being only about 1/8 wavelength high over "poor" ground, the antenna likely radiates most of its energy up, rather than out to the horizon.

I'm sure we all are familiar with several modes of radio wave propagation between a transmitter and a receiver:

1. Line of sight – direct path without nearby obstruction between transmitter and receiver antennas

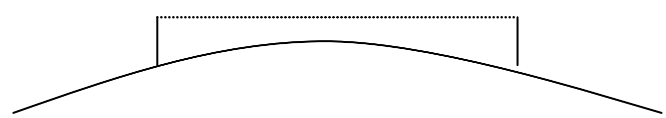

Figure 2 - Line of sight

2. Ground wave – a short path but not line of sight, where the transmitted signal may diffract around or across obstacles in its path. Traditionally these paths are 30 miles (50 kilometers) in length or less

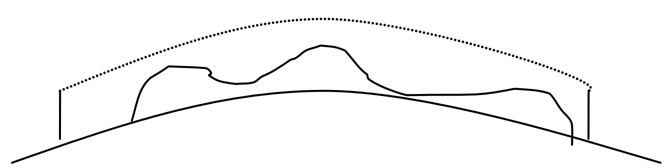

Figure 3 - Ground wave

3. Sky wave – a long path where the signal path is both

beyond line of sight and beyond ground wave, and the signal is reflected from the ionosphere. These paths are typically greater than 500 nautical miles in length, with a "skip zone" from the end of the ground wave area until the nearest part of the first sky wave zone

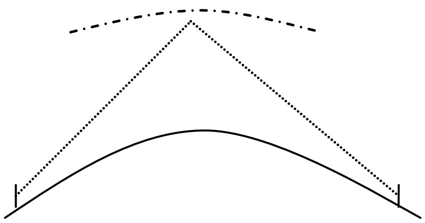

Figure 4 - Sky wave

4. Scatter – a medium path beyond ground wave where inconsistencies in the atmosphere scatter a small part of the transmitted signal forward to the receiver (This can include meteor scatter, tropospheric scatter, and even "aircraft scatter")

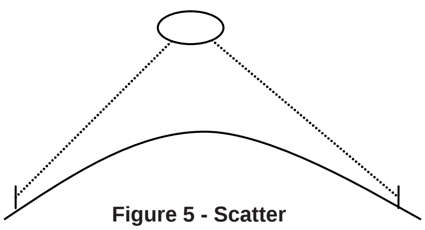

Figure 5 - Scatter

5. Moonbounce – high power, sensitive receivers and directional antennas that can track the moon are needed. Further, the moon must be visible to transmitter and receiver

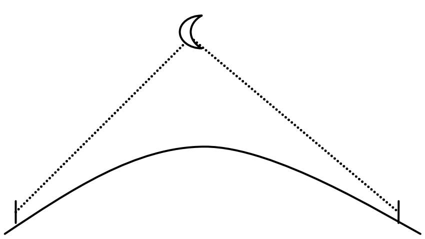

Figure 6 - Moonbounce

6. Repeater – both transmitter and receiver must be in range of the repeater

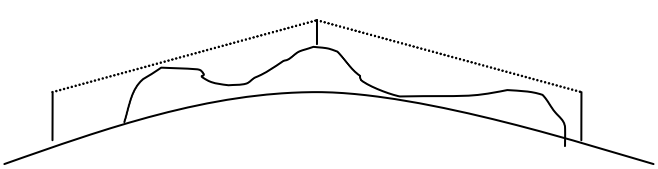

Figure 7 - Repeater

7. Satellite – just another repeater, in essence, except for the store and forward digital mode repeaters, but located in orbit above the atmosphere.

The HF operator usually uses, knowingly or not, one or more of the first three modes. VHF and UHF operators usually use the first and the last four. Scatter can require high power and/or narrow bandwidths – military and commercial tropospheric scatter systems often had enormous antenna arrays for both ends of a communications link.

So, what's that got to do with Mercury Amateur Radio Association Northeast Net members? Most of us are separated by too much distance or too rugged terrain for line of sight or ground wave propagation.

Dave, VE1VQ, in Nova Scotia is about 830 kilometers (530 miles) to the northeast of my station in Susquehanna County, Pennsylvania. The Washington DC area stations are about 325 kilometers (200 miles) to my south, and the Carolinas and Georgia are still farther -- (N4NQG is 1370 kilometers or 850 miles) away, while Colin, W9UPK, in Dubuque, Iowa is about 1260 kilometers or 780 miles away from my station. Most of these longer distances are clearly sky wave propagation distances.

Furthermore, for reliable communications between MARA stations and other stations in our own local areas (stakes or even regions), traditional sky wave signals tend to skip right past the stations which we need to reliably communicate with. These signal paths are too long or interrupted by terrain so that ground wave signals don't get through reliably either. How can we ensure reliable communications within our areas?

Further, when we need to set up at an emergency site, what should we do?

There is a propagation mode not mentioned above that works well where line of sight and ground wave are not practical due to terrain or distance, but traditional sky wave would skip across. New (30 year old) jargon calls this mode "Near Vertical Incidence Skywave" or "NVIS". Please note this is a propagation mode, not an antenna or other piece of equipment. There are many antenna designs that can be optimized (or for Dave's benefit, optimised) for NVIS propagation. The key is the "Near Vertical Incidence" part of the name, and it means the signal from the transmitter's antenna goes up and hits the ionosphere in a nearly vertical path.

If the level of ionization is sufficient, the signal will be refracted back downward by the ionosphere, coming right back down to the area from which it left.

An analogy might be in order. A water hose on one side of a wall can water things on the other side of the wall by shooting water over the top of the wall. There may be an area near the opposite side of the wall where little water falls to earth unless the hose jet sprays straight up (at a near vertical) angle, and then the water will fall back nearly vertically to the ground.

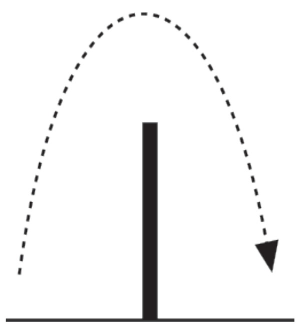

Figure 9 - Water over the wall at lower angle.

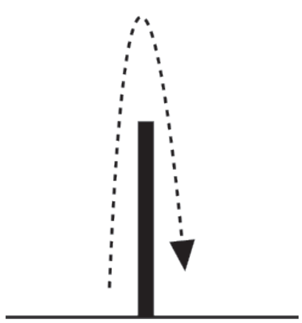

Figure 10 - Water over the wall at higher angle.

It is often thought that this is new technology – but much research and development came from military use in the jungles and mountains of Vietnam in the 1960s and early 1970s. Interestingly though, this propagation mode was extensively used during World War II in Europe with great success for communications with agents behind enemy lines, and during the D-Day invasion of Normandy. I have read that H. H. Beverage (inventor of the Beverage Wave Antenna among many other things) helped in these developments and the communication plans for D-Day.

At any case, here are some ideas that are useful for emergency communications.

1. VHF/UHF can be good for short distances, and with repeaters or repeater networks can be used for much longer ranges. Repeaters are a point of failure, however. When the repeater(s) are working, this is great for point to point communications.

2. HF (higher frequency HF – 20 meters and up) can be good for very long range (sky wave distances) communications. High antennas produce low angles of radiation, meaning longer skip distances and longer range communication, but less reliability for defined point to point communication.

3. HF (lower frequency HF – 80, 60, and at times 40 meters) can be very good for short range (ground wave distances) communication at most times. High antennas and vertical polarization can be used in this mode. Antennas should send their energy DOWNWARD (well, horizontally) toward the horizon.

4. HF (lower frequency HF – 80, 60, and at times 40 meters) can be excellent for mid range (greater than ground wave, less than sky wave distances) if the frequency is below the critical frequency, and if the antenna is constructed to send most of its energy UPWARD away from the horizon toward the zenith.

This last point is the essence of success using NVIS propagation. You want to “warm the clouds” and have the ionosphere return your signal to the receiver rather than sending your signal directly. This will get your signal over the ridge to the receiver on the other side.

Here, in the Scranton Pennsylvania Stake, we have a very rugged terrain with valleys and mountains that block most direct (line of sight or ground wave) signals. NVIS lets a station with a relatively low antenna communicate with other stations without need for repeaters, very tall towers, or extremely high power. Significant signal to noise ratios are easily achieved with low power (100 watts or less) and at low antenna elevation.

On the other hand, military documentation (see Figure 11) indicates that normal ground wave communications are greatly limited by path loss depending on terrain and ground quality. In much of the eastern Pennsylvania, the mountainous terrain is classified as “poor” ground.

The following chart shows received signal levels for ground wave propagation, which depends upon ground quality and distance between transmitter and receiver. It shows that ground wave propagation is not particularly useful for our mid range communications requirements.

80, 60, and sometimes 40M are THE bands for NVIS

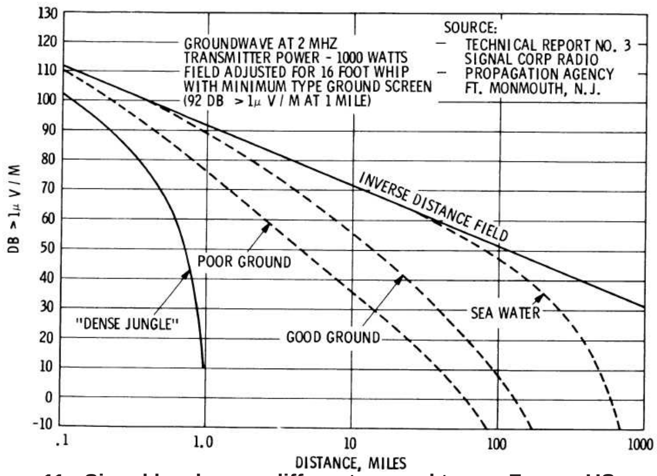

Figure 11 - Signal levels over different ground types. From a US Marine Corps NVIS manual.

So, again, what's to do?

We can actually communicate more reliably over ranges up to 200 miles or so with NVIS, using simple, low (easy to erect) dipole antennas. Send a dipole over the roof of a meetinghouse and tie the two outer ends to trees, light poles, or whatever (some pre-planning would be helpful). Let the middle of the dipole rest on the roof (unless you have a metal roof meetinghouse ;-)) and you likely have an antenna very good for local to mid-range (200 miles, 300 kilometers) path lengths. These are clearly inexpensive and require no modifications to meetinghouses other than perhaps opening a window to let the coax come inside. Yes, you want to avoid having the coax feedline run parallel to the antenna, but if it has to, let it.

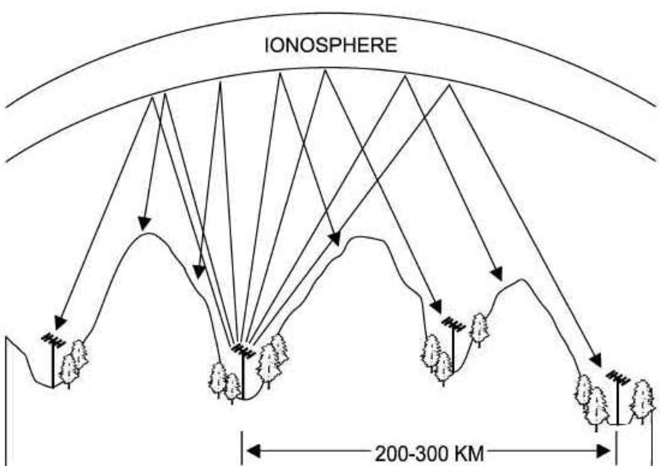

Figure 12 - This picture from a US Marine Corps manual gives you an idea of NVIS communications over mountainous terrain.

One hundred watts into this kind of antenna works. A dozen years ago I provided emergency communications support (which turned out, of course, not to be needed since it was available!) for a youth "Pioneer Trek" experience. This was before pervasive cell phone service. I strung up an 80 meter dipole from my "go box" between a couple trees using my Wrist Rocket, and took the TS-850 in the minivan. The antenna was about 20 feet high in the middle, and a bit higher at the ends, but communications with the MARA net was very similar to what I get from my home station.

I said "if the antenna is constructed to send most of its energy UPWARD" – this means the antenna is low – ¼ wavelength high is too high for optimum use. At my station, I have a full-length 80 meter dipole whose center is about 40 feet in the air, and the two ends are about 30 feet up. A higher antenna would produce poorer communication among other stations in the area of our stake, which extends about 100 miles from my location. (This is the distance from AA3LS to N2PCT, approximately.)

NVIS IS A PROPAGATION MODE, NOT AN ANTENNA

Rather than tell you everything I have learned, let me encourage you to learn about this the way I did: There is a Yahoo group entitled "NVIS" which you can join and which has an enormous library of information contributed by members and others about this mode of propagation and antennas which help exploit it.

The access is similar to access for the MARA Northeast Yahoo Group. Here are links for MARA Northeast group:

http://groups.yahoo.com/group/mara_ne/

and this is the link for the NVIS group where I found the graphics I used:

http://groups.yahoo.com/group/NVIS/

You probably need to (well, I know you need to) have a Yahoo ID, but you can register for your own Yahoo ID, then navigate to one or the other of these groups and register there. You'll have access to message archives, many files and other useful bits of information.

Dan AA3LS

CULTURED CORNER
by ANØNMS

A VALENTINE POEM

Even though we're older now
And my hair has turned to gray
Yours is still as beautiful
Just like on our wedding day

Even though we're older now
And my waist is more around
You are still as beautiful
I can't see you've gained a pound

Even though we're older now
And my eyes seem not as sharp
Yours are still as beautiful
Like soft music from a harp

Even though we're older now
And my aches and pains abound
You are still as beautiful
Oh how you do astound

Even though we're older now
You seem just the same to me
You are still as beautiful
The girl I asked to marry

Even though we're older now
Our footsteps not as sure
You are always beautiful
Together we will endure

ANØNMS

GRANDMA MARA'S CORNER

BATTLE OF THE WAISTLINE!

A friend of mine has a theory that as you get older your lungs sag and that's where the added baggage around your waistline comes from. All Grandma knows is that the after effects of over indulgence from Christmas and New Years combined with the chocolates and candy at Valentines Day really does a number on my waistline.

Forget all of the diets that promise you a figure like you had when you were twenty-five. If you eat more food than you can use, you gain weight. If you take in less food than your body needs, you lose weight. It's that simple! Exercise takes away some of the effect of over eating, but only some! Exercise also benefits your muscles (helps to hold the fat in place!), heart, and lungs. It still comes back to 'eat less - weigh less'.

If you sit all day and/or evening in front of the TV, with the chips and dip on the tray table next to you, doing no more physical work then moving your arm to transfer stuff to your mouth, you are in trouble!

Over the years, I've spent enough money on exercise equipment that you'd think I'd be able to show some results. Those people in the ads certainly look fit! But no, all of that hardware has ended up being fancy and expensive clothes hangers!

I read once that the best exercise is walking. Low in impact and easy on the joints, and that's important for those of us with more years on our bodies than we care to admit. Doesn't require any fancy equipment (although proper clothing is important, if only from a fashion statement point of view) or expensive club memberships, just a pair of good walking shoes if you have foot problems or to prevent them if you don't already.

Push yourself away from the table before you see what's for desert, close down the rig after the Saturday morning net, get up from the comfy chair in front of the computer or TV, and get out there and get some exercise.

Grandma Mara

TECH STUFF
by VE1VQ

NVIS - NEAR VERTICAL INCIDENCE SKYWAVE

Most articles on antennas in magazines and handbooks tell you to mount your antenna as high as possible. To say that may not be the best idea may seem like heresy to some of you!

As mentioned by AA3LS, NVIS is not a specific antenna, but a way of using a regular antenna to direct the radiated RF energy from your station in a direction that will provide more reliable communications between the area covered by close-in ground wave and that of the first skip zone - the forgotten zone (see Figure 14). The information that follows works for any half wavelength long antenna, whether it be the standard dipole, the inverted V, or the end fed. If you ignore any effect of the feed line on the radiation pattern, all will be the same.

to maintain communications with stations in your ward, stake or area. It is not very useful to speak with Tokyo when you want to know how members of a ward on the far end of your stake are faring.

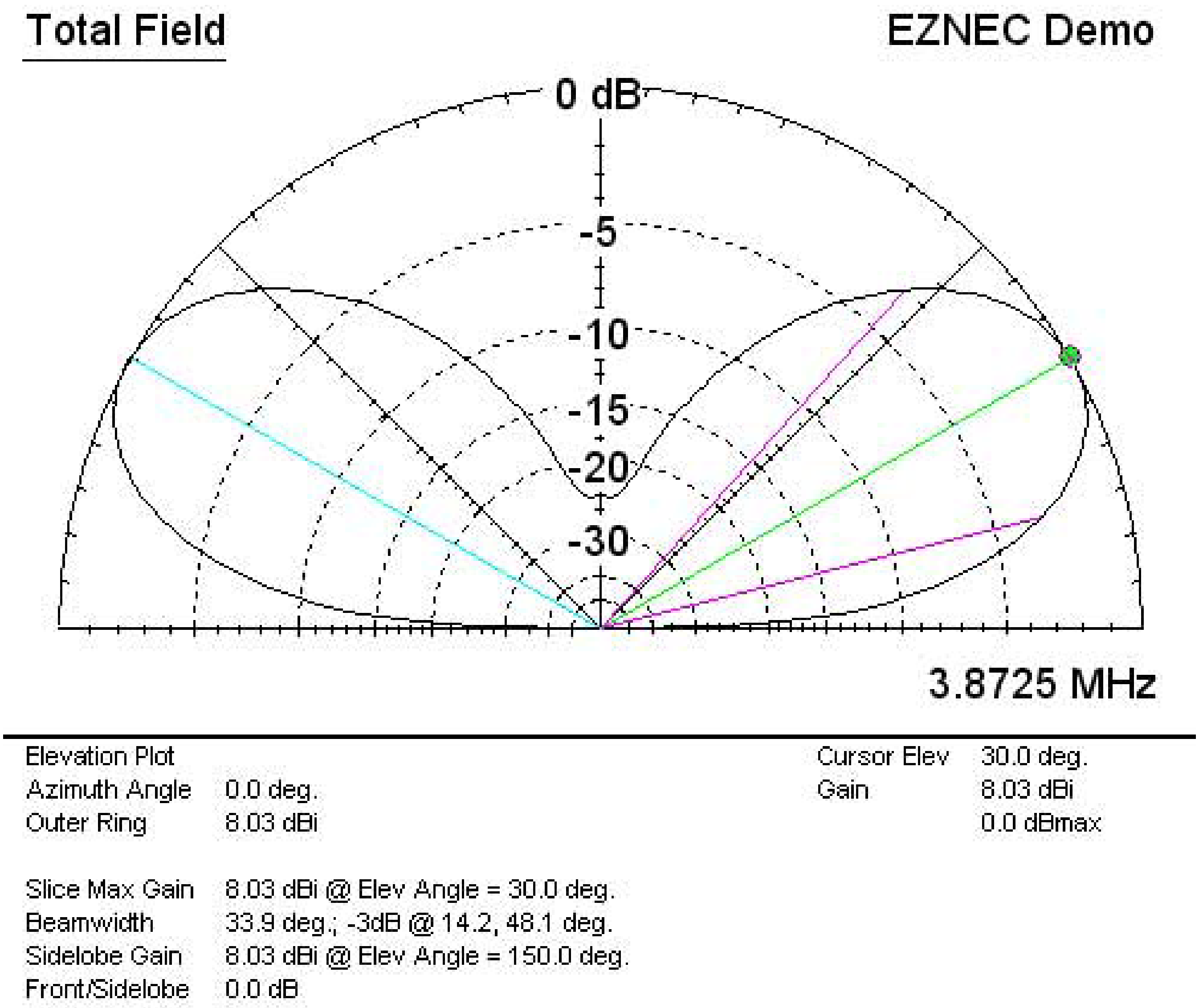

Figure 13 - Showing low angle RF radiation with an antenna suspended at a half wavelength. Note that maximum radiation is at 30 degrees above the ground.

Figure 13 shows an RF elevation plot when your antenna is suspended at a height of a half wavelength, meaning that one end of the wire would be looking out of the diagram towards you.

Figure 14 shows what happens (in a simplified way) to your transmitted RF energy when it is emitted from an antenna suspended a half wavelength above ground. Observe how it ‘skips’ over the close-in stations and instead reaches the farther away receivers. This is what you want if you are looking for DX, but not if you are trying

This drawing is representative only and certainly not drawn to any kind of scale.

Now, if we lower the mounting height of our antenna down to a quarter wave above ground we see the RF power lobe move upwards. Figure 15 shows the effect of aiming the transmitted power straight upwards to concentrate the energy on the close in stations. In figure 16, note also that the power level measured in dBi (decibels relative to an isotropic antenna) has only dropped by 1 db compared to figure 13.

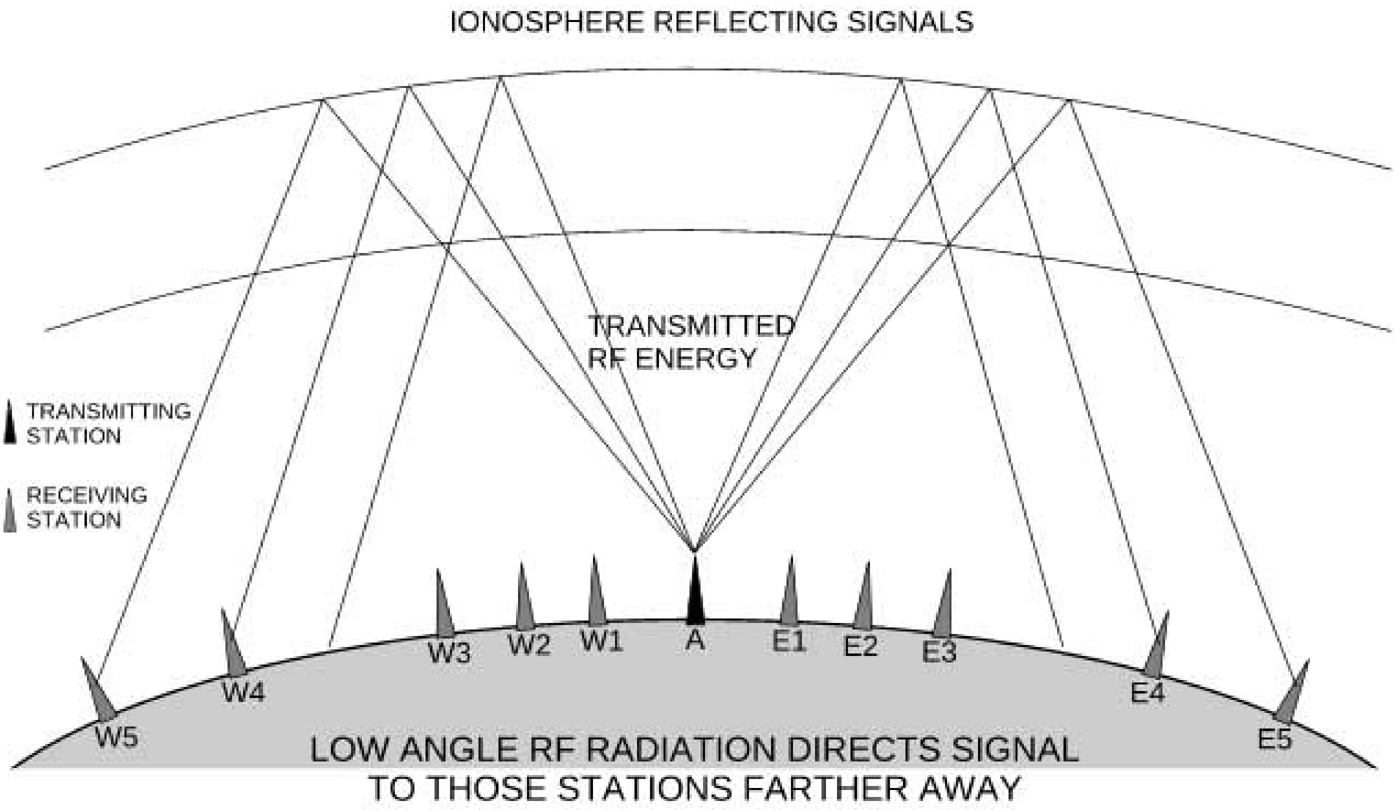

Figure 14 - Drawing representing the effect of low angle radiation. Note how the transmitted RF 'skips' over the close in stations placing them in a low or no signal area.

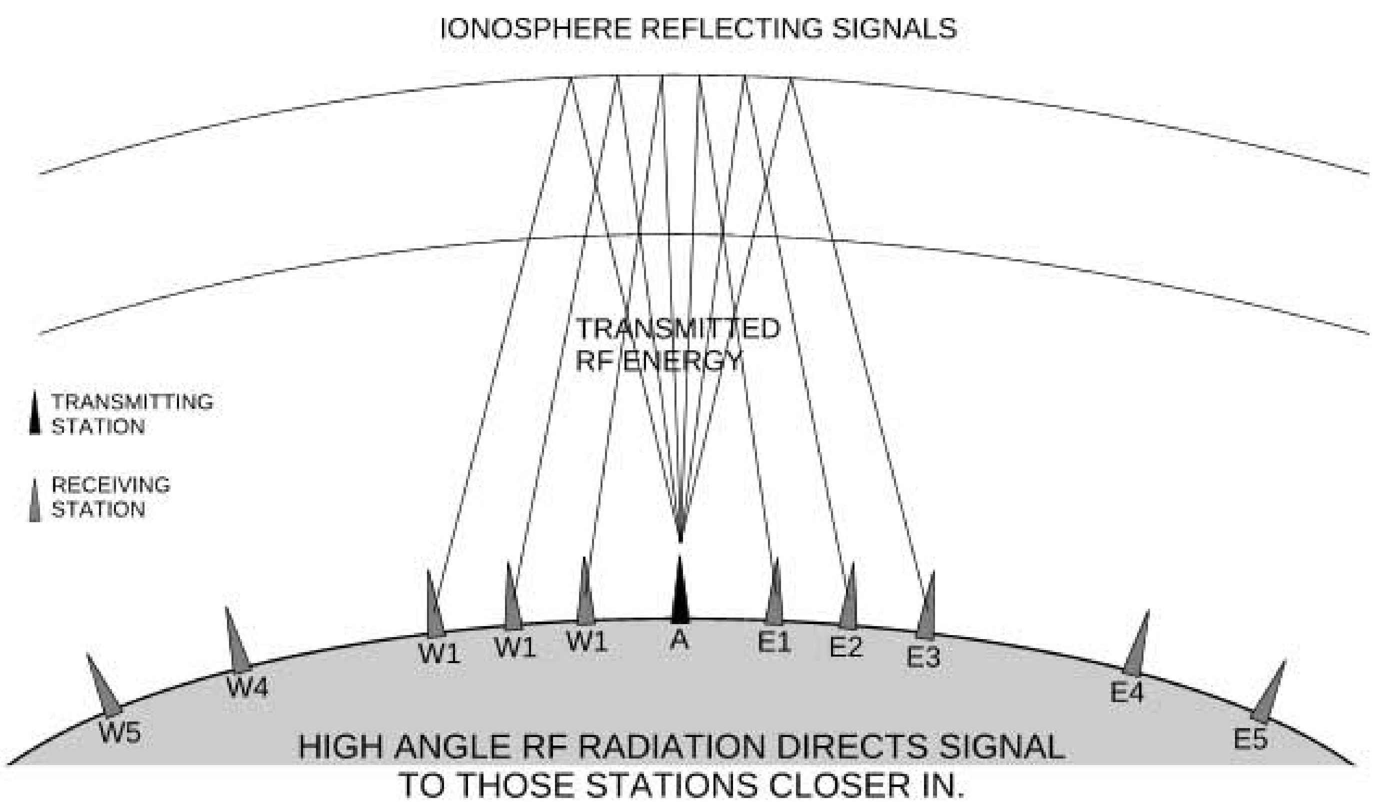

Figure 15 - Drawing representing the effect of high angle radiation. RF now is broadly beamed straight up and reflected directly back down to the close-in stations.

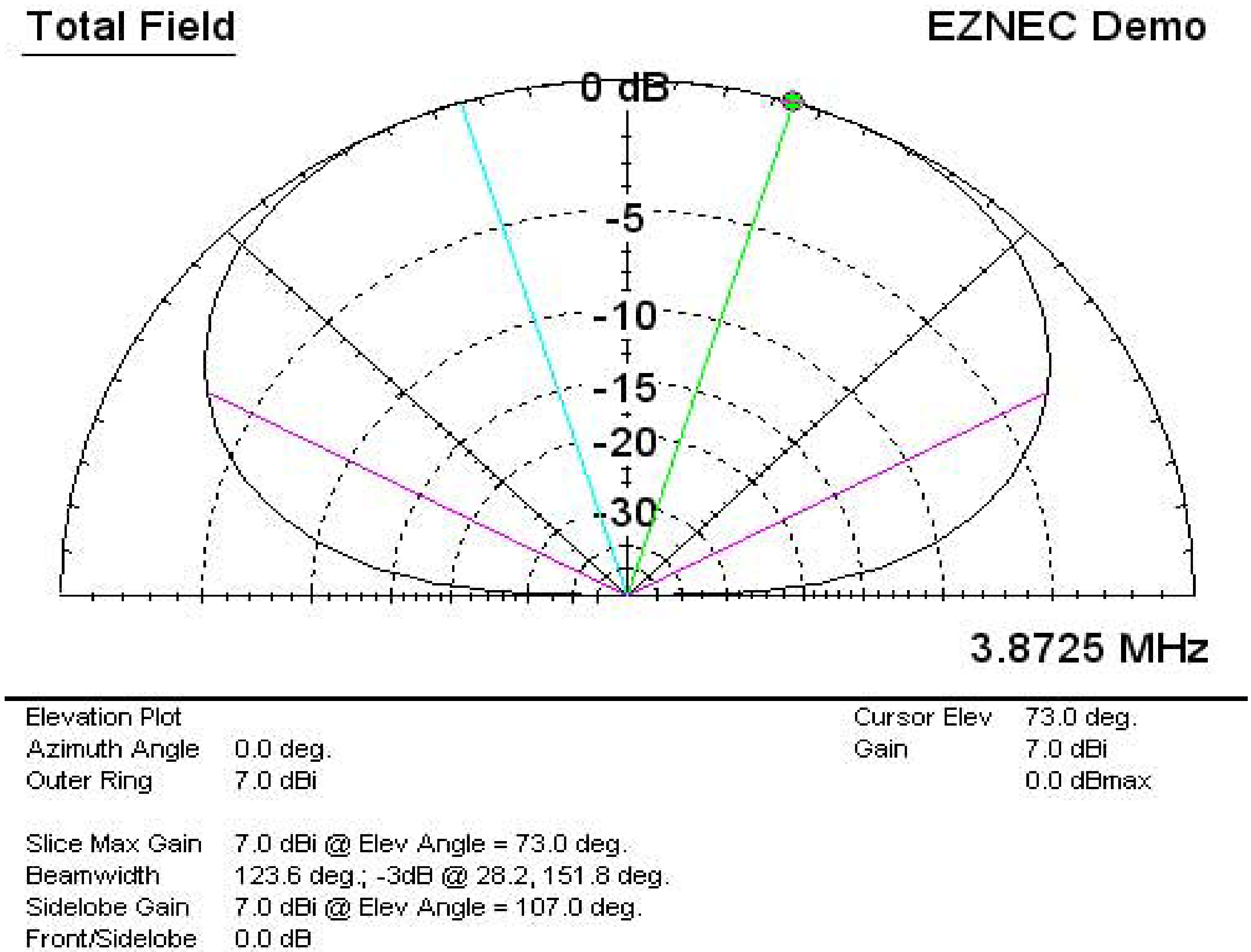

Figure 16 - Elevation plot with antenna at a quarter wave length above ground level. RF is now being directed more in an upwards direction.

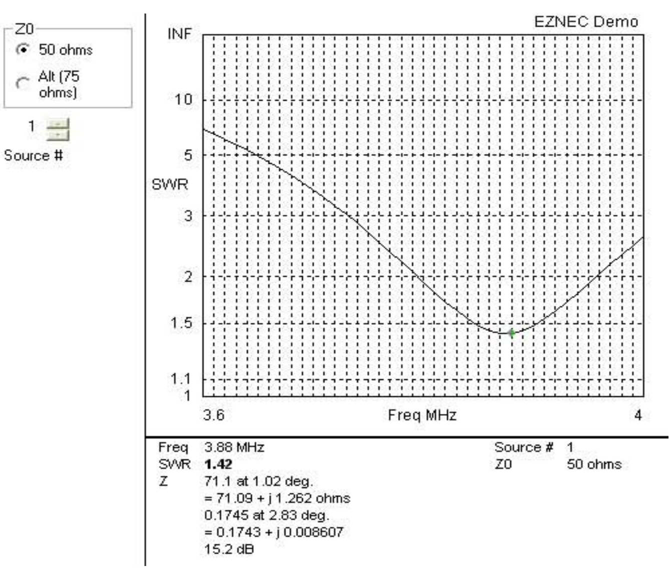

Figure 17 - SWR at a half wavelength high.

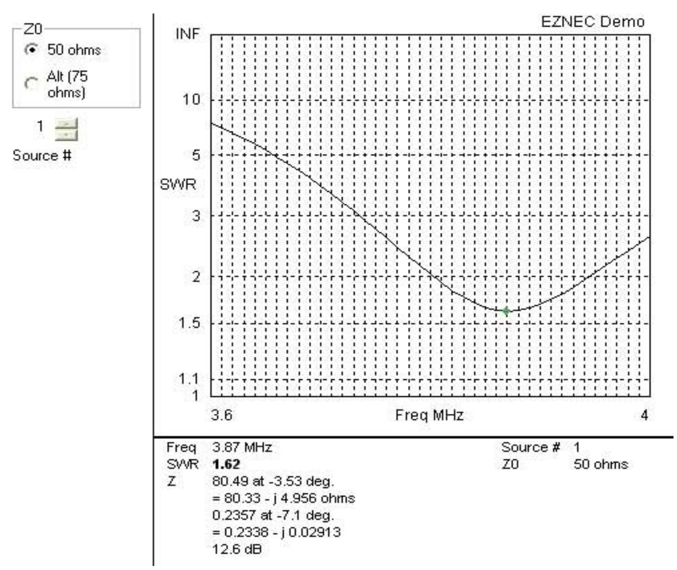

Figure 18 - SWR at a quarter wavelength high.

As the antenna is lowered closer to the ground, the impedance changes from the neat and clean 50 ohms resistive that you find at a half wavelength height. Entering the descending heights in the EZNEC program will show that the ‘gain’ in a vertical direction continues to increase as the antenna is lowered nearer the ground. Compare figures 13, 16, 19 - 22.

The impedance continues to change as well, dropping

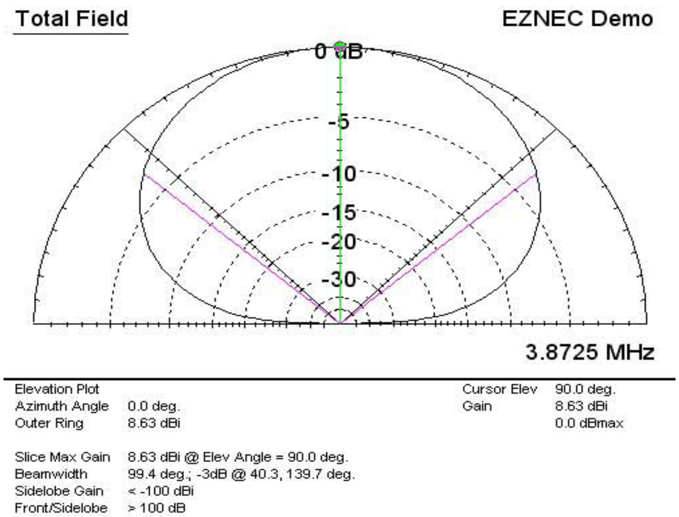

Figure 19 - Plot at an eighth wavelength.

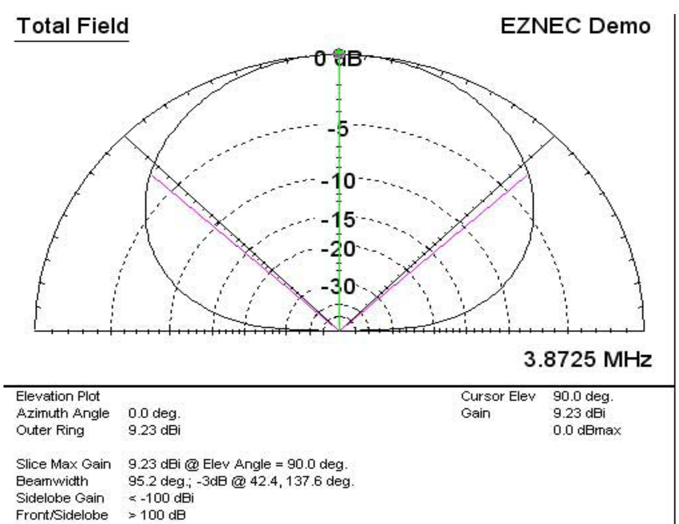

Figure 20 - Plot at a height of twenty feet.

to nearly 3 ohms at a height of 10 feet off the ground and requiring a tuner to compensate and match to your transmitter.

You might think that lowering the antenna to the ground would make the ultimate NVIS antenna but that is not the case, as the impedance factors become very difficult to match. Eventually, you reach a low spot where the

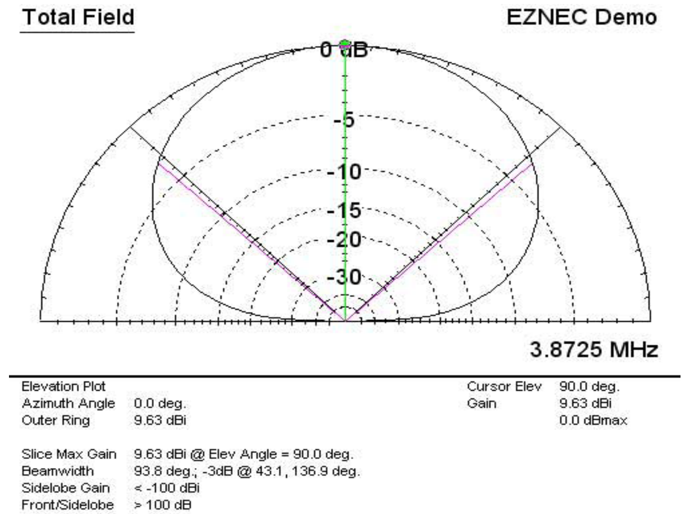

Figure 21 - Plot at a height of fifteen feet.

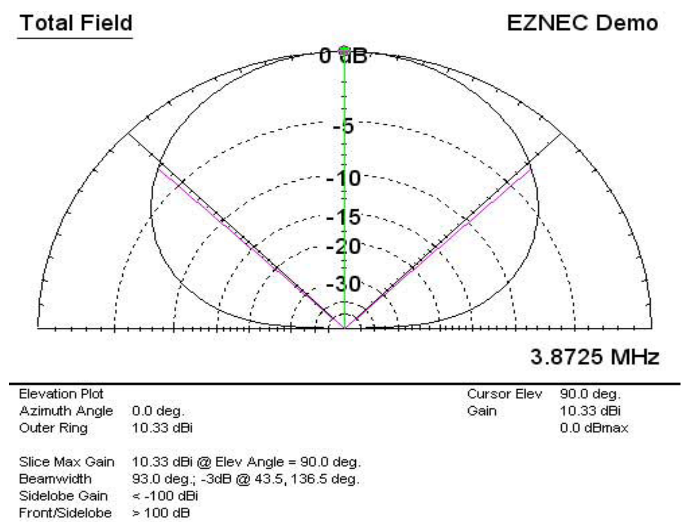

Figure 22 - Plot at a height of 10 feet.

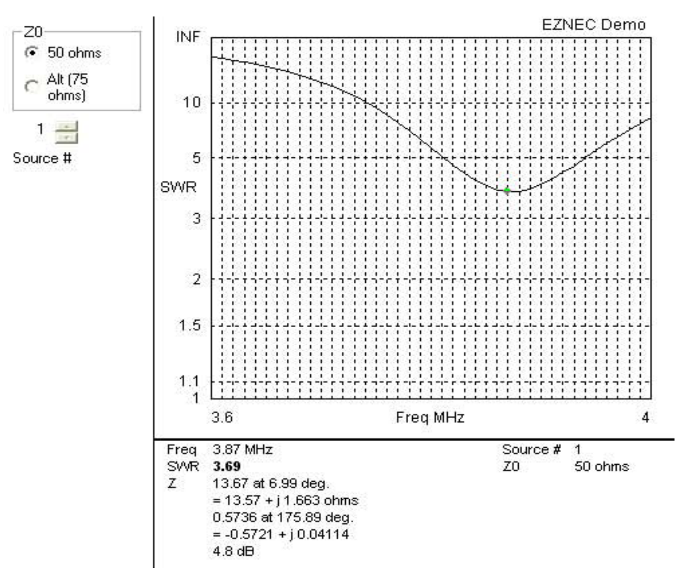

Figure 23 - SWR at twenty feet.

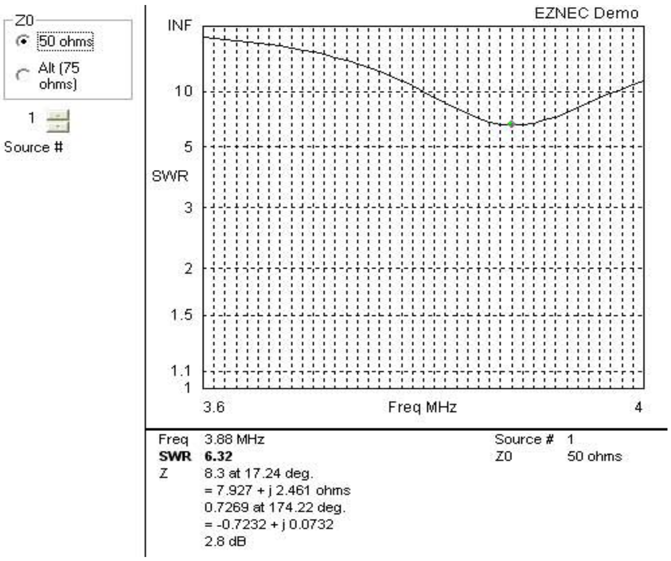

Figure 24 - SWR at fifteen feet.

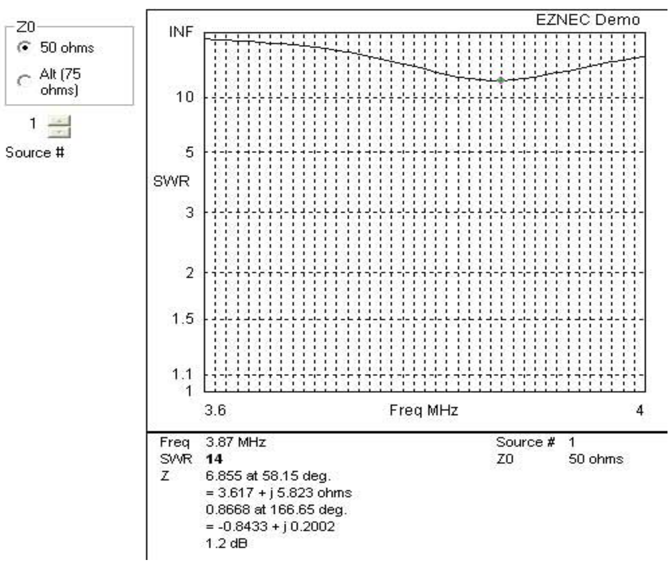

Figure 25 - SWR at ten feet.

losses increase so dramatically that it is no longer a practical antenna. At this point those very significant losses in the feed line and the tuner waste nearly all of your valuable RF.

One other benefit of NVIS is the lowering of QRM and QRN because of the lesser gain at the lower receive angles. Distant noise and stations are simply not heard.

If you have the luxury of being able to install your antenna with adjustable support lines, try varying the height over a period of time (net on Saturdays) to see what works best for your location. Too high and you won't get the NVIS 'benefit', too low and you will not be able to reach or receive all of the stations on the net, eliminating the farthest away ones (like VE1VQ or W9UPK!).

CONCLUSION

NVIS is a propagation mode worth considering for emergency communications, in a way that MARA members may be required to use it. We are usually more concerned with communicating with other operators in our own stake or multi-stake area than with those on the other side of the country. To have the best of both, lower the antenna to the best height for local communications, and raise it up to reach the area storehouse or Salt Lake City. Or for those times when you get a hankering to work some DX!

SWAP SHOP

List your items you wish to buy, sell, trade, or give away at "no charge"!

DI-DAH-DI-DAH-DIT

More than any other item you can add to or modify at your station, a change that makes for a more effective antenna will get you the most results for your dollar. Trying NVIS with an existing antenna won't cost much, if anything, extra. If you need some ideas for support line mounting techniques, see previous newsletters.

Who knows when we will ever have to provide emergency communications. I would think that all of us hope we never will. It would certainly be better to be ready and never have to than to be unprepared when the lights go out over the entire east coast.

On another, perhaps more important note, Valentine's Day is on the 14th, guys! Consider this a reminder that you need to get a card and a gift of some kind for your sweetheart. You really don't want to forget two years in a row, now do you? That might not be good for harmony in the home.

Until next month,

VE1VQ

IN MARCH'S NEWSLETTER...

Maybe another installment of 'ADVENTURES OF A NEW HAM'...

Perhaps some more on NVIS...

MARK IT ON YOUR CALENDARS

May 30th 2009 for the MARA NorthEast Annual Meeting at Nazareth Ward, Scranton PA Stake

NOTE THE CHANGE OF DATE FROM THE 2ND OF MAY!