NVIS ANTENNA FOR ARES® EMERGENCY OPERATION

BY WX2NJ

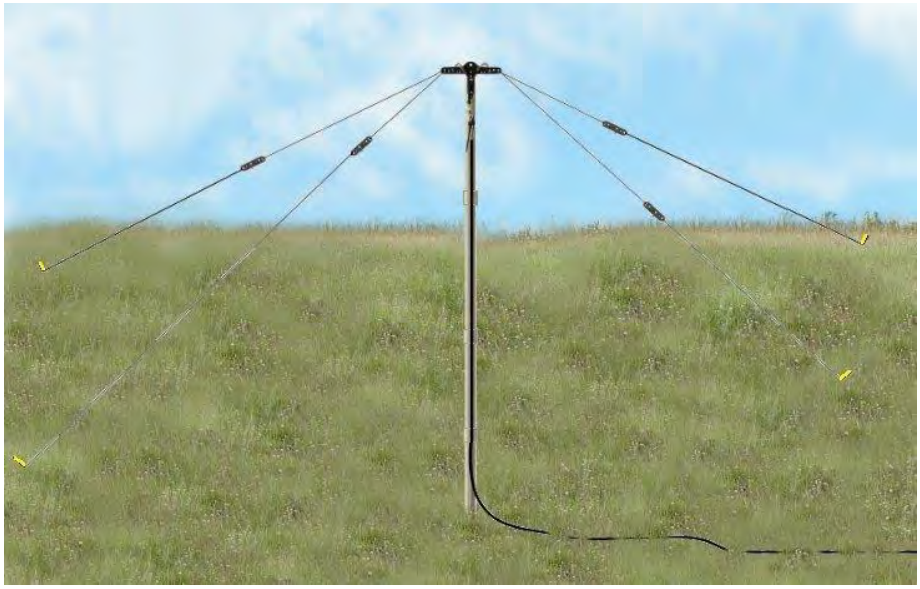
The following document is a compilation of information on Near Vertical Incidence Skywave (NVIS) antenna systems for Amateur Radio use.

This document is comprised of four sections:

1. Section 1 – DX Engineering, WP-NVIS, Revision 3, A Practical NVIS Antenna for Emergency or Temporary Communications
2. Section 2 – WX2NJ enhanced construction details of 80 and 40 meter loading coils
3. Section 3 – N3AE and N3IDX, Improving the AS-2259 Antenna
4. Section 4 – WX2NJ NVIS Experience

A Practical NVIS Antenna for Emergency or Temporary Communications

WP-NVIS Rev. 3



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WARNING!

INSTALLATION OF ANY ANTENNA NEAR POWER LINES IS DANGEROUS

Warning: Do not locate the antenna near overhead power lines or other electric light or power circuits, or where it can come into contact with such circuits. When installing the antenna, take extreme care not to come into contact with such circuits, because they may cause serious injury or death.

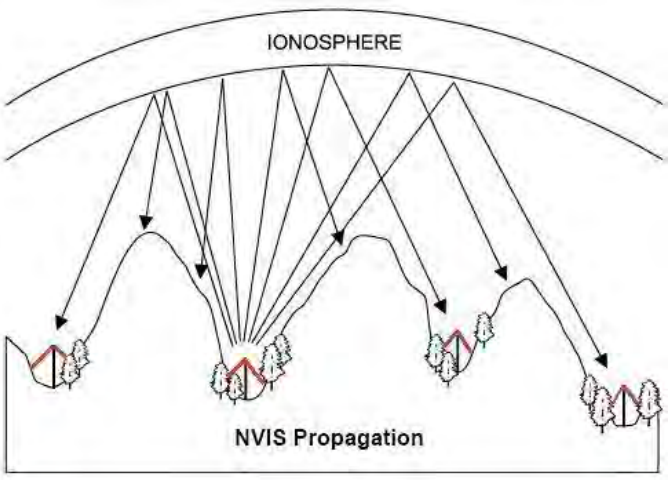
Overhead Power Line Safety

Before you begin working, check carefully for overhead power lines in the area you will be working. Don't assume that wires are telephone or cable lines: check with your electric utility for advice. Although overhead power lines may appear to be insulated, often these coverings are intended only to protect metal wires from weather conditions and may not protect you from electric shock

Keep your distance! Remember the 10-foot rule: When carrying and using ladders and other long tools, keep them at least 10 feet away from all overhead lines - including any lines from the power pole to your home.

NVIS

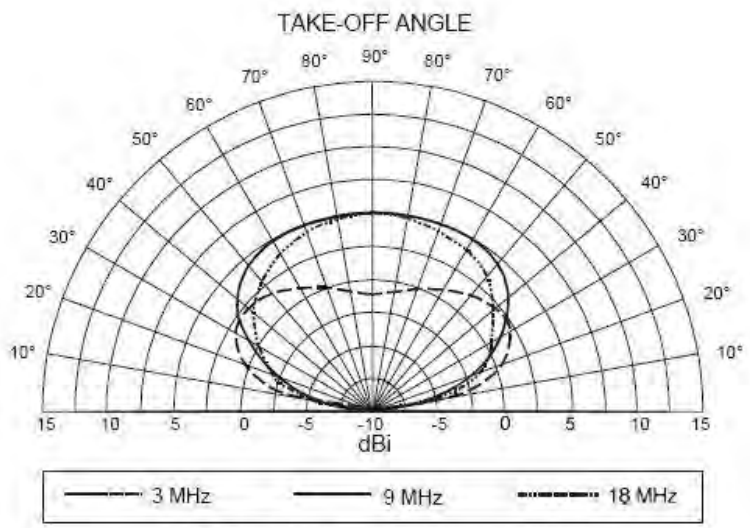
Near Vertical Incidence Skywave (NVIS) is a propagation mode which uses high angle radiation to send signals almost straight up to be reflected back to Earth for very effective short to medium distance communications. This mode of operation makes it ideal for in-state communications during disasters or other emergency situations. The military has used NVIS techniques for decades to provide short haul communication with other units on the ground.



NVIS only works at frequencies from 2 MHz to 10 MHz. The signal must penetrate the D layer of the ionosphere, and bounce off the F layer. Lower-frequency signals will not penetrate the D layer; higher frequencies will not bounce off the F layer at these sharp angles and just goes out into space. Remember the Maximum Useable Frequency (MUF? For amateur radio operators, we're looking at 40 and 80 meters primarily for NVIS use.

A good NVIS antenna will not work well at DX distances. Antenna gain is a zero sum game. There is a fixed amount of energy radiating. If we push it all out in one direction (the near-vertical angles), we have to take it away from another direction (the low DX angles).

Regular height dipoles or vertical antennas have a lower take off angle and your signal may be heard three states away, but not in your state due to the skip zone. This skip zone is the area between the maximum ground wave distance and the shortest sky wave distance where no communications are possible. Depending on operating frequencies, antennas, and propagation conditions, this skip zone can start at roughly 10 to 20 miles and extend out to several hundred miles, preventing communications with the desired station. The other term called ground wave is where your signal does reach someone closer. A ground wave signal can go up to approximately 50 miles if conditions, including terrain and obstacles, are favorable.



AS-2259 Vertical Radiation Pattern

Using no skip zone or ground wave, the NVIS mode is used for making reliable HF communications below 10 MHz effective for a range to 600 miles. The NVIS propagation mode works best on HF below 10 MHz since these high angle radio waves are reflected back to Earth. Most often a low dipole is the best antenna to use and will provide reliable communications. This makes a NVIS antenna an excellent choice for emergency communications and for staying in contact with other amateur radio operators in nearby locations.

Dipoles only exhibit directionality once they reach 1/2 wavelengths above ground. However, NVIS antennas are located from 1/4 to 1/10 wavelength above ground.

Vertical RF energy radiated at a low enough frequency is reflected back to earth at all angles. The effect is similar to taking your garden hose with a fog nozzle and pointing it straight upwards. The water coming back down gives you an omni-directional pattern without dead spots. It's a continuous circular radiation pattern coming back down. Since it is omni-directional, dipole orientation is not important.

The higher the angle, the lower the frequency needed to work properly. Therefore lower amateur radio frequencies such as 40 and 80 meters are ideal for NVIS use. NVIS generally requires takeoff angles of 70 degrees or higher. Radio waves directed vertically at frequencies higher than the critical frequency pass through the ionized layer out into space.

The military uses a dual band NVIS antenna known as the **AS-2259/GR**. It consists of two crossed inverted "V" dipoles positioned at right angles to each other and is supported at the center by a 15-foot mast. The antenna was designed for military use from 2 to 10 MHz (some references say 2 to 30 MHz). The dual dipole wires do the job of providing guying support for the mast.

Military AS-2259/GR

There are a number of different NVIS antenna plans on the internet that can be adopted to amateur radio use. Many hams have modified those plans to operate on the bands they have chosen. Although originally made for military use, this particular design was found to work on the 80 and 40 meter amateur bands using a good tuner without modifications for the Ohio State Parks On The Air contest held every September (since 2008) in Ohio (www.ospota.org). This design was chosen because of the simplicity, ease of construction and operation.

Let's Build One!

- The NVIS antenna described is based on the proven information from the military AS-2259/GR antenna. It will provide excellent short range communications and is easy to set up for emergency or temporary communications.
- It's a dual band inverted "V" at a height of 15 feet.
- The area required (foot print) is approximately 45 feet by 45 feet.
- The mast support used is fiberglass to avoid any signal coupling from the low antenna wires. The fiberglass sections are widely available on the military surplus market, or you can make your own support using PVC tube sections.
- The 4 wires used for the antenna elements are also used with rope to provide the support or guying for the 15 foot mast.
- Your tuner is connected to the antenna Center "T" using 100 feet of RG-8X coaxial cable. A tuner is required to match the antenna to your transmitter.

You can get as simple as you want or you can get creative and make it more involved. As with all amateur radio gear, modifications can be made and experimenting with this design may result in even better performance for your chosen area of operation.

The antenna described was successfully used during the first Portage County (Ohio) Amateur Radio Service's contest called Ohio State Parks On The Air (OSPOTA - www.ospota.org) in September 2008. The object of this contest was to make two way contacts with amateur operators located at the 73 Ohio State Parks. Ohio is roughly 200 miles square, so the NVIS antenna was the ideal match. Contacts were made on both 80 and 40 meters ranging from 15 miles to 2,000 miles. This antenna has been in continued use for OSPOTA and other contests since 2008.

OSPOTA Contest Station
NVIS Antenna made from DX Engineering Parts
Icom 706 MkIIg
MFJ-969 Tuner
Astron 30 amp power supply
AC Power - 1 kW gas generator

NVIS Antenna

KD8GGZ and KB8VJL

KB8VJL and KB8UUZ

Parts Needed

From **DX Engineering**:

1 **DXE-UWA8X-KIT** - Universal Wire Antenna Kit for RG-8X
1 **DXE-ANTW-150** - #14 Insulated Antenna Wire, 150 Ft.
2 **DXE-ECL-24SS** (or **DXE-ECL-2000-10P**) - Element Clamp for 1-7/8 to 2 in. tube
1 **DXE-UWA-END-KIT** - End Insulators, Package of 8
1 **DXE-8XDX100** - 100 Feet of RG-8/X coaxial cable with PL-259's on each end
1 **SYN-DBR-94-100** - 3/32 in. Diameter, Double-Braid Dacron/Polyester Rope, 100 ft. Roll

From your local source:

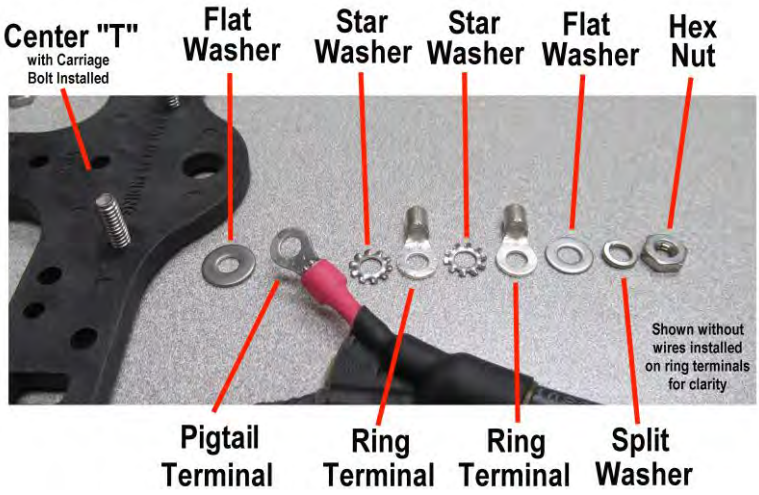
15 ft 2 Inch Diameter Fiberglass pole. Military surplus 4' interlocking poles obtained locally
4 "J" hooks & mounting hardware, obtained locally
4 Tent Pegs, obtained locally
2 Ring Terminals for 14-16 ga wire (2 are in the kit, you need 4 total)

Construction

Using the **DXE-ANTW-150** - #14 Insulated Antenna Wire, cut four wires. Two wires are 25 Ft each (40 meter side) and 2 wires are 38 Ft each (80 meter side). No further length adjustment will be needed.

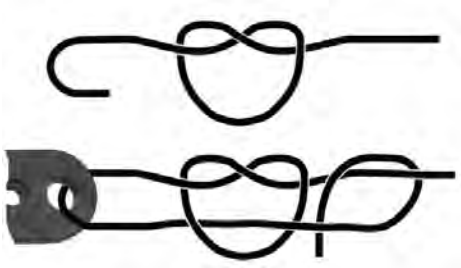
Assemble the **DXE-UWA8X-KIT** - Universal Wire Antenna Kit for RG-8X per the instructions supplied. The antenna wires are connected to the Center "T" using the supplied ring terminals. Connect one 25 Ft. wire and one 38 Ft. wire to each leg of the Center "T".

Here is the proper hardware stack-up for the Center-T:



Using four **DXE-UWA-END-KIT** End Insulators, weave the antenna wire ends as shown in the **DXE-UWA8X-KIT** instructions.

Using the **SYN-DBR-94-100** - 3/32 in. Diameter, Double-Braid Dacron/Polyester Rope, 100 ft. Roll, cut four ropes. The rope lengths from the End Insulators to the Tent Pegs are: Two at 7 Ft. and two at 20 Ft. Allow extra rope length to tie to the End Insulators and the Tent Pegs. Keeping that in mind, cut the ropes: Two at 10 Ft. each and two at 23 Ft. each.



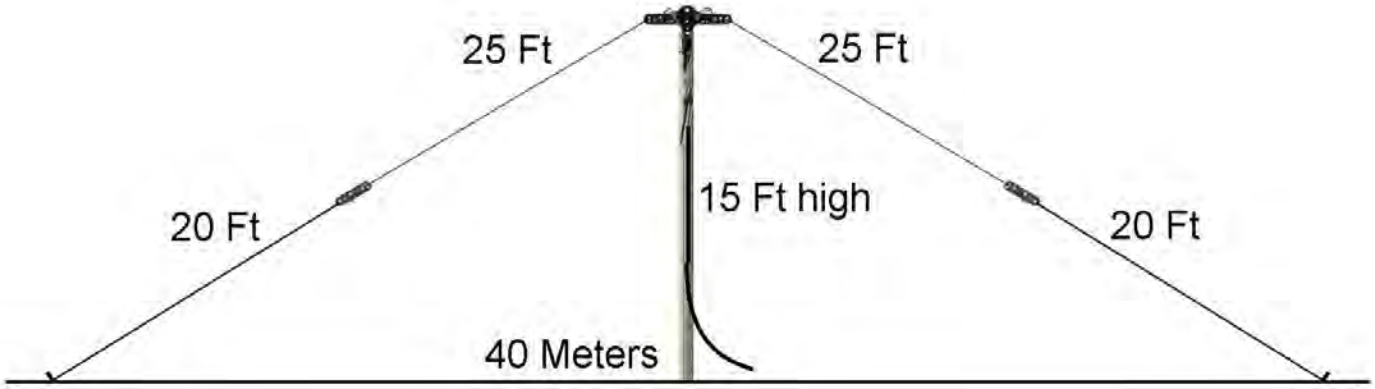
The knot shown for Dacron Polyester Rope will not slip and yet is easily adjustable.

The Center "T" is held in place on the top mast using two **DXE-ECL-24SS** - Element Clamps as shown in the pictures shown on pages 7 and 8.

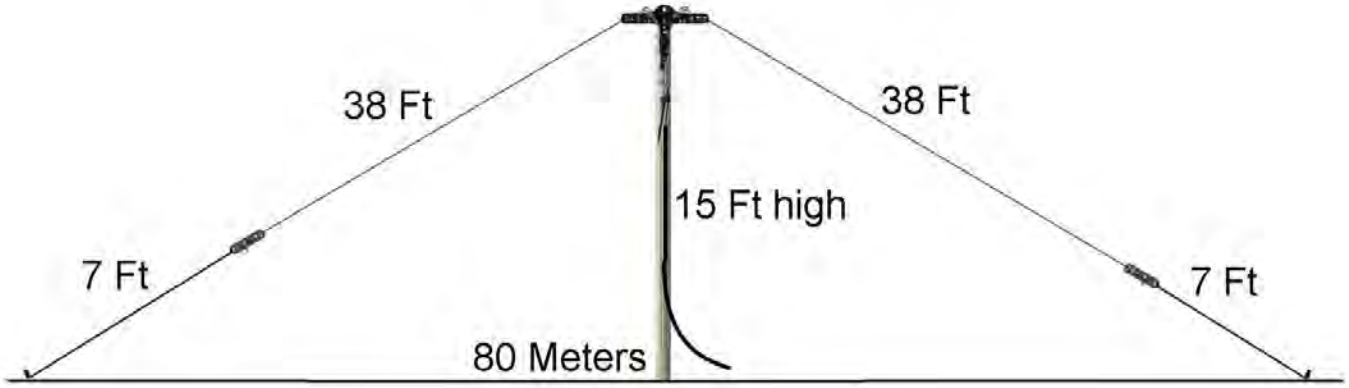
The J-Hooks mounted on the top fiberglass pole (shown on page 8) are optional and are used to wind the antenna wires on when not in use. You could also just coil the wire up and use small ties to hold the loops together.

The overall length from the center "T" to each tent peg is 45 feet (diagonal measurement). This sets up each leg of the NVIS antenna to the proper angles.

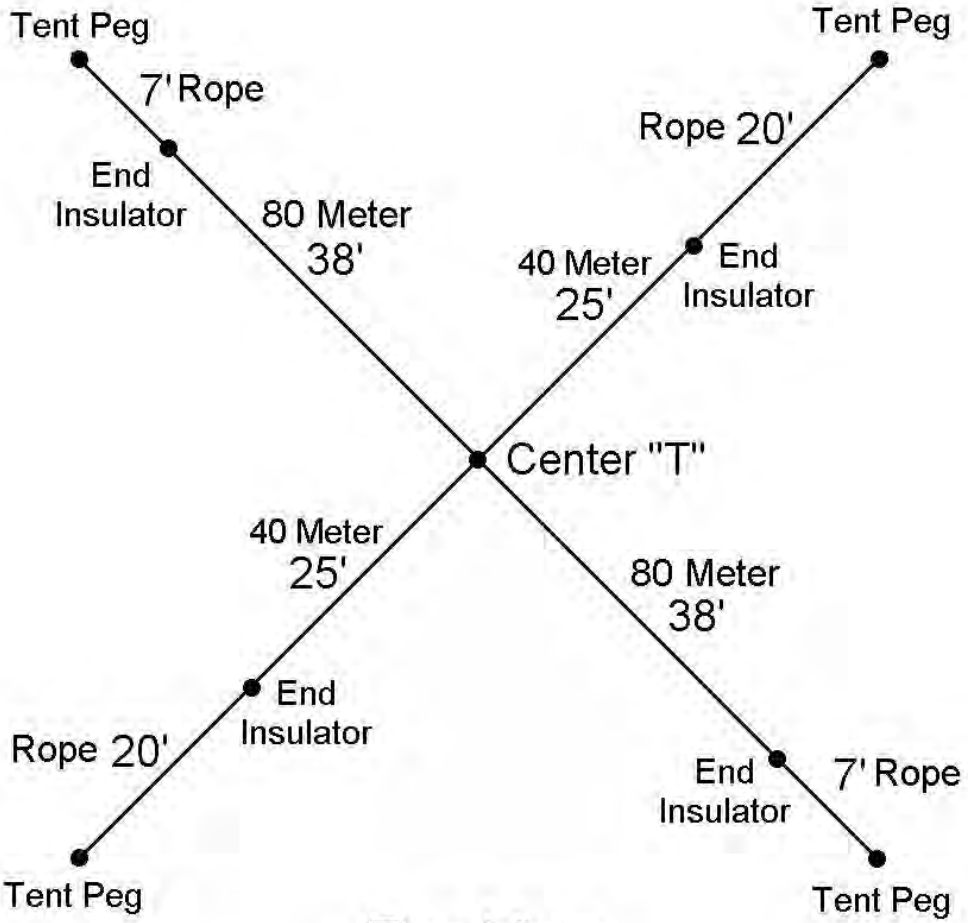
When the antenna is set up, run the **DXE-8XDX100** RG-8/X coaxial cable to your tuner and connect the tuner to your transceiver. The tuner is necessary to provide the correct impedance match for proper operation with your transceiver. You are ready to get on the air using NVIS technology with a portable antenna that can be packed up and taken just about anywhere! Additional Tuning Information: Since the antenna is based on the military version, stay with the measurements shown. If you connect an antenna analyzer to this antenna as show, you will get erroneous readings due the lengths of the elements and their proximity to ground. Don't prune or add wire to the elements. It really works as-is.



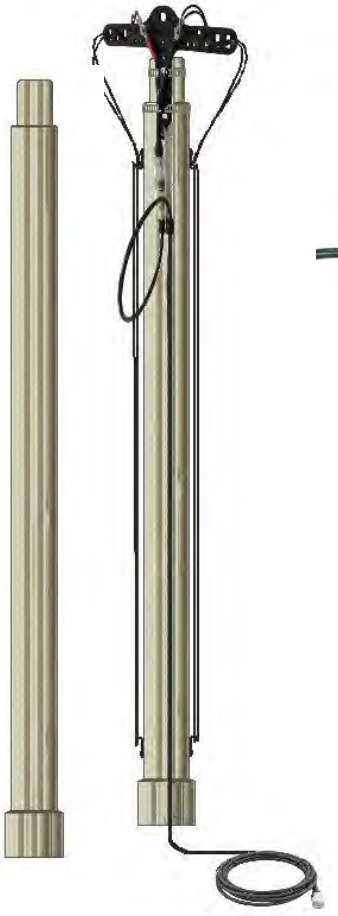
Side Views

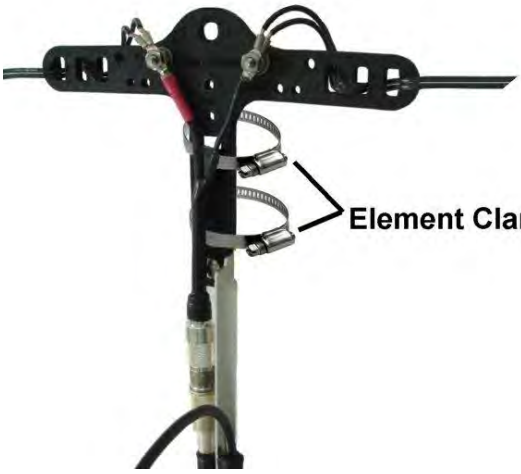


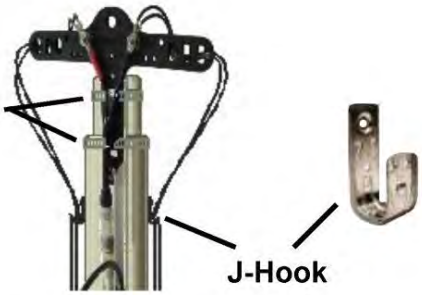
Center "T"



Top View







Element Clamps and J-Hook Details

DX Engineering Parts Used

DXE-UWA8X-KIT Universal Wire Antenna Kit for RG-8/X

This model of our patented **EZ-BUILD®** versatile insulator kit is for building wire antennas of almost any design for low to medium power operation. It includes a new, completely unique coaxial cable connector and feedline strain relief system. This kit includes the patented light weight, high strength, UV-protected Center-T and End Insulators. They feature an exclusive serpentine wire grip for insulated DX Engineering Antenna Wire and our high strength, high power 300 Ω Ladder Line. The serpentine connection's grip is strong enough to permanently support the antenna wires without the need for looping or wrapping the wire ends. This allows fast and easy field adjustments of antenna length without soldering! Stainless steel hardware is included. You can build wire antenna designs using any combination of wire or ladder line. Connection from your wire antenna to your coax cable is made with a pre-assembled coax cable and adapter that accepts a feedline with a PL-259 / UHF male connector. The feedline is secured with the included aluminum bracket, neoprene cushioned P-clamps and stainless steel hardware. This method supports the feedline without subjecting connectors to the strain of the coaxial cable's weight. The Center-T includes a centered top 3/8 inch hole for attachment of an antenna support rope, and the End Insulators accept up to 5/16 inch antenna support rope.
The DX Engineering Universal Wire Antenna Kits let you create any type of wire antenna including single band, multi-band, multi-frequency or folded dipole, doublet and inverted-vee, off-center fed, Windom, Zepp, long wires, rhombic, vee beam, and loop antenna. The **DXE-UWA8X-KIT** will handle low and medium power levels and tolerate low SWR levels.

The **DXE-UWA8X-KIT** includes:

- One patented Center-T Insulator featuring an exclusive no-loop, no solder, wire and 300 Ω ladder line grip which allows for rapid field adjustment of wire lengths – Center-T includes a centered top hole for attaching a support rope
- Two patented End Insulators featuring the no-loop, no solder grip design mentioned above
- Two stainless steel wire connection bolts, nuts and washers
- Four crimp ring terminals for the antenna and ladder line wire connections
- One pre-soldered and tested coax, connector and adapter assembly
- One aluminum cable strain relief bracket and mounting hardware
- Two strain relief P-clamps with neoprene cushions sized to grip only RG-8X without crushing the coaxial cable
- Additional hardware for mounting a DX Engineering Balun

DXE-ANTW-150 - #14 Insulated Antenna Wire, 80M & Up, 150 Ft.

Use this wire to achieve top performance and long, trouble free operation. This antenna wire kit uses insulated wire that is UV resistant and pays out easily, unlike the wire that is commonly available at the big box stores which coils and kinks. It will last much longer in contact with the environment than bare wire.

- Heavy #14 AWG stranded copper antenna wire
- 150 feet, more than enough for a half wavelength 75/80 meter dipole
- UV-resistant insulation
- Reduces precipitation static
- Long, reliable life

DXE-ECL-24SS - (or DXE-ECL-2000-10) Element Clamp for 1-7/8 to 2 in. tube

Typical elements are built using 0.058" wall tubing, which allows successive sizes to slide together with good contact. These clamps are used to hold the telescoping tubing in place at the length that you have chosen. Our clamps are Marine grade - meaning that they are made **entirely** of stainless steel as opposed to the normal hardware store variety.

- Marine grade clamp.
- High nickel alloy stainless steel meets the demands of severe corrosive environment.

DXE-8XDX100 - Coax Cable DXE RG-8/X, with PL-259 Connectors - 100 ft.

Connectors: PL-259 Connectors at each end, Length: 100 ft.
Conductor RG Type: 8/X AWG: 16 Stranded: 19x29 Conductor Material: Bare Copper
Insulation Material: Gas injected FPE- Foam Polyethylene
Insulation Diameter: .155 in., Outer Shield Type: Braid Outer Shield Material: Bare Copper
Outer Shield % Coverage: 96% , Outer Jacket Material: PVC Type II Non-Contaminating
Overall Nominal Diameter: .242 in.

SYN-DBR-94-100 - 3/32 in. Diameter, Double-Braid Dacron/Polyester Rope, 100 ft. Roll

Synthetic Textile Industries Double-braided Dacron/Polyester ropes are not weakened by decay or mildew and provide excellent resistance to abrasion. The color sealed black polyester yarn used in the braided jacket also protects the cord from damage due to ultra-violet light.

- 100' spool
- 3/32" diameter rope
- Double-braided Dacron/Polyester rope
- Excellent resistance to abrasion
- NOT weakened by decay or mildew
- UV-Resistant
- Rated for a load of 260 lbs.

DXE-UWA-END-KIT - End Insulators, Package of 8

This kit includes eight of the patented light weight, high strength, UV-protected End Insulators used in the UWA KITS. They feature an exclusive serpentine wire grip for insulated DX Engineering Antenna Wire and our high strength, high power 300 Ω Ladder Line. The serpentine connection's grip is strong enough to permanently support the antenna wires without the need for looping or wrapping the wire ends. This allows fast and easy field adjustments of antenna length without soldering!

Technical Support

If you have questions about DX Engineering products, contact DX Engineering at (330) 572-3200. You can also e-mail us at:

dxengineering@dxengineering.com

Warranty

All products manufactured by DX Engineering are warranted to be free from defects in material and workmanship for a period of one (1) year from date of shipment. DX Engineering's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by DX Engineering. If DX Engineering's products are claimed to be defective in material or workmanship, DX Engineering shall, upon prompt notice thereof, issue shipping instructions for return to DX Engineering (transportation-charges prepaid by Buyer). Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing. The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation, damaged from severe weather including floods, or abnormal environmental conditions such as prolonged exposure to corrosives or power surges, or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's specifications. In addition, DX Engineering's warranties do not extend to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to DX Engineering. The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR DX ENGINEERING ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.

Specifications subject to change without notice.

Attached is a pdf explaining how to improve the performance of the NVIS antenna shown on several websites and DX Engineering. Not much detail was given to the construction of the loading coils, so I built a few and I'll document the details. AWG #14 stranded wire is used for all coils, which is the same as the wire for the antenna elements (38 and 25 feet).
The 80 Meter coil form is made of 1-1/2" PVC, 4 inches in length. Drill a 3/16" hole, 1/2 inch from the edge and insert a #10 SS bolt to secure the terminal. Solder an un-insulated lug on one end and fasten lug to #10 bolt. Tightly wrap wire around form 19-1/2 turns. Drill 1/8 hole on side opposite #10 bolt and pass wire through hole and out of PVC form. Cut wire 7 inches from end of PVC and solder another lug on wire.

The 40 Meter coil form is made of 3/4" PVC, 3.5 inches in length. Drill a 3/16" hole, 1/2 inch from the edge and insert a #10 SS bolt to secure the terminal. Solder an un-insulated lug on one end and fasten lug to #10 bolt. Tightly wrap wire around form 14 turns. Drill 1/8 hole on same side of #10 bolt and pass wire through hole and out of PVC form. Cut wire 7 inches from end of PVC and solder another lug on wire.

WX2NJ

40 Meter Coils

80 Meter Coil

NVIS with only 80 Meter Coils

Improving the AS-2259 NVIS Antenna
By N3AE and N3IDX

Most CARA members just finished making NVIS antennas for HF emergency service use on 80 and 40 meters. The antenna design is based on the military AS-2259 with the dimensions shown in Figure 1. Further information can be found at W9WIS's web site. The cross dipole wire lengths of 38 ft and 25 ft provide for a reasonably small antenna footprint but the resonant frequencies are well outside the 40 and 80 meter amateur bands, requiring the use of an antenna tuner.

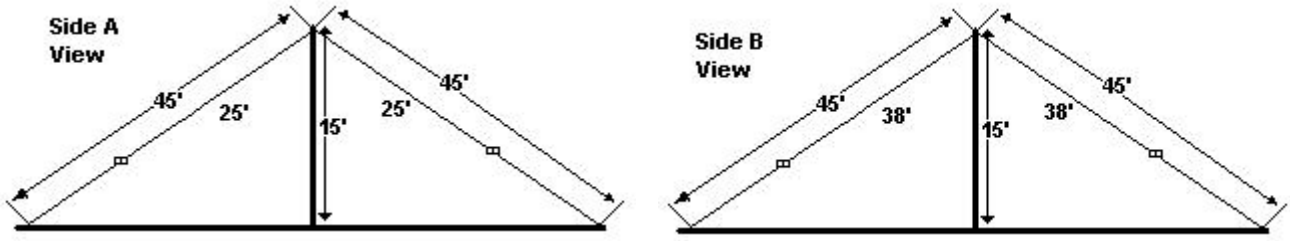


Figure 1

The antenna was analyzed using EZNEC to determine its basic characteristics and to identify any improvements that could be made. The SWR plot shown in Figure 2 shows the antenna has low SWR only at 5.9 MHz and 9.1 MHz. At 3.820 MHz the antenna has a feed point impedance of 12.51 - j406.4 ohms, leading to a very high SWR. The performance at 7.2 MHz isn't any better, with a feed point impedance of 923.8 - j205.3 ohms. The high 40 and 80M SWR, as well as the resonances around 5.9 MHz and 9.1 MHz were confirmed on N3IDX's antenna using an MFJ-259 antenna bridge.

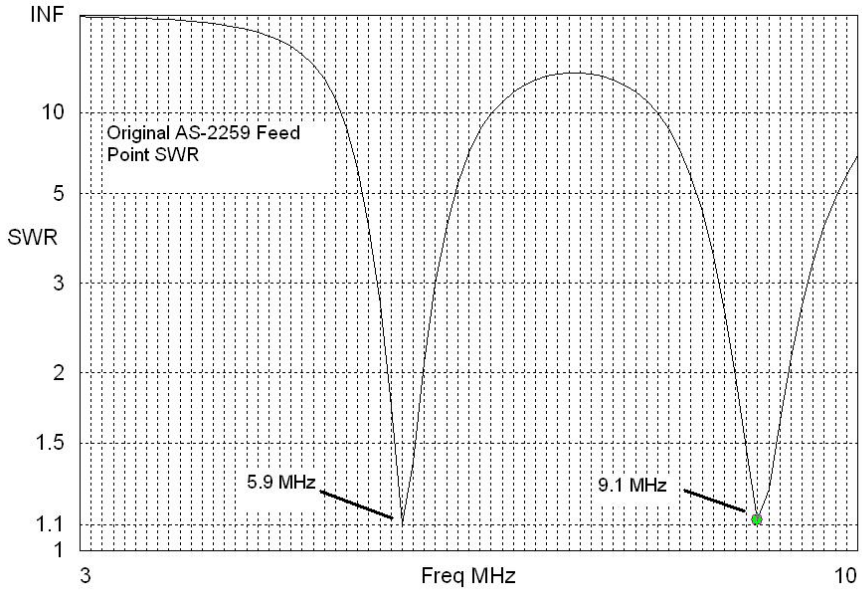


Figure 2

While a good antenna tuner may be able to match the antenna on 40 and 80 meters, the SWR on the coax feedline is very high, leading to high losses well beyond the matched loss of the coax itself. A quick check with a transmission line program shows that on 3.820 MHz, using 100 ft of RG-8X coax, the high SWR adds 11.6 db of loss on top of the basic 0.4 db matched loss of the coax. The total 12 db of loss means that your 100 watt transmitter is only getting 6.3 watts into the antenna. So why does this antenna work for the military? For one thing, the radio is typically right at the bottom of the mast, not many feet away. Also, for the military version (at least the version built by Collins Radio) the mast itself is designed to be a very low loss, large diameter coax transmission line.

So what can we do to improve this antenna for 40 and 80M amateur use? One solution is to make the antenna elements look longer electrically by adding loading coils near the center of the antenna. EZNEC has a very nice method to add series impedances in the antenna segments. In this case, we need inductive impedance. A bit of trial and error resulted in the much improved SWR plot shown in Figure 3. At 3.8 MHz, the SWR drops to a respectable 2:1. The 40M SWR is even better, dropping to about 1:1.6 around 7.2 MHz.

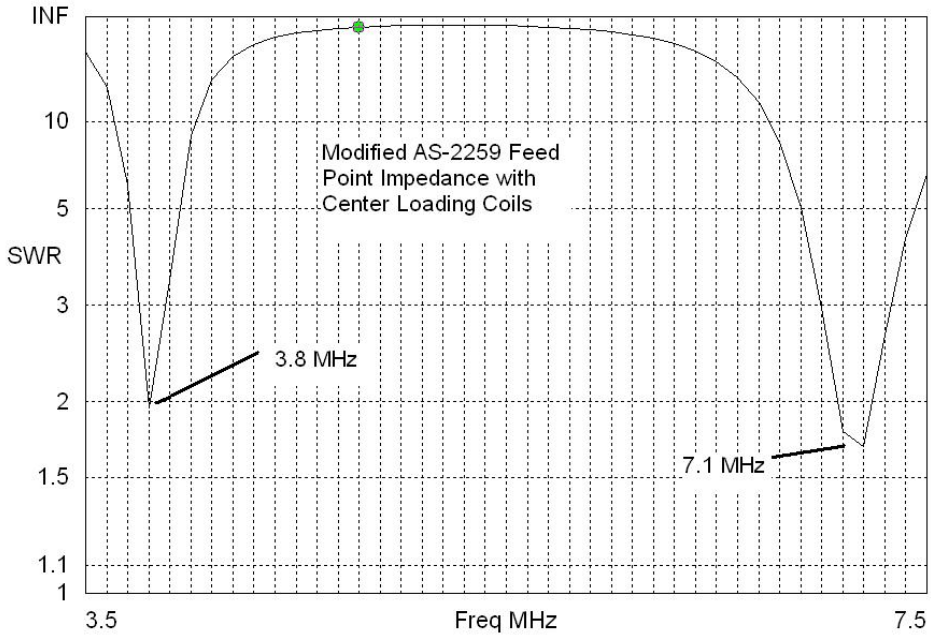


Figure 3

So how do we make the coils? The formula for a single layer closed-wound inductor can be found in the ARRL handbook . K7MEM has a very nice on-line calculator. The EZNEC derived inductance values were used to build loading coils using PVC pipe for the coil form. The 80M coils use 1.5 inch pipe (which has an outside diameter of 1 7/8 inches). The 40M coils use 3/4 inch pipe (which has an OD of 1.05 inches). Insulated 14 gage house wire was used. After some final tweaking to adjust the number of turns to achieve best SWR as measured by the MFJ-259, we arrived at 14 turns for the 40M coils

and 19.5 turns for the 80M coils. The differences between the EZNEC calculated values (19 turns on 40M; 22.5 turns on 80M) and the final MFJ-259 confirmed values are probably due to errors modeling an antenna this close to the ground, plus the fact that the coil wire leads add length to the overall antenna wire.

The coils are close wound on the PVC pipe and anchored by drilling a small hole through the pipe to pass the end of the wire. One end is mounted to a small screw and nut. The coil system easily installs between the antenna's end cap and the current antenna wire system. The 40M coil is shown in Figure 4 and the 80M coil is shown in Figure 5. A close-up of the antenna with all four coils installed is shown in Figure 6.

We hope CARA members have found this article useful and will take advantage of the improvements for their NVIS antennas.

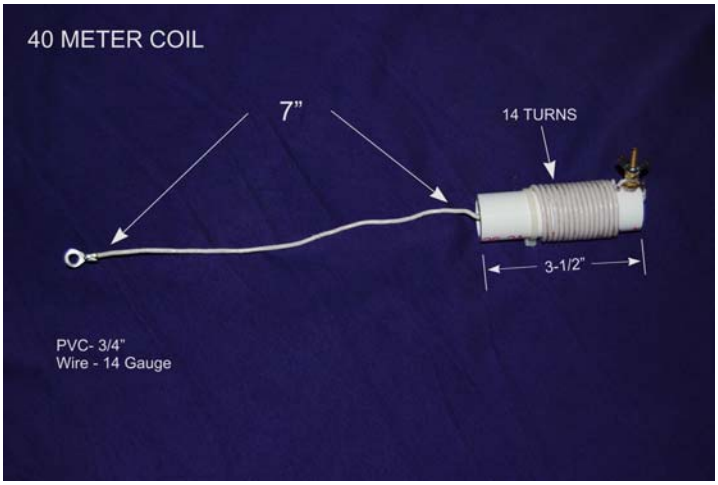


Figure 4

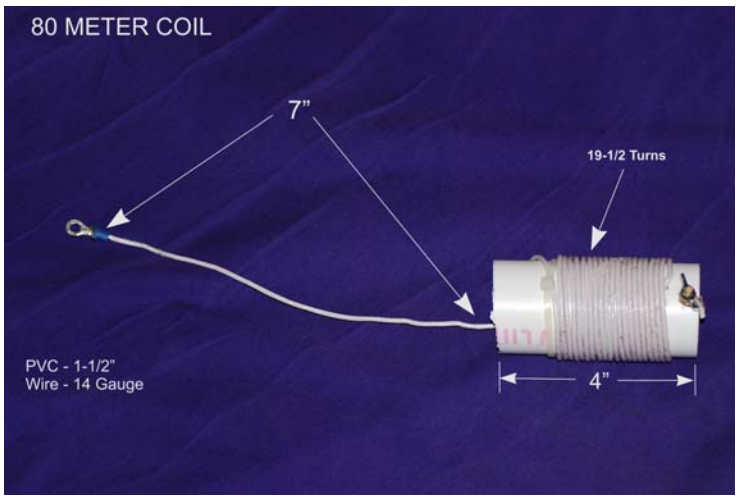


Figure 5

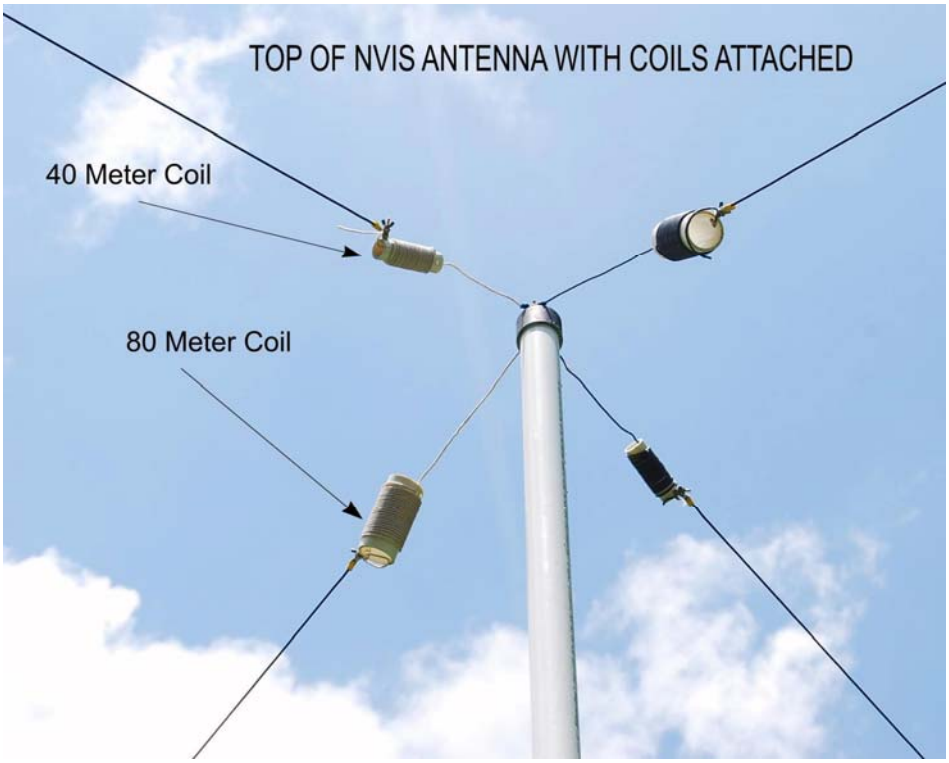

TOP OF NVIS ANTENNA WITH COILS ATTACHED
40 Meter Coil
80 Meter Coil

Figure 6

NVIS EXPERIENCE, by WX2NJ

First off I had three objectives when installing a NVIS antenna at my home:

1. I had to be able to remove the radials and keep the mast intact
2. I wanted local 80 meter coverage for ARES emergencies
3. I wanted local 60 meter coverage for ARES emergencies

For the mast material, I chose 2 inch grey PVC electrical conduit. Two, ten foot lengths, cemented in the center, gave me a perfect length. The electrical PVC has extended slip joints at one end and this made for a strong coupling. I had no concerns about separating the sections since the mast was to be installed permanently. The slip joint from the bottom was cut off.

I had a length of 2-1/2 inch grey PVC electrical conduit left over from another project and 2 inch conduit slips inside 2-1/2 inch with little play. Note: 2-1/2 inch conduit is not easy to come by. I was lucky to obtain several lengths from Lowes years ago that they were trying to get rid of.

I cut a five foot section of 2-1/2 conduit and buried 3 foot of it in the ground with two 80 lb bags of concrete. This enabled the 2 inch mast to be inserted into the 2-1/2 “sleeve” so the NVIS could be handled by one person.

I used the DX Engineering Universal Wire Antenna kit, DXE-UWA-KIT, since I wanted to use RG8 coax and not RG8X.

The kit is held onto the PVC conduit using two stainless hose clamps and I topped off the conduit with a white PVC 2 inch cap to keep rain from entering.

A ¾ inch hole was drilled near the top of the mast and near the bottom so the coax could be routed inside the conduit and exit just above the sleeve. One end of the coax was split and prepared with two ring terminals. Sealing heat shrink was applied to keep water out of the coax. Both conduit penetrations were sealed with silicon caulk.

The two 80 meter loading coils described previously were attached to the DX “T” per DX Engineering instructions. Two 38 foot radials were attached to the coil terminals. Additionally, two 44 foot radials were attached to the same connection for a 60 meter dipole. Since I use a separate dipole for 40 meter NVIS operation, no 40 meter coils were installed.

UV protected support ropes were attached to DX Engineering End Insulators for both the 80 and 60 meter radials. The beauty of these insulators is that it is easy to shorten the radial length in a matter of minutes. The 60 meter radials had to be shortened by about 8 inches for better SWR at 5.3 MHz (See photo).

The 80 and 60 meter radials do not run at 90 degree angles to one another because of space limitations. Instead they are only a few feet apart at their ground anchors.

Underground PVC conduit carries the RG8 feedline to a central connection point, where a remote conduit switch can select a GAP Titan vertical antenna or the dual band NVIS.

Comparisons can easily be made between the GAP vertical and NVIS by merely flipping a switch in the shack. East Coast NBEMS nets and PA NBEMS were barely able to be copied on the vertical and were S9 on the NVIS. Several experimental contacts through the SNJ area proved to be more than satisfactory using the NVIS.

As was previously mentioned, the 60 meter radials were shortened to better SWR at 5.3 MHZ and many 60 meter QSO's have been copied using the NVIS.

Bob Murdock, WX2NJ

Ocean County ARES EC

A need came up for 40 meter coverage using the previously addressed NVIS for 80 and 60 meters.

After several cut and try experiences, the following solution was found:

The 44 foot 60 meter radials were reduced by 12 feet for a length of 32 feet each. A DX Engineering insulator was inserted at each end of the 32 foot radials. See picture below.

The grey AWG 16 wire is the 32 foot radial and a ¼ inch stab connector is crimped on the end. A stainless steel 5 mm stud is installed to terminate a jumper (with mating ¼ inch stab) and the 12 foot radial for 60 meters (black AWG 14). The other end of the black 12 foot radial is terminated in another insulator and is guyed to a ground stake.

This configuration is on each end of the NVIS, one for coax shield and one for coax center conductor (half-wave dipole).

For 40 meter operation, leave the jumper open on both sides. For 60 meter operation, connect the jumper on both sides. The 40 meter is cut for 7.200 MHz and the 60 meter is cut for 5.300 MHz.

This now makes the entire NVIS antenna good for 80-60-40 meters.

73, WX2NJ, Bob

Ocean County ARES NVIS Project

September 2020 Update

During weekly NVIS testing by the Ocean County ARES NVIS Team, it was discovered that portable NVIS antennas were causing issues with some laptop computers, specifically the touch pad. When transmitting the touchpad would take on a mind of it's own when a finger was placed near it. The team suspected RF interference.

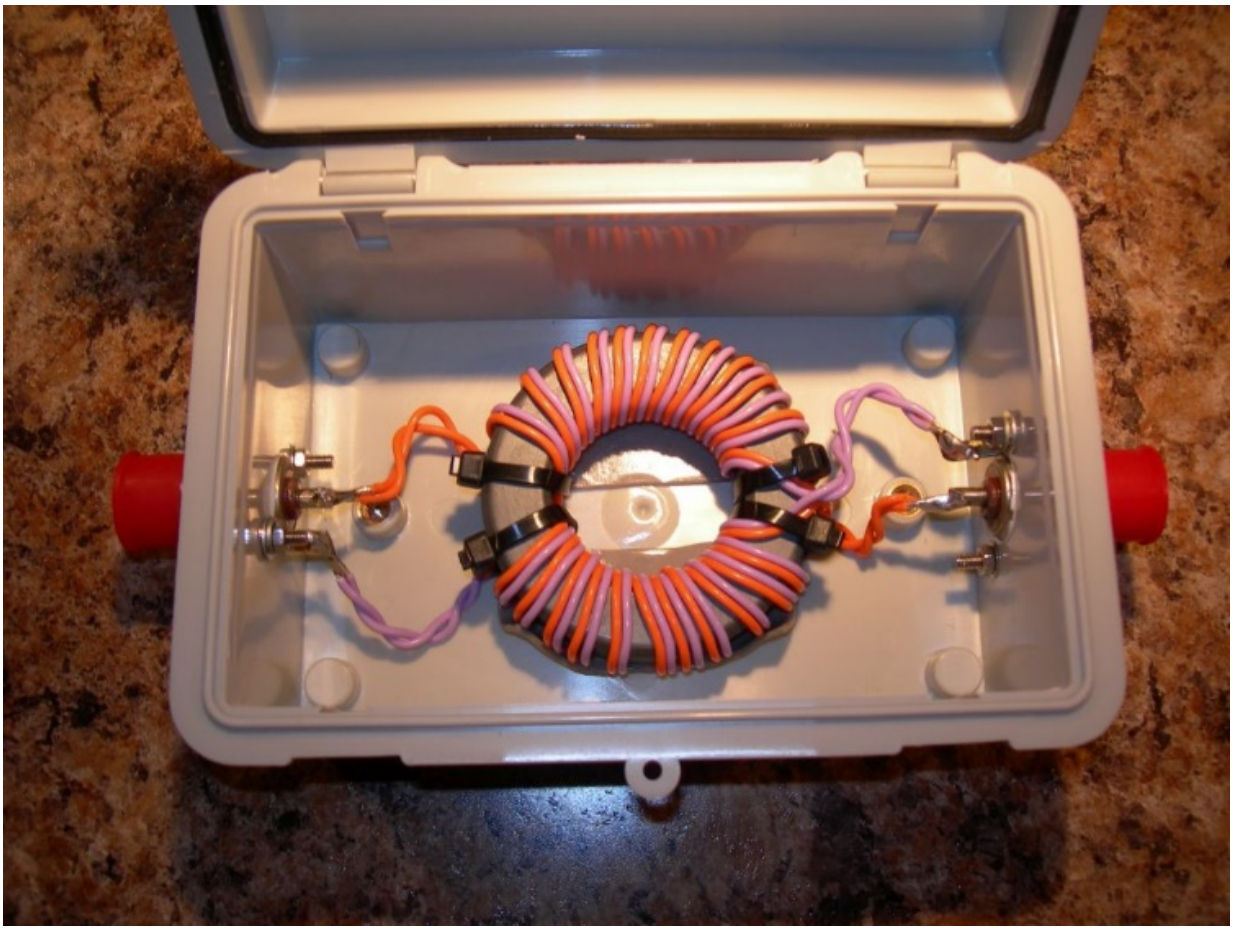
WX2NJ used an old RF Sniffer he had constructed for detecting common mode current in J-Pole antennas and clamped the sniffer onto the coax line coming from the NVIS antenna. The team found considerable current coming back to the radio from the NVIS antenna.

A 1:1 HF Common Mode Balun was placed on the feedline from the NVIS antenna and the RF current was found to be greatly reduced and the laptop touch pad was no longer causing problems. Several other NVIS antennas were check and similar currents were found. It can be concluded by the team, that portable NVIS antennas and most likely those also installed for base operation, should all have an isolation balun installed.

WX2NJ RF Current Sniffer

Ocean County ARES NVIS Project

The current sniffer shown above uses a type 43 split clamp type ferrite with a single wire passing through it. The wire is attached to the input (AC side) of a bridge rectifier using 1N34 diodes. The output of the bridge (DC side) is attached to a 100 microamp meter shunted with a 0.01 ufd capacitor. Between the meter and the bridge is a 10 K ohm pot for gain control. Ideally, with the gain control full CW you should have little or no current when clamped onto an HF coax feedline.



Typical HF 1:1 Common Mode Balun By WX2NJ

The balun design was obtained from a You Tube video series:

https://www.youtube.com/watch?v=kMlKfHHR8FY&t=6s&ab_channel=TRXBench

https://www.youtube.com/watch?v=JhAPJISUjB8&ab_channel=TRXBench

The core is an FT240-43 ferrite and the wire is AWG18 PTFE stranded silver tinned wire.

73, WX2NJ