



# Near Vertical Incidence Skywave (NVIS) Antenna

**DXE-NVIS-8040**  
**DXE-NVIS-8040S**

DXE-NVIS-INS Revision 0



© DX Engineering 2018  
1200 Southeast Ave. - Tallmadge, OH 44278 USA  
Phone: (800) 777-0703 · Tech Support and International: (330) 572-3200  
Fax: (330) 572-3279 · E-mail: [DXEngineering@DXEngineering.com](mailto:DXEngineering@DXEngineering.com)

## Introduction

DX Engineering's Near Vertical Incidence Skywave (NVIS) Antennas for both 80 and 40 meters are available in two models. The difference between the two models is the footprint size area needed. The larger version the **DXE-NVIS-8040** is a full size 80 and 40 meter NVIS antenna that uses no coils. The footprint for this model is approximately 158 feet by 75 feet. The second version - **DXE-NVIS-8040S** uses two coils on the 80 meter legs which shrinks the footprint to approximately 75 feet x 75 feet.

Both versions operate virtually identical to each other and provide the operator with a complete kit to get on the air in an emergency or other temporary communications event. The NVIS antenna can also be permanently installed for every day use.

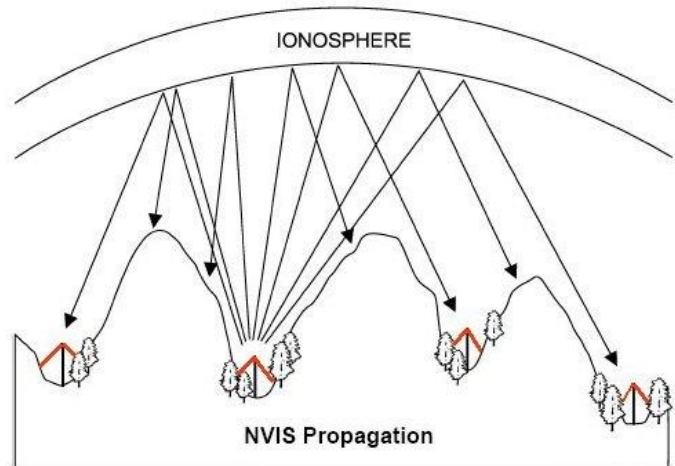
## NVIS

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.

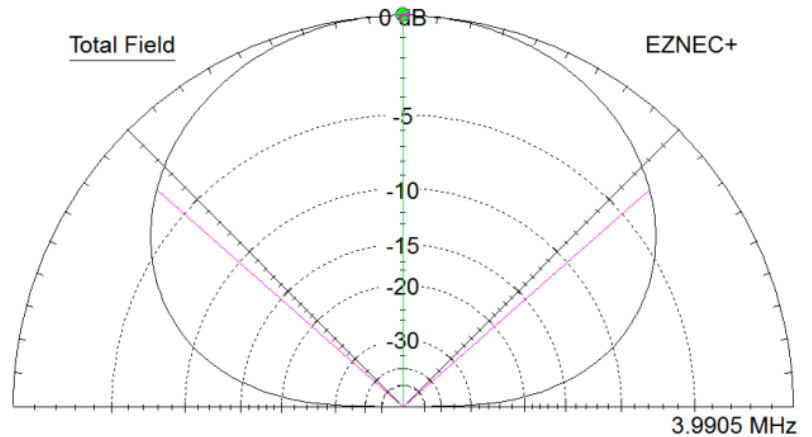
A good NVIS antenna will not work well at DX distances. Antenna gain is a zero sum game. There is a fixed amount of energy radiating. If we push it all out in one direction (the near-vertical angles), we have to take it away from another direction (the low DX angles).

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



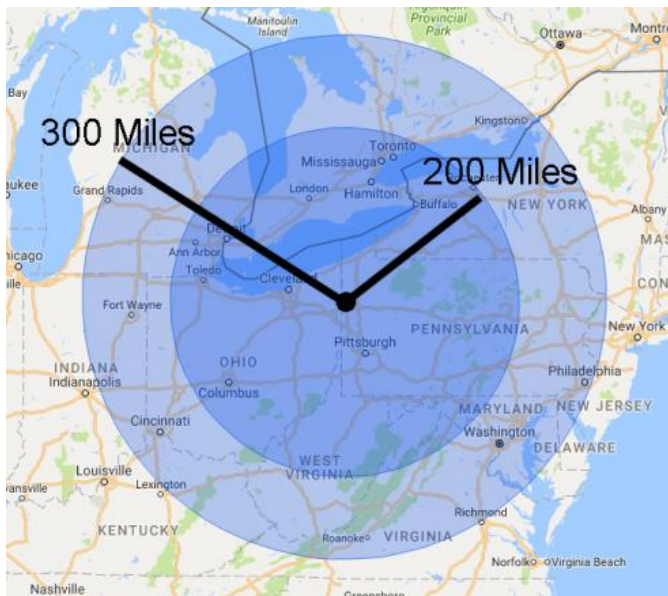
where your signal does reach someone closer. A ground wave signal can go up to approximately 50 miles if conditions, including terrain and obstacles, are favorable.

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.

Typical expected ranges are up to 300 miles when using NVIS antennas which make them ideal for close in communications (not for DXing).

The DX Engineering versions of the NVIS antenna have been designed and tested in real-world situations and found to offer great performance for NVIS communications on both 80 and 40 meters.

## 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.

#### Fiberglass Information

The mast sections in this kit are fiberglass. Take normal precautions when handling any fiberglass material. **There may be fiberglass dust, slivers or particles present when the fiberglass parts were manufactured.** The use of typical fiberglass handling safety gear, (gloves, dust mask, eye shield, clothing, etc.) when handling and working with fiberglass, is recommended. Use a damp rag to wipe the parts. **Do not** use compressed air to clean fiberglass parts. Measures can be taken to reduce exposure after a person has come in contact with fiberglass. Eyes should be flushed with water and any area of exposed skin should be washed with soap and warm water to remove fibers. Clothing worn while working with fiberglass should be removed and washed separately from other clothing. The washing machine should be rinsed thoroughly after the exposed clothing has been washed. Check with your local or state safety and/or environmental agencies for more detailed precautions.

#### NVIS Features and Specifications:

- Easy Assembly ideal for emergency set-up
- Covers both 40 and 80 meter bands - ideal for NVIS communication
- Transports easily
- Made with quality rugged parts for long service life
- Tunable with modern transceivers that have internal tuners
- Can be installed as a temporary or permanent system

## Parts Lists



## DX Engineering NVIS Antenna Kits for 80 and 40 Meters

Parts Common to Both 8040 and 8040S Models		
Qty	Part Number	Description
1	DXE-NVIS-MAST	Tubes and Hardware for the NVIS Mast
		(1) 2" OD x 4 feet long, fiberglass tube
		(1) 1-3/4" OD x 4 feet long, fiberglass tube
		(1) 1-1/2" OD x 4 feet long, fiberglass tube
		(1) 1-1/4" OD x 4 feet long, fiberglass tube
		(1) Compression Clamp 2" to 1-3/4"
		(1) Compression Clamp 1-3/4" to 1-1/2"
		(1) Compression Clamp 1-1/2" to 1-1/4"
		(1) Band Clamp for, 2.250" OD (use 5/16" Nut Driver)
		(2) Band Clamp for, 2.000" OD (use 5/16" Nut Driver)
		(2) Band Clamp for 1.750" OD (use 5/16" Nut Driver)
		(1) Band Clamp for 1.500" OD (use 5/16" Nut Driver)
		(1) Black Vinyl Cap for 1-1/4" Fiberglass Tube
		(4) Tent Peg Ground Stakes, Aluminum
1	COM-BAL-11150T	COMTEK 1:1 Single Core Balun
1	DXE-NVIS-BMB	Balun Mounting Bracket with Stainless Steel Hardware
		(2) Hex Head Nut, Nyloc, Stainless Steel
		(2) Flat Fender Washer, Stainless Steel
		(2) DXE-ECLS-150 Studded Band Clamp, Stainless Steel, w/ hardware
1	DXE-CSR8X-1	Cable Strain Relief Kit for 8X Coaxial Cable
1	DXE-8XDX100	RG-8X Coaxial Cable, 100 Ft, with PL-259 connectors
1	SYN-DBR-125-100	Antenna Support Rope, 0.125" dia, 100 FT
2	DXE-TGI-2	Glass Antenna Insulators (2 packages, total of 4 insulators)

DXE-NVIS-8040		
Qty	Part Number	Description
3	DXE-ANTW-75	Premium Antenna Wire, 14 ga, Relaxed PVC, 75 feet per roll
Plus the common parts listed above		

DXE-NVIS-8040S		
Qty	Part Number	Description
2	DXE-ANTW-75	Premium Antenna Wire, 14 ga, Relaxed PVC, 75 feet per roll
1	DXE-NVIS-80RES	(2) Resonator Coils for the 80 meter NVIS-8040S antenna
		(2) MSG-ADC03 Wire Strain Relief Clamp, 3 mm
Plus the common parts listed above		

## Manual Updates

Every effort is made to supply the latest manual revision with each product. Occasionally a manual will be updated between the time your DX Engineering product is shipped and when you receive it. Please check the DX Engineering web site ([www.DXEngineering.com](http://www.DXEngineering.com)) for the latest revision manual.

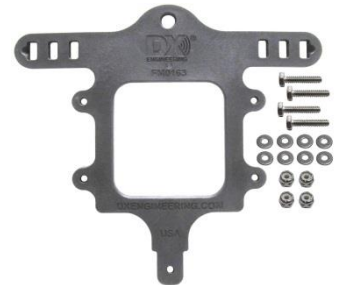
## Tools Required

Wire Stripper  
Soldering Iron and Solder  
Utility Knife and Lighter (for rope)  
Nut Drivers: 1/4", 3/8", 5/16"  
Wrench: 7 mm (for the 80 meter coil strain relief clamps)  
Pliers  
Gloves (see information on Fiberglass Tubing on page 4)  
Hammer (for Tent Peg Ground Stakes)

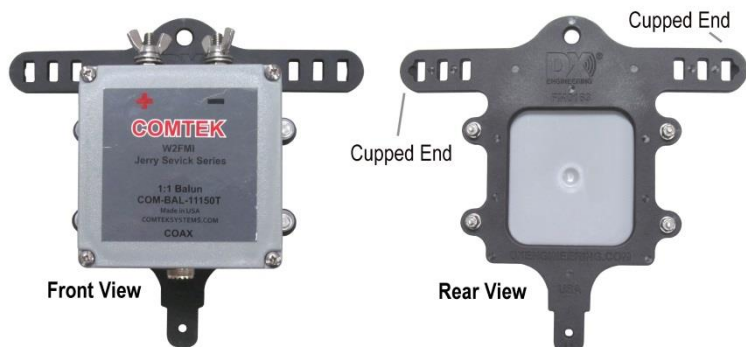
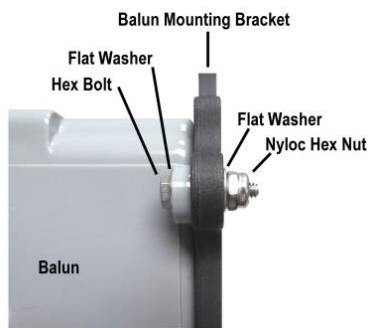
## Assembly

### Mounting the BALUN to the BMB BALUN Mounting Bracket

1. The **BMB BALUN Mounting** bracket comes with the hardware required to mount the BALUN. As shown, mount the BALUN in place on the Mounting Bracket using the four #6 hex head bolts, eight #6 washers and four #6 Nyloc hex nuts.



**Note: The cupped ends are facing the rear.**

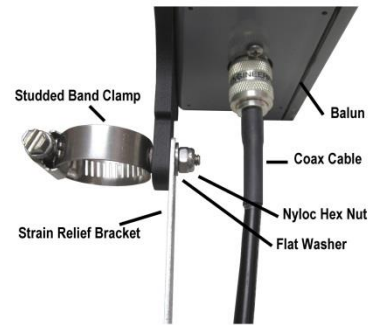


## Installing the Coaxial Cable and Coaxial Cable Strain Relief

1. The **DXE-CSR8X-1** Cable Strain Relief has the parts needed to mount to the previous assembly. The assembly will be slightly different that what is described in the **DXE-CSR8X-1** instructions.



2. Connect one end of the **DXE-8XDX100** coaxial cable to the BALUN. Fully insert the PL-259 to the balun and tighten the collar.



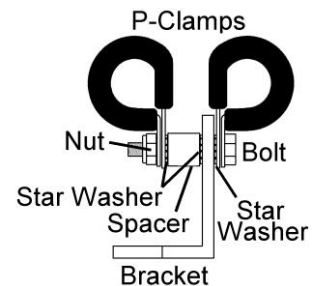
3. Loosely mount the **DXE-CSR8X-1** Cable Strain Relief bracket to the **DXE-BMB-4P** bracket using the **DXE-ECLS-150** Studded Band Clamp, with a flat washer and a Nyloc hex nut as shown.

4. Loop the coax cable through the 'P' clamps and form approximately a 6" diameter loop of cable.



5. Mount the 'P' clamps on both sides of the bracket using the hardware (1" hex bolt, 1/4" spacer, three star washers, and Nyloc hex nut) as shown. Using pliers will help hold the clamps and parts together while you get the Nyloc hex nut started.

6. Once the cable is aligned between the Balun and the first 'P' clamp, tighten the Nyloc hex nut that holds the Studded Band Clamp at the balun end of the bracket. Ensure the cable going through the 'P' clamps is properly aligned and has the loop. Tighten all the parts holding the 'P' clamps in place.



7. The completed **DXE-CSR8X-1** Cable Strain Relief installation should look as shown below.

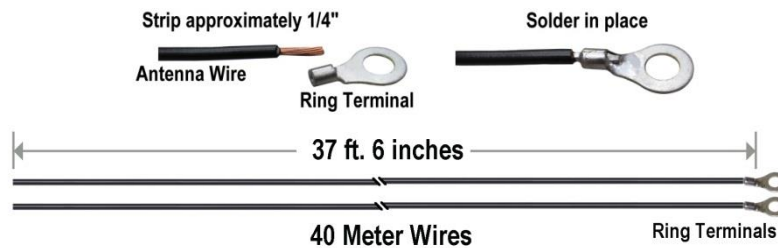


- Mount the second Studded Band Clamp to the top of the Balun Mounting Bracket using two large Flat Fender Washers and one Nyloc hex nut as shown.



## Preparing the 40 meter Wire Elements

- Both models of the NVIS antenna (**DXE-NVIS-8040** and **DXE-NVIS-8040S**) use the same lengths of antenna wire for 40 meters.
- Using one roll of the **DXE-ANTW-75** Antenna Wire, cut the wire length in half so you have two pieces of wire approximately 37 feet 6 inches long. **Note** - The test antenna **after** tuning had the 40 meter length as 32 feet 5 inches each. Until you perform tuning, **do not** shorten the 37-1/2 foot wires.
- On each wire, solder **one** Ring Terminal as shown.

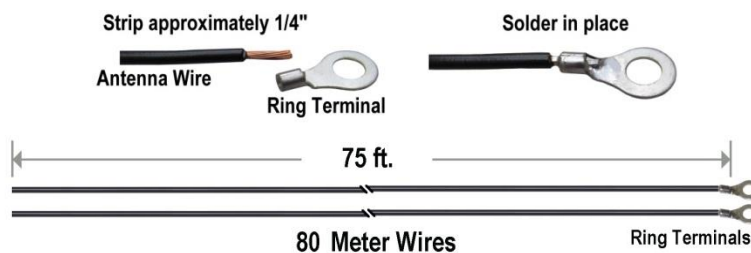


## Preparing the 80 meter Wire Elements

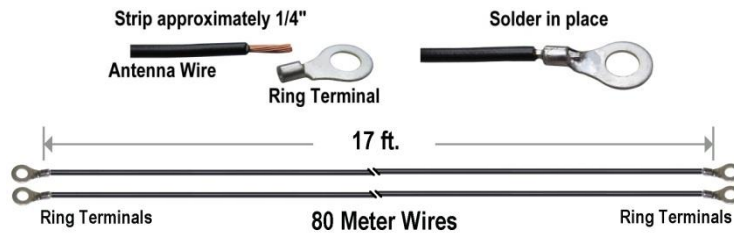
Each model of the NVIS uses different lengths of Antenna Wire for 80 meters.

For the **DXE-NVIS-8040** there are no coils used. The wire lengths are **two** 75 foot wires for 80 meters. **Note** - The test antenna **after** tuning had the 80 meter length as 61 feet each. Until you perform tuning, **do not** shorten the 75 foot wires.

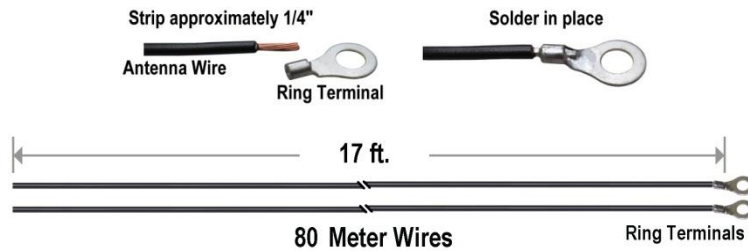
- Using **two** rolls of the **DXE-ANTW-75** antenna wire solder **one** ring terminal as shown on one end of each 75 foot roll of antenna wire.



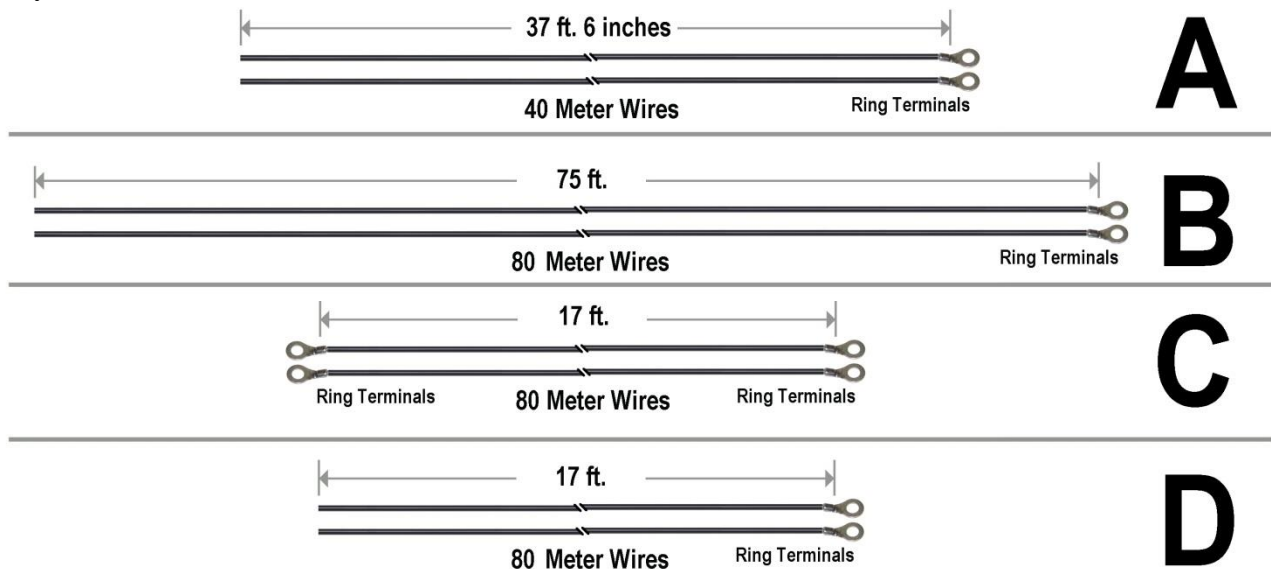
- The **DXE-NVIS-8040S** uses two coils. There are **four** wires for 80 meters. After assembly, each leg of the dipole will be approximately 32 feet. 16 feet in length between the BALUN and the 80 Meter Coil and another wire, approximately 16 feet from the coil to the end insulator.
- Cut one of the 75 foot antenna wire rolls so you have 4 pieces of antenna wire 17 feet long each.
- On two of the wires, solder **one** ring terminal to **each end** of the wires as shown.



- For the other two 17 foot wires, solder **one** ring terminal to **one end** of the wires as shown.



From this point on the wires will be designated as **A, B, C, D** to help make the assembly clear and easy to understand.



## Attaching the antenna element Wires to the Balun

Both models (**DXE-NVIS-8040** and **DXE-NVIS-8040S**) use the same method for attaching the antenna wires to the balun.

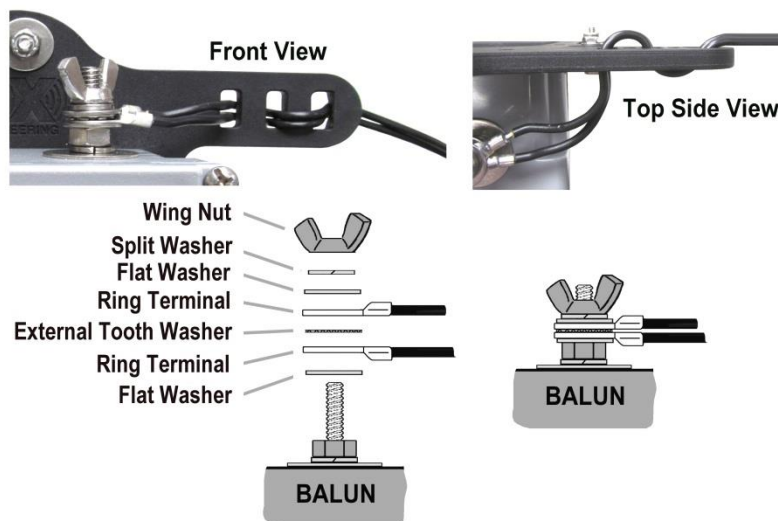
Wires **A** and **B** are connected to the BALUN for the **DXE-NVIS-8040**

Wires **A** and **C** are connected to the BALUN for the **DXE-NVIS-8040S**

## Attaching the 40 and 80 meter Wires for the DXE-NVIS-8040

1. Install one 40 meter wire (**A**) and one 80 meter wire (**B**) on each side of the Balun Bracket for the **DXE-NVIS-8040** as shown.

Note how the wires route through the three serpentine slots. Allow a bit of extra wire so there is no strain on the wires when connecting them to the balun.



## Attaching the 40 meter Wires and the 80 meter Coils for the DXE-NVIS-8040S

1. Install one 40 meter wire (**A**) and one 80 meter wire with two terminals (**C**) in each side of the Balun Bracket for the **DXE-NVIS-8040S** as shown. Note in the previous picture, how the wires route through the three serpentine slots.
2. The 80 meter coils are installed by routing and clamping the antenna wires to provide strain relief for the coil assemblies. Using Wire **C** that is attached to the Balun, route the end through the two holes on one of the 80 meter coils as shown. Allow enough slack to avoid sharp bends and provide strain relief for the coil.

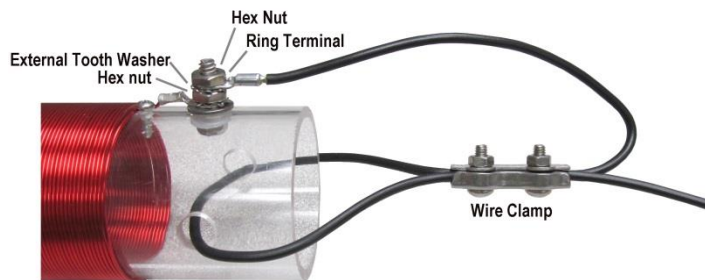
3. Using one of the wire clamps, press the wire **C** in place in the clamp.



4. Adjust wire lengths if needed to avoid sharp bends and still allow strain relief as shown. Once the wire is in place, install the clamp hardware as shown to hold the wire in place.



5. From the clamp, connect the ring terminal on wire **C** to the coil bolt as shown.



6. Repeat the same sequence (steps 2 through 5) for wire **D** on the other end of the coil (the 17 foot wire with one ring terminal).



7. Again, repeat the above sequence (steps 2 through 6) for the other 80 wires (**C** and **D**) connected to the other side of the balun.



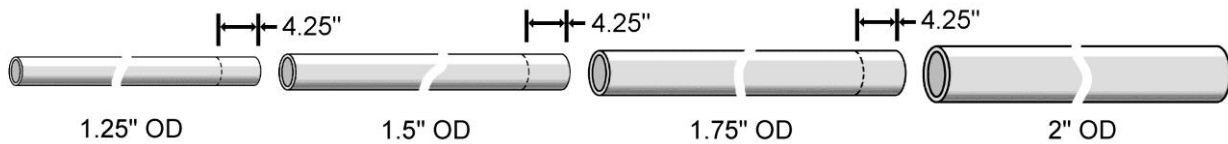
## Mast Assembly

The NVIS Mast Assembly is the same for both the **DXE-NVIS-8040** and **DXE-NVIS-8040S** NVIS antennas.

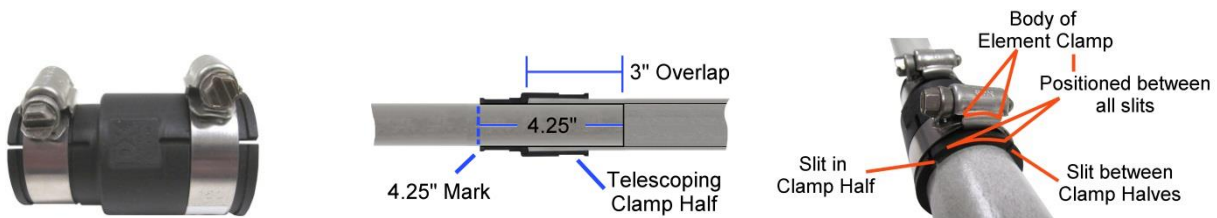
The mast is made with four fiberglass tubes, three telescoping mast clamps, six element clamps and one vinyl cap.



1. On three of the fiberglass tubes (1.25" OD, 1.5" OD and 1.75" OD) make a mark on the tubes 4.25" from one end as shown.



2. Install the telescoping clamps on the element tubes using the supplied element clamps with the overlap as shown. Install the vinyl cap on the top tube.



## Mounting the BALUN to the top of the Mast

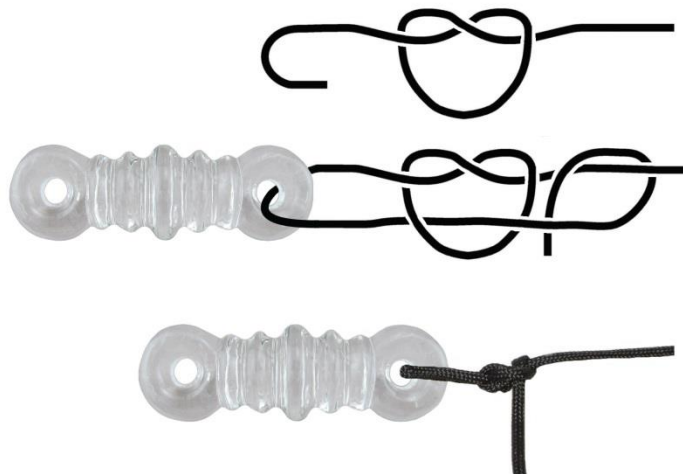
Loosen the band clamps on the Balun Mounting Bracket and install the bracket to the top mast section as shown. The top element clamp will be even with the bottom of the previously installed vinyl cap. Tighten the two clamps in place.



## Attaching the End Insulators to the Guy Ropes

Using the supplied 100 foot roll of rope, cut four pieces of rope 25 feet each. Attach each guy rope to one of the glass insulators.

One suggestion for attaching the guy rope is using a non-slip knot shown below. The ends of the guy rope should be cauterized with a small flame to prevent the rope braid from fraying.



## **Attaching the End Insulators with ropes to the NVIS Antenna Elements**

Attach one end insulator with rope to each of the four antenna elements. Since you will change lengths on the wires during tuning, do not cut any wires at this time. Insert each wire through the end insulator and then wrap the wire back on itself as shown below.

The starting lengths of wire are shown on pages 16 and 17.



## **Attaching the Guy Ropes to the Tent Pegs**

Tie the guy ropes from each insulator to the Tent Pegs allowing approximately 8 feet of rope. Reference the overhead and side views to see the tent pegs in place. Do not shorten the rope until you are satisfied that the tuning is complete.

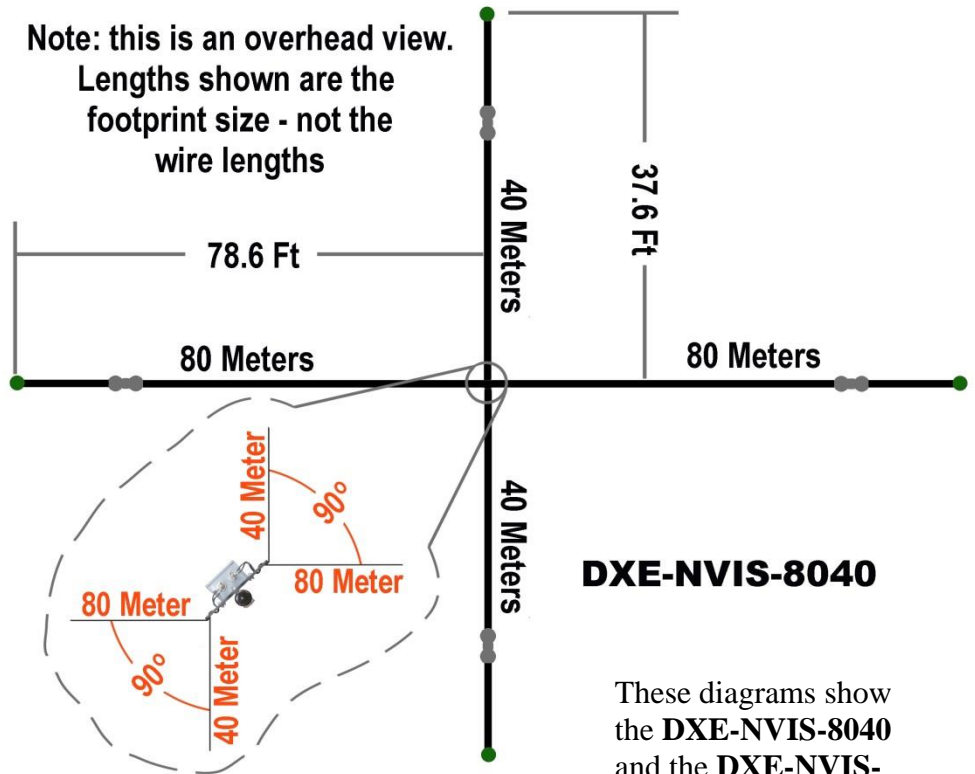


## Setting up the NVIS Antenna

It is advisable to use two people when setting up the NVIS antenna to ensure the mast is held vertically in place while the ropes and tent stakes are installed as shown in the diagrams.

Note how the antenna wire elements are in reference to the Balun Mounting Bracket.

Note: this is an overhead view.  
Lengths shown are the footprint size - not the wire lengths

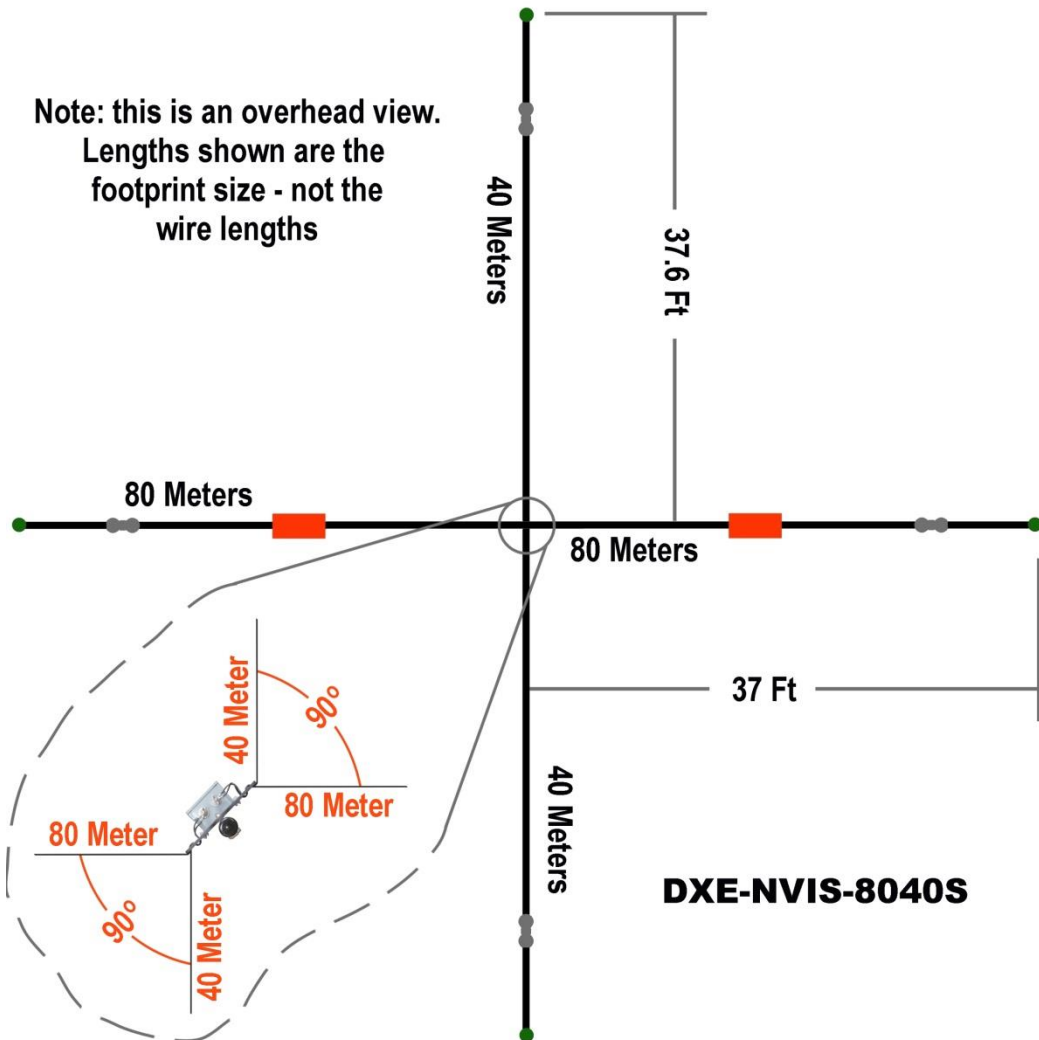


### DXE-NVIS-8040

These diagrams show the **DXE-NVIS-8040** and the **DXE-NVIS-8040S** footprint view from overhead. Note the dimensions shown are the **footprint size, not the wire/rope lengths.**

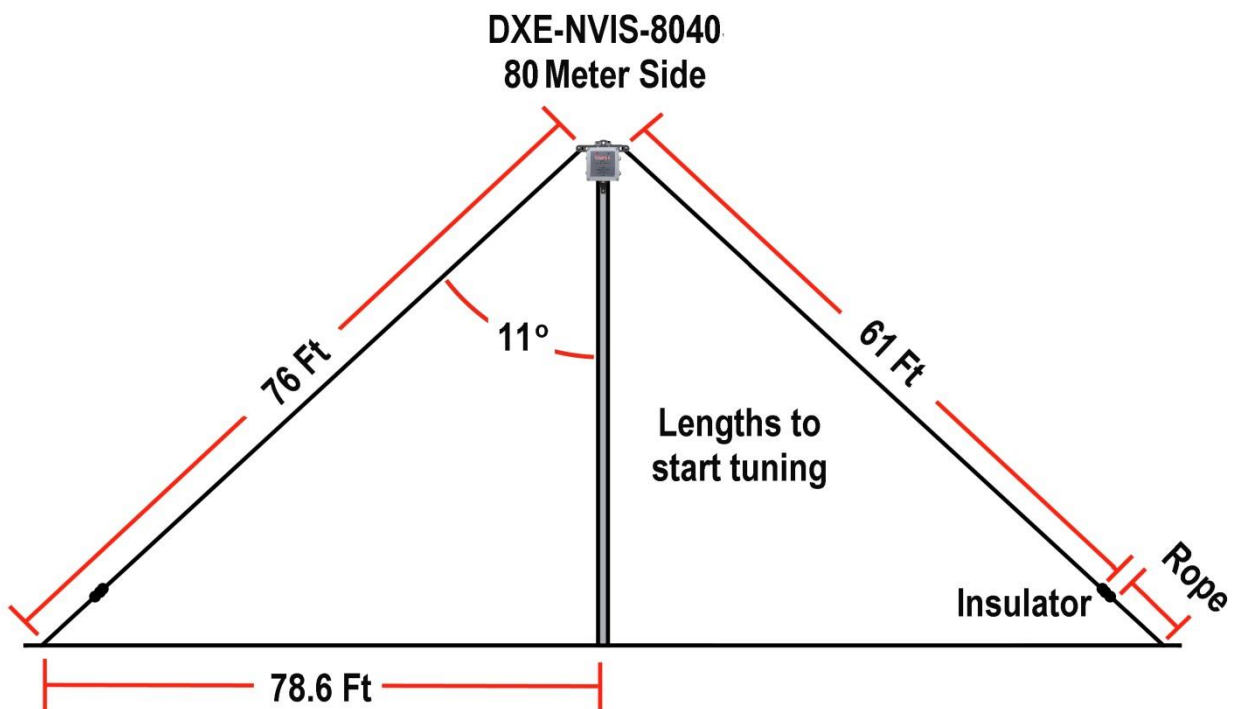
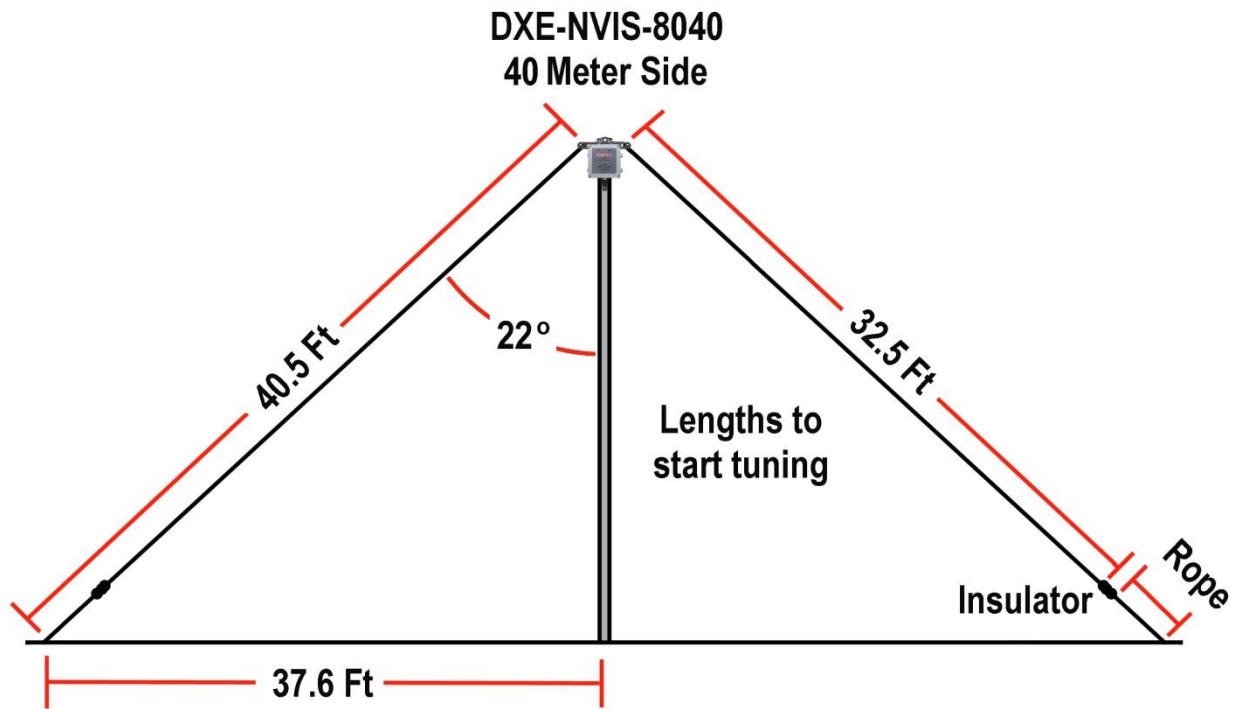
As an option to secure the mast in place on the ground, a 1-1/2" OD pipe may be used. Install the pipe in the ground so it is sturdy. Allow approximately 1 to 2 feet above ground to slip the bottom of the NVIS antenna mast over it. It is recommended that the PL-259 connector be weather proofed using Temflex and Scotch 88 tape to avoid any moisture entering the coaxial cable and fitting.

Note: this is an overhead view.  
Lengths shown are the footprint size - not the wire lengths

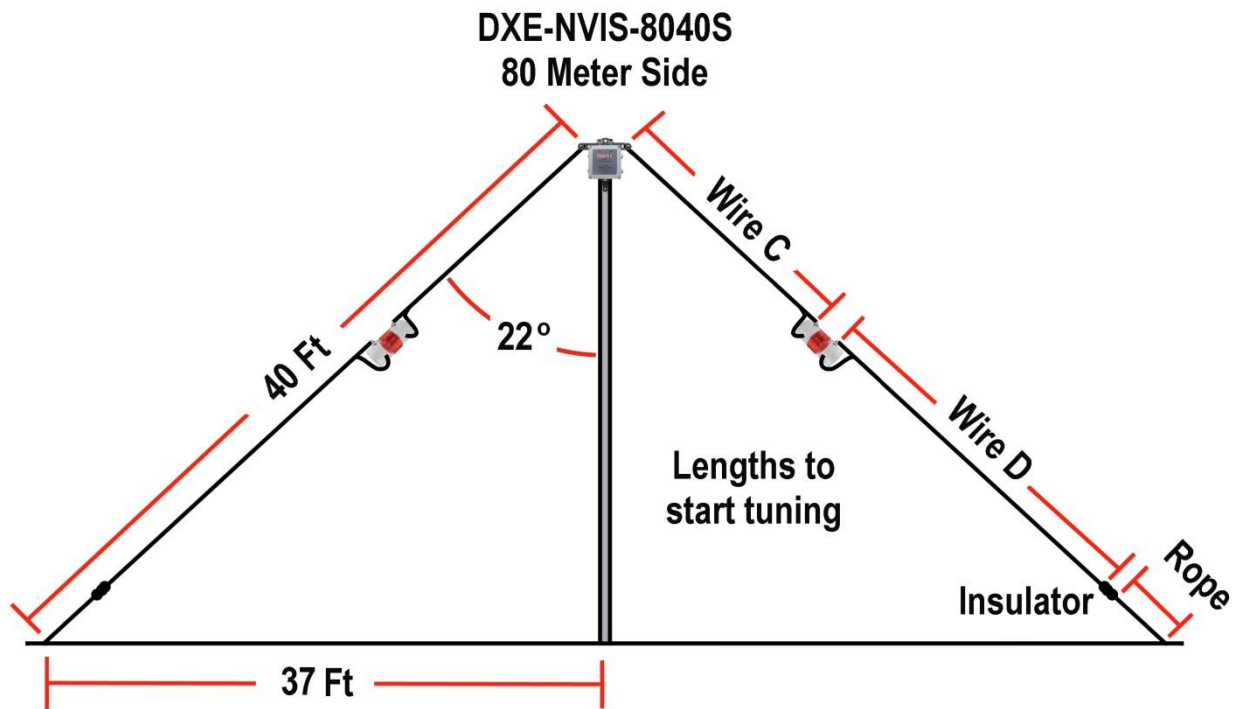
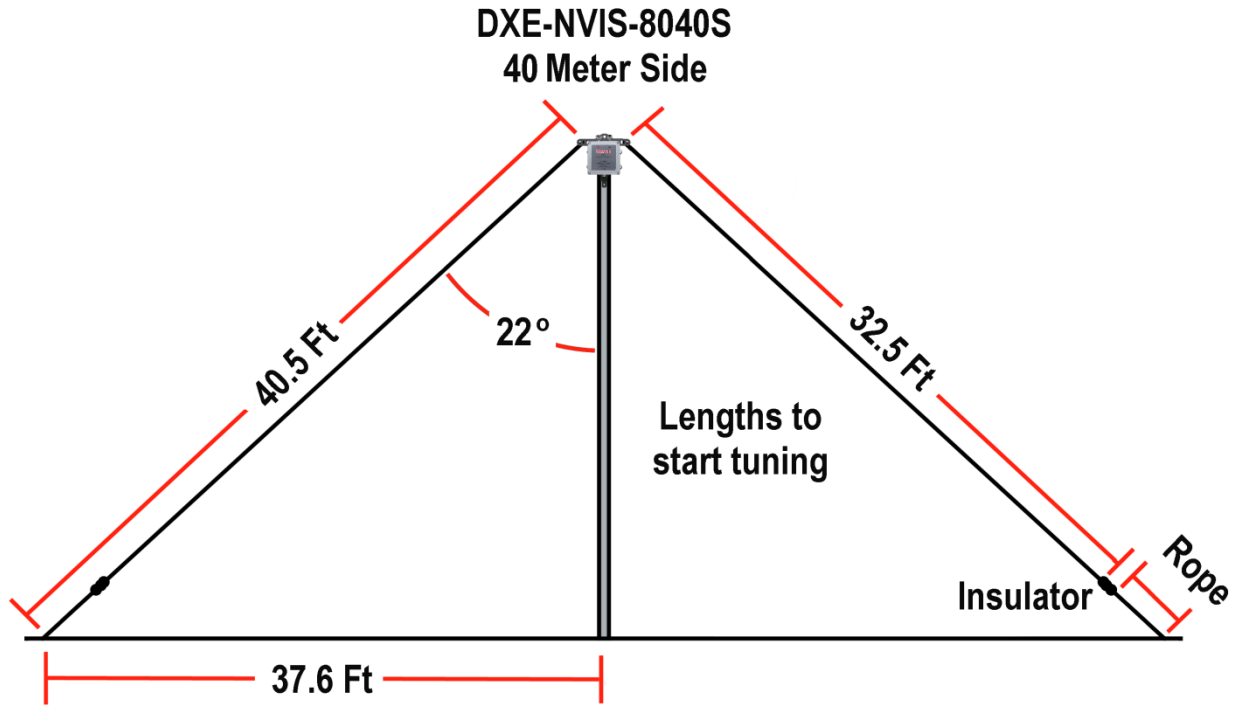


### DXE-NVIS-8040S

The following shows side views for the DXE-NVIS-8040 antenna.



The following shows side views for the DXE-NVIS-8040S antenna.



## Tuning

Using a *good* quality Antenna Analyzer, connect the coaxial cable coming from the NVIS antenna.

**40 Meters:** Sweep the antenna for 40 meters to see where the SWR dip is located.

Ideally, you will want the 40 meter dip to be near the lower end or mid range on the 40 meter band. If you are specifically going to use one frequency, then adjust for that frequency for best results. If the dip is low, shorten the 40 meter antenna wires equally to raise the frequency dip. If the dip is high, lengthen the 40 meter antenna wires equally to lower the frequency dip.

With the length described, the test antenna (NVIS-8040S) resonated at 7.261 kHz. The length of each leg was then lengthened by 3 inches on each side and the measurement was then 7.147 kHz. This works out to approximately **38 kHz per inch of change**.

When changing wire lengths, wrap the excess wire back on itself rather than cutting the wire. This will allow for future adjustments that may be needed.



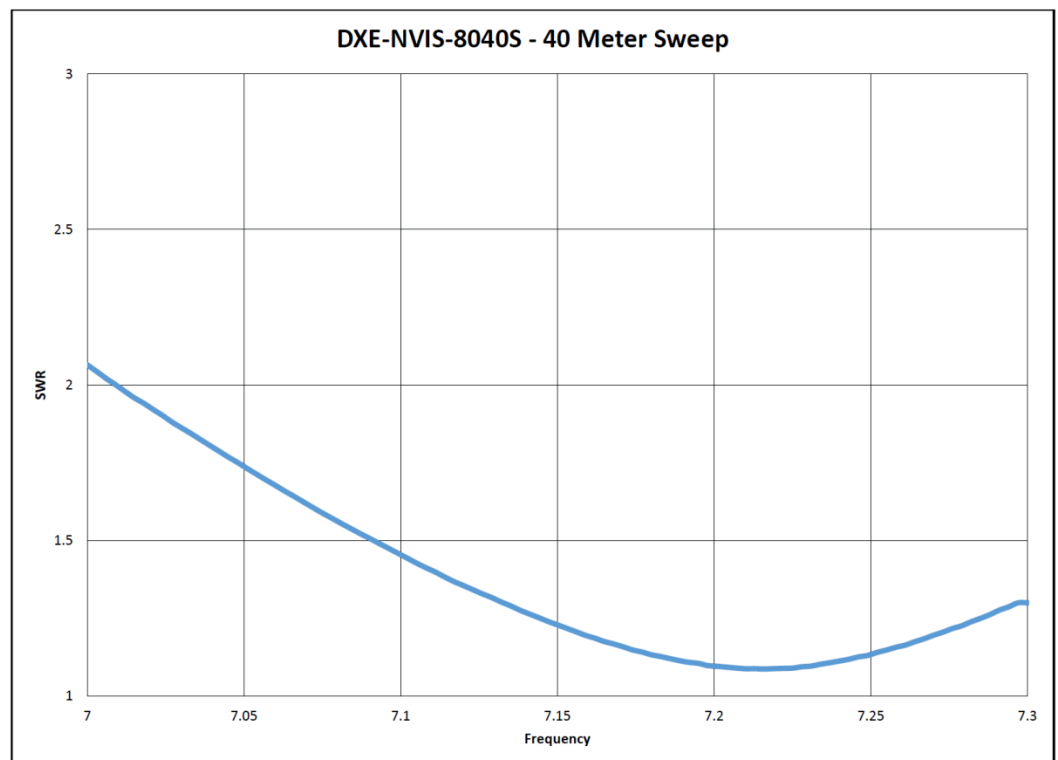
**Repeat the sequence above for 80 meters.**

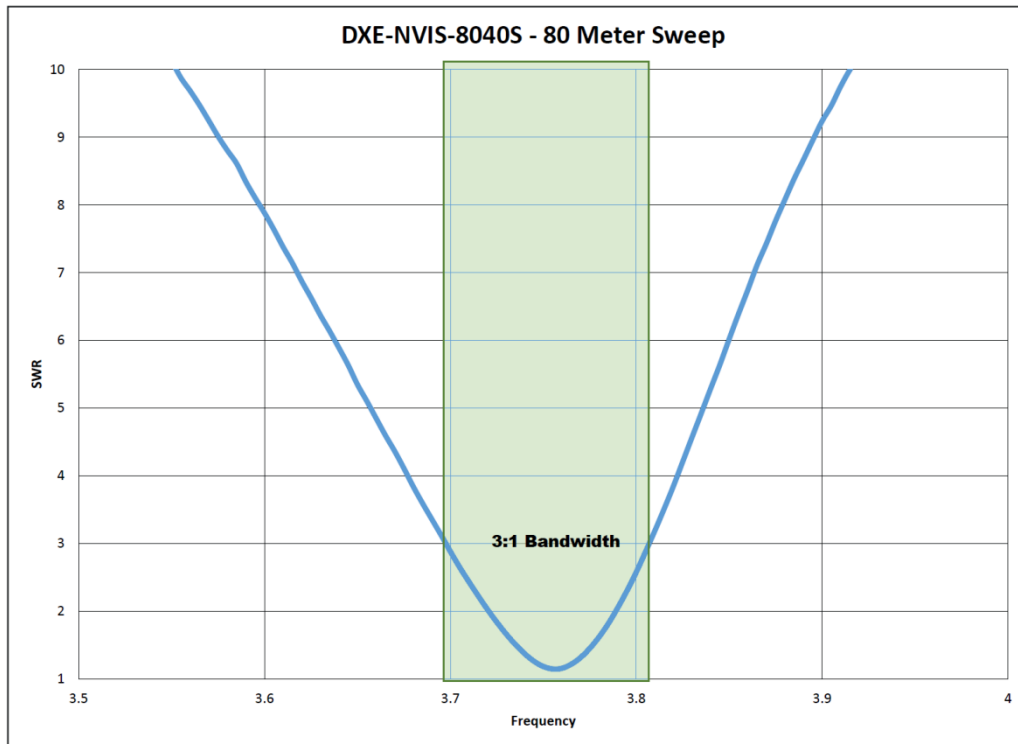
**80 Meters:** For 80 meters the bandwidth is a bit narrow and physical tuning of the 80 meter wires may be needed to get in your desired area of the 80 meter band.

With the length described, the test antenna (NVIS-8040S) resonated at 3.410 kHz. The length of each leg was then shortened by 8 inches, then 3 feet, then 2 feet on each side and the measurement was then 8.96 kHz. To make it better, it was then lengthened by 4.8 inches, which brought the resonant point to 3.972 kHz. All of this worked out to be **8.95 kHz per inch of change**.

Once the antenna is tuned, you can connect the coaxial cable to your transceiver for operation. Modern transceivers that have an internal tuner should be able to perform 'touch-up' tuning easily on this antenna.

Typical 40 meter and 80 meter SWR sweeps using a Rig Expert antenna analyzer:





## Transporting the NVIS Antenna

The DX Engineering NVIS antennas can be collapsed, wires wrapped and made ready for transport without disassembling the entire antenna. This makes these antennas a viable option for on-the-go emergency or portable operation.

Loosen the upper band clamp on one of the telescoping clamps to allow the section to telescope inside the larger tube, snug the clamp in place, then do the same for the other clamps. The antenna system will collapse to less than 6 feet in length.

Secure the wires, ropes and coaxial cable to configure the antenna to be easily transported.

DX Engineering offers Velcro style “Rip-Ties” that are perfect for securing wrapped antenna wires, coaxial cable and ropes. See the DX Engineering web site for details.



The **DXE-NVIS-8040** ‘Ready to Go’.

## Technical Support

If you have questions about this product, or if you experience difficulties during the installation, contact DX Engineering at (330) 572-3200. You can also e-mail us at:

[DXEngineering@DXEngineering.com](mailto:DXEngineering@DXEngineering.com)

For best service, please take a few minutes to review this manual before you call.

## 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.

©DX Engineering 2018

DX Engineering<sup>®</sup>, DXE<sup>®</sup>, DX Engineering, Inc.<sup>®</sup>, Hot Rodz<sup>®</sup>, Maxi-Core<sup>®</sup>, DX Engineering THUNDERBOLT<sup>®</sup>, DX Engineering Yagi Mechanical<sup>®</sup>, EZ-BUILD<sup>®</sup>, TELREX<sup>®</sup>, Gorilla Grip<sup>®</sup> Stainless Steel Boom Clamps, Butternut<sup>®</sup>, SkyHawk<sup>™</sup>, SkyLark<sup>™</sup>, SecureMount<sup>™</sup>, OMNI-TILT<sup>™</sup>, RF-PRO-1B<sup>®</sup>, AFHD-4<sup>®</sup> are trademarks of PDS Electronics, Inc. No license to use or reproduce any of these trademarks or other trademarks is given or implied. All other brands and product names are the trademarks of their respective owners.

Specifications subject to change without notice.

