Tactical Delta Loop Antenna Operator's Manual

Nevada - USA

WWW.CHAMELEONANTENNA.COM

VERSATILE – DEPENDABLE – STEALTH – BUILT TO LAST

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WARNING! Never mount this, or any other antenna near power lines or utility wires! Any materials: ladders, ropes, or feedlines that contact power lines can conduct voltages that kill. Never trust insulation to protect you. Stay away from all power lines.

WARNING! Never operate this antenna where people could be subjected to high levels of RF exposure, especially above 10 watts or above 14 MHz. Never use this antenna near RF sensitive medical devices, such as pacemakers.

Introduction

Thank you for purchasing and using the Chameleon Antenna™ Tactical Delta Loop (CHA TDL) antenna. The CHA TDL, see plate (1), is a portable High Frequency (HF) antenna specially designed for transportability, quick setup, and a small footprint. This antenna is ideal for camping or temporary installation in a townhome or other houses with a small yard or antenna restrictions. It can operate on all amateur radio bands from 3.5 to 54.0 MHz (80-6m), but is most effective on the bands from 10.1 to 54.0 MHZ (30-6m). The Tactical Delta Loop will also provide acceptable shorter range Near-Vertical Incidence Skywave (NVIS) propagation on the 3.5 to 7.0 MHz bands (80 - 40m) making it a useful backup EMCOMM antenna or for amateur radio operators (hams) involved in disaster preparedness.

The CHA TDL can easily be configured as a horizontally polarized inverted Delta Loop or as a ground mounted vertical antenna. Some of the advantages of a Delta Loop antenna over a vertical are increased efficiency, reduced noise, and some broadside directionality. An antenna tuner or coupler is required for operation on the amateur radio bands from 3.5 to 7.0 MHz (80-40m). Setup can typically be accomplished by one operator in 5 minutes.

The CHA TDL antenna is comprised of two 17-foot telescoping whip antennas, a matching transformer, a 25-foot loop wire, a ground spike mount, a Hub, and 50 feet of coaxial cable.

Antennas built by Chameleon Antenna™ are versatile, dependable, stealthy, and built to last. Please read this operator's manual so you may obtain the maximum utility from your Tactical Delta Loop antenna.

Plate 1. Tactical Delta Loop Antenna.

HF Propagation

HF radio provides relatively inexpensive and reliable local, regional, national, and international voice and data communication capability. It is especially suitable for undeveloped areas where normal telecommunications are not available, too costly or scarce, or where the commercial telecommunications infrastructure has been damaged by a natural disaster or military conflict.

Although HF radio is a reasonably reliable method of communication, HF radio waves propagate through a complex and constantly changing environment and are affected by weather, terrain, latitude, time of day, season, and the 11-year solar cycle. A detailed explanation of the theory of HF radio wave propagation is beyond the scope of this operator's manual, but an understanding of the basic principles will help the operator decide what frequency and which of the EMCOMM III Portable's configurations will support their communication requirements.

HF radio waves propagate from the transmitting antenna to the receiving antenna using two methods: ground waves and sky waves.

Ground waves are composed of direct waves and surface waves. Direct waves travel directly from the transmitting antenna to the receiving antenna when they are within the radio line-of-sight. Typically, this distance is 8 to 14 miles for field stations. Surface waves follow the curvature of the Earth beyond the radio horizon. They are usable, during the day and under optimal conditions, up to around 90 miles, see table (1).

Low power, horizontal antenna polarization, rugged or urban terrain, dense foliage, or dry soil conditions can reduce the range very significantly. The U.S. Army found that in the dense jungles of Vietnam, the range for ground waves was sometimes less than one mile.

Sky waves are the primary method of HF radio wave propagation. HF radio waves on a frequency below the critical frequency (found by an ionosonde) are reflected off one of the layers of the ionosphere and back to Earth between 300 and 2,500 miles, depending upon the frequency and ionospheric conditions.

Frequency	Distance	Frequency	Distance
2 MHz	88 miles	**14 MHz**	33 miles
4 MHz	62 miles	**18MHz**	29 miles
7 MHz	47 miles	**24 MHz**	25 miles
10 MHz	39 miles	**30 MHz**	23 miles

Table 1. Maximum Surface Wave Range by Frequency.

HF radio waves can then be reflected from the Earth to the ionosphere again during multi-hop propagation for longer range communication. The most important thing for the operator to understand about HF radio wave propagation is the concept of Maximum Usable Frequency (MUF), Lowest Usable Frequency (LUF), and Optimal Working Frequency (OWF). The MUF is the frequency for which successful communications between two points is predicted on 50% of the days of in a month. The LUF is the frequency below which successful communications are lost due to ionospheric loses. The OWF, which is somewhere between the LUF and around 80% of the MUF, is the range of frequencies which can be used for reliable communication. If the LUF is above the MUF, HF sky wave propagation is unlikely to occur.

The HF part of the Radio Frequency (RF) spectrum is usually filled with communications activity and an experienced operator can often determine where the MUF is, and with less certainty, the LUF by listening to where activity ends. The operator can then pick a frequency in the OWF and attempt to establish contact. Another method is using HF propagation prediction software, such as the *Voice of America Coverage Analysis Program (VOACAP)*, which is available at no cost to download or use online at www.voacap.com. The operator enters the location of the two stations and the program show a wheel with the predicted percentage of success based on frequency and time. ALE, which is the standard for interoperable HF communications, is an automated method of finding a frequency in the OWF and establishing and maintaining a communications link.

Even under optimal conditions, there is a gap between where ground waves end (around 40 to 90 miles) and the sky wave returns to Earth on the first hop (around 300 miles). NVIS propagation can be used to fill this gap. The frequency selected must be below the critical frequency, so NVIS is can normally only be

used on frequencies from around 2 to 10 MHz. Frequencies of 2 – 4 MHz are typical at night and 4 – 8 MHz during the day.

Parts of the Antenna

The CHA TDL antenna is comprised of the following components, see plate (2):

a. Matching Transformer. The Matching Transformer is a CHA HYBRID MICRO or HYBRID MINI and provides impedance matching for the Tactical Delta Loop antenna.

b. Line Winder. The Line Winder is used to store the Loop Wire (g) and enables rapid deployment and recovery of the Tactical Delta Loop antenna.

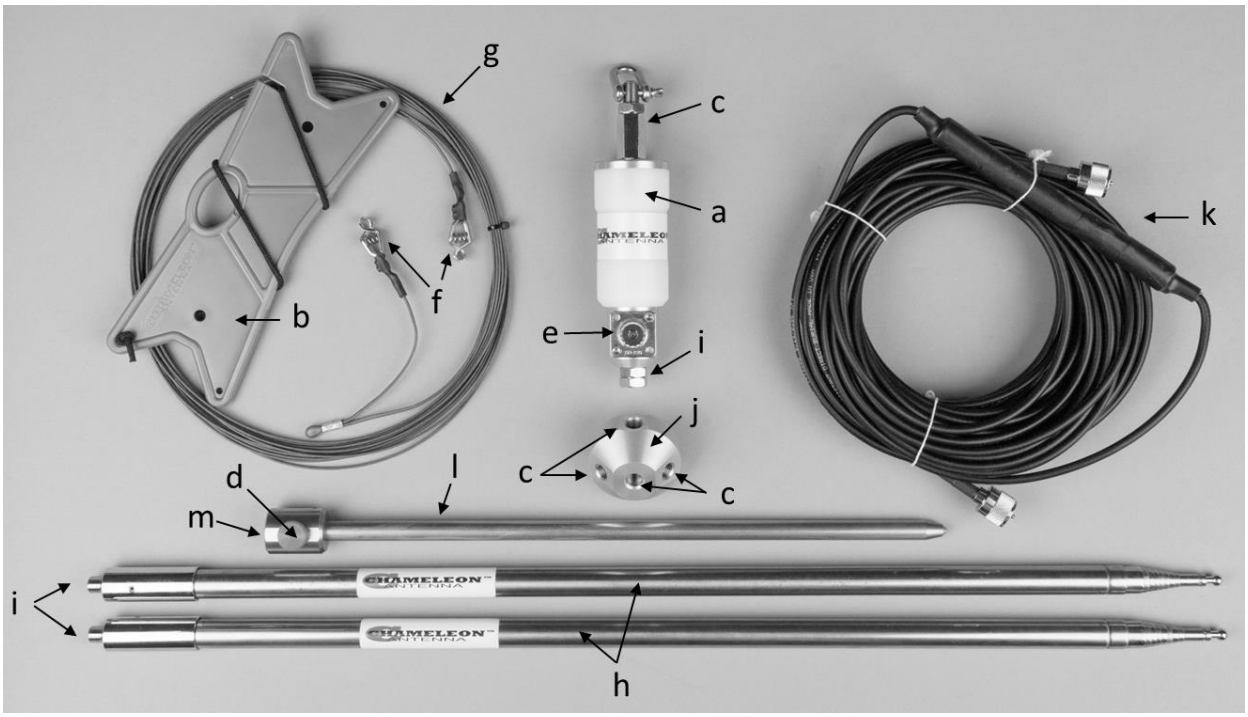


Plate 2. Tactical Delta Loop Components.

c. Antenna Socket. The Antenna Sockets are the 3/8" x 24 threaded sockets used to attach the Telescoping Whips (h) and Hub (j).

d. Counterpoise Connection. The Counterpoise Connection is the knurled knob, on the side of the Spike Mount (l), used to connect the Loop Wire as a counterpoise in the vertical antenna configuration**.**

e. UHF Socket. The UHF Socket, SO-239, is located on the side of the Matching Transformer (a).

f. Antenna Clip. The Antenna Clips connect the ends of the Loop Wire to the tips of the Telescoping Whips (h).

g. Loop Wire. The Loop Wire consists of a 25-foot 4-inch length of insulated wire, wrapped around the Line Winder (b). It is used as part of the antenna in the Inverted Delta Loop configuration and as the counterpoise in the Vertical configuration.

h. Telescoping Whip. The Telescoping Whip is a telescoping metal vertical radiator. It extends to 17 feet and collapses to 24 inches.

i. Base Stud. The Base Stud is a 3/8" x 24 threaded stud used to connect the Matching Transformer, Hub, and Telescoping Whips to the Antenna Sockets (c).

j. Hub. The Hub connects the vertical legs of the Delta Loop to the Spike Mount.

k. Coaxial Cable Assembly. The Coaxial Cable Assembly *(not pictured)* connects to the UHF Socket (e) at one end and the Radio Set at the other.

l. Spike Mount. The Spike Mount provides the base for the antenna.

m. Mount Socket. The Mount Socket is a 3/8" x 24 threaded socket used to mount the Hub or Matching Transformer to the Spike Mount.

Antenna Configurations

Using the supplied components, the Chameleon Antenna™ Tactical Delta Loop antenna can be deployed into two useful configurations. Two more configurations can be made using an optional mast. Each configuration has unique performance characteristics and table (2) can assist the operator to quickly select the most appropriate antenna configuration to meet their operational requirements.

Configuration	Ground	Short	Medium	Long	Directionality
Inverted Delta Loop		↓	↑		Bi-directional
Vertical	↕		↕		Omni-directional
"V" Dipole		↓	↕		Bi-directional
Horizontal Dipole		↓	↕		Bi-directional

Table 2. Antenna Configuration Selection.

To use the table, decide which distance column (Ground = 0 to 90 miles, Short = 0 - 300 miles, Medium = 300 – 1500 miles, Long > 1500 miles) best matches the distance to the station with whom you need to communicate. Then, determine if the OWF is in the lower (↓ = 1.8 – 10 MHz) or upper (↑ = 10 – 30 MHz) frequency range. Finally, select the Tactical Delta Loop configuration with the corresponding symbol in the appropriate distance column. All Tactical Delta Loop configurations provide some capability in each distance category, so depending upon the complexity of your communications network, you may need to

select the best overall configuration. The directionality column indicates the directionality characteristic of the antenna configuration. When using NVIS, all the configurations are omnidirectional.

Inverted Delta Loop Configuration

The CHA TDL Inverted Delta Loop configuration, see figure (1), is a short to medium range HF antenna. It can provide acceptable NVIS propagation below 10 MHz and good medium range communications above 10 MHz. This configuration is bidirectional broadside to the "V" of the antenna above 10 MHz and omni-directional below 10 MHz. Elevating the base will greatly improve the performance of the antenna, although it will decrease portability.

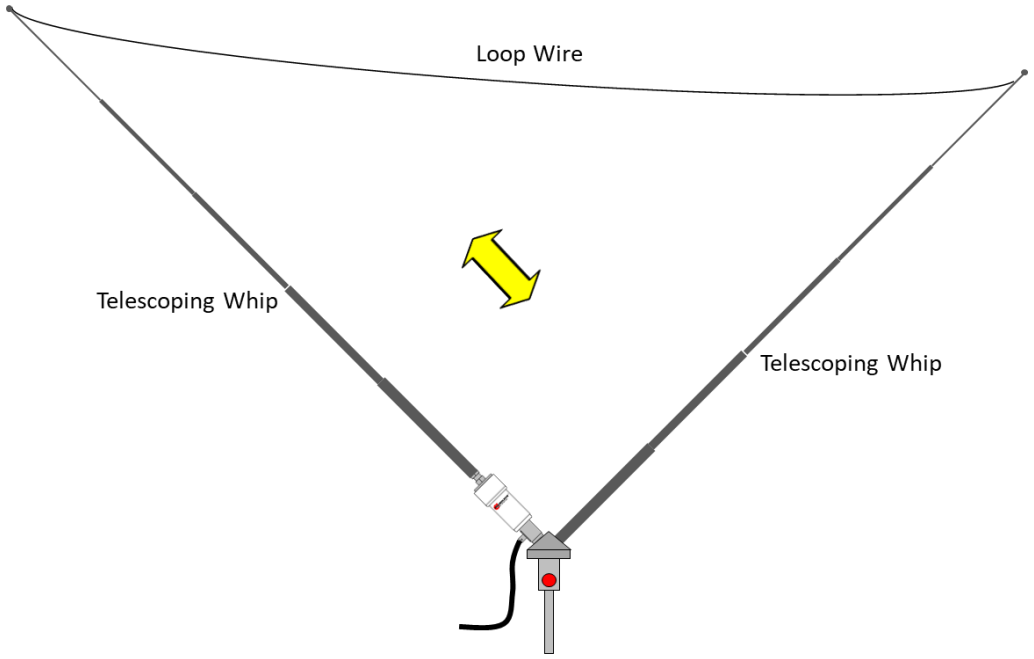


Figure 1. Inverted Delta Loop Configurations.

Site Selection and Preparation.

1. Select a site to deploy the CHA TDL Inverted Delta Loop configuration. The best site would be a clear circular area, around 26 feet in diameter.
2. Drive the Spike Mount (l) around halfway into the ground (approximately eight inches) in the center of the cleared area. Use a plastic or rubber tent mallet to avoid damaging the face of the Spike Mount.

Assemble Components.

3. Thread the Base Stud (i) on the bottom of the Hub (j) into the Mount Socket (m) on top of the Spike Mount. Tighten by hand until snug.
4. Starting at the bottom, extend a Telescoping Whip (h), one section at a time, until it is fully extended.
5. Thread the Base Stud of the Telescoping Whip into the Antenna Socket (c) on top of the Hub. Tighten by hand until snug.
6. Thread the base Stud of the Matching Transformer (a) into the other Antenna Socket on top of the Hub.

7. Starting at the bottom, extend the other Telescoping Whip (h), one section at a time, until it is fully extended.
8. Thread the Base Stud of the Telescoping Whip into the Antenna Socket (c) on top of the Matching Transformer. Tighten by hand until snug.
9. Unwind the Loop Wire (g) from the Line Winder (b). Secure the Line Winder to prevent it becoming lost.
10. Clamp the Antenna Clip (f) from one end of the Loop Wire to the end of one of the Telescoping Whips just below the Corona Ball, as shown in plate (3). Clamp the Antenna Clip from the other end of the Loop Wire to the other Telescoping Whip.
11. Connect the Coaxial Cable Assembly (k) to the UHF Socket (e) on the Matching Transformer. *The assembled antenna should look like that depicted in figure (1) and plate (4).*
12. Perform operational test.

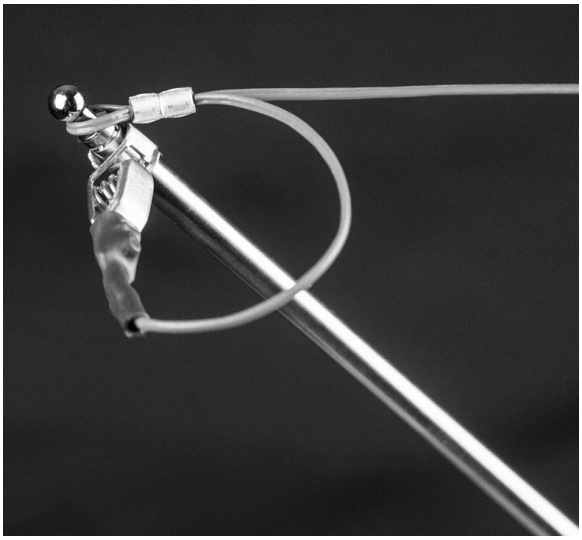


Plate (3). Antenna Wire Clamp Detail.

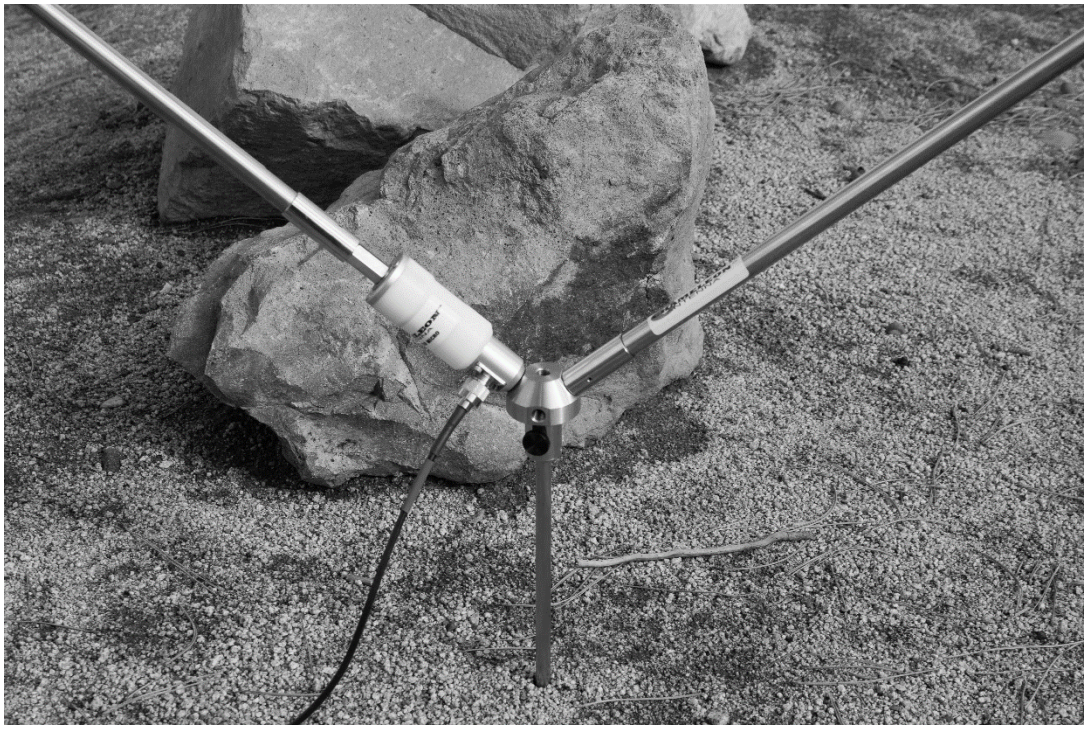


Plate 4. Installed Inverted Delta Loop Configuration.

Ground Mounted Vertical Configuration

The CHA TDL Ground Mounted Vertical configuration, see figure (2), is an omnidirectional medium range HF antenna. It will provide good overall performance using skywave and ground wave propagation. This configuration is quick and easy to setup. Improved performance can also be obtained using the optional Counterpoise Kit; which will create an efficient ground-plane for the Vertical configuration.

Site Selection and Preparation.

1. Select a site to deploy the CHA TDL Ground Mounted Vertical configuration. The best site would be a clear circular area around 26 feet in diameter.
2. Drive the Spike Mount (l) halfway into the ground (approximately eight inches) in the center of the cleared area. Use a plastic or rubber tent mallet to avoid damaging the face of the Spike Mount.

Assemble Components.

3. Thread the base Stud of the Matching Transformer (a) into the Mount Socket (m) on top of the Spike Mount.
4. Starting at the bottom, extend the Telescoping Whip (h), one section at a time, until it is fully extended.

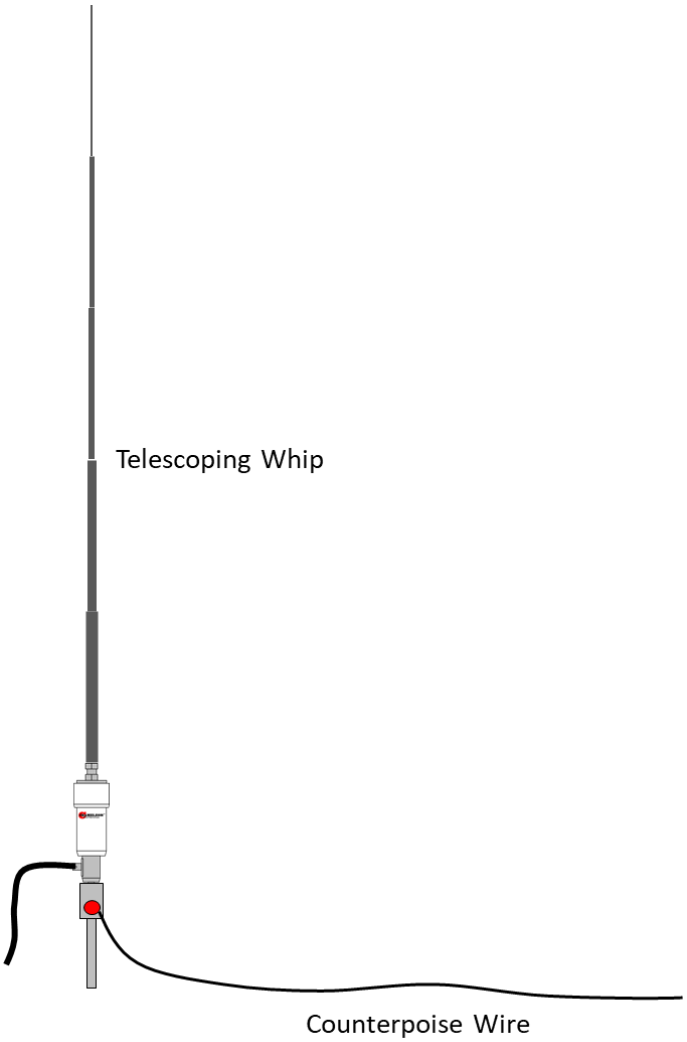


Figure 2. Ground Mounted Vertical Configuration.

5. Thread the Base Stud of the Telescoping Whip into the Antenna Socket (c) on top of the Matching Transformer. Tighten by hand until snug.
6. Unwind the Loop Wire (g) from the Line Winder (b). Secure the Line Winder to prevent it becoming lost.
7. Clamp the Antenna Clip (f) from one end of the Loop Wire to the threads of the Knurled Knob on the Spike Mount.
8. Extend the Loop Wire as the counterpoise in any convenient direction.
9. Connect the Coaxial Cable Assembly (k) to the UHF Socket (e) on the Matching Transformer. *The assembled antenna should look like that depicted in figure (2) and plate (5).*
10. Perform operational test.

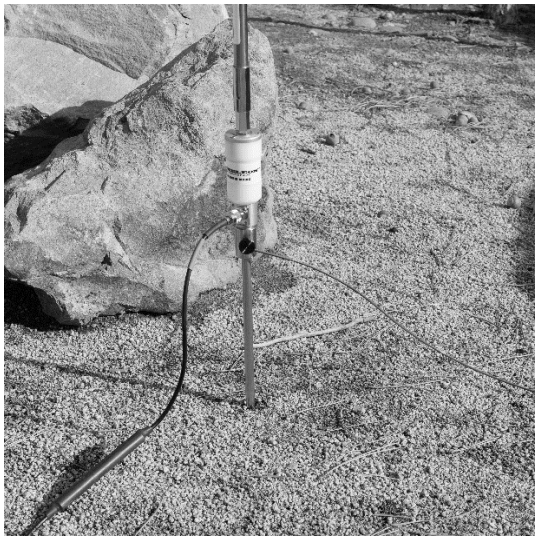


Plate 5. Vertical Configuration.

Horizontal Dipole (NVIS) and "V" Dipole Configuration

The CHA TDL Horizontal Dipole and "V" Dipole configurations, see figures (3) and (4), are short to medium range HF antennas. They have similar performance characteristics that emphasize NVIS propagation below 10 MHz and acceptable medium range communications on all supported bands. These two configurations are both bidirectional broadside to the antenna.

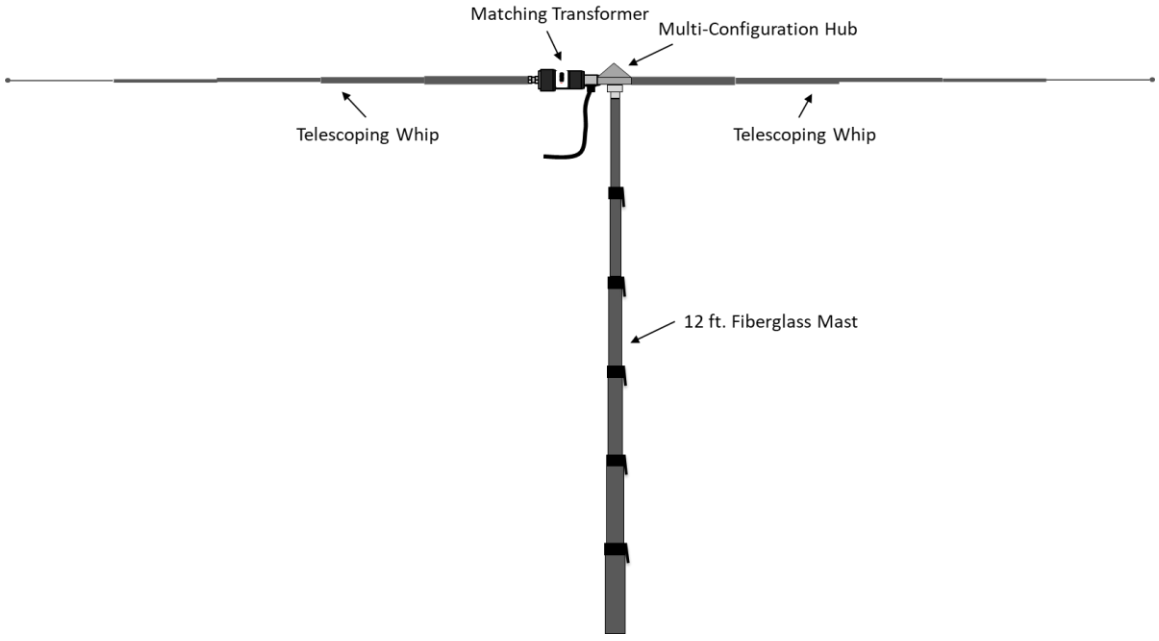


Figure 3. Horizontal Dipole.

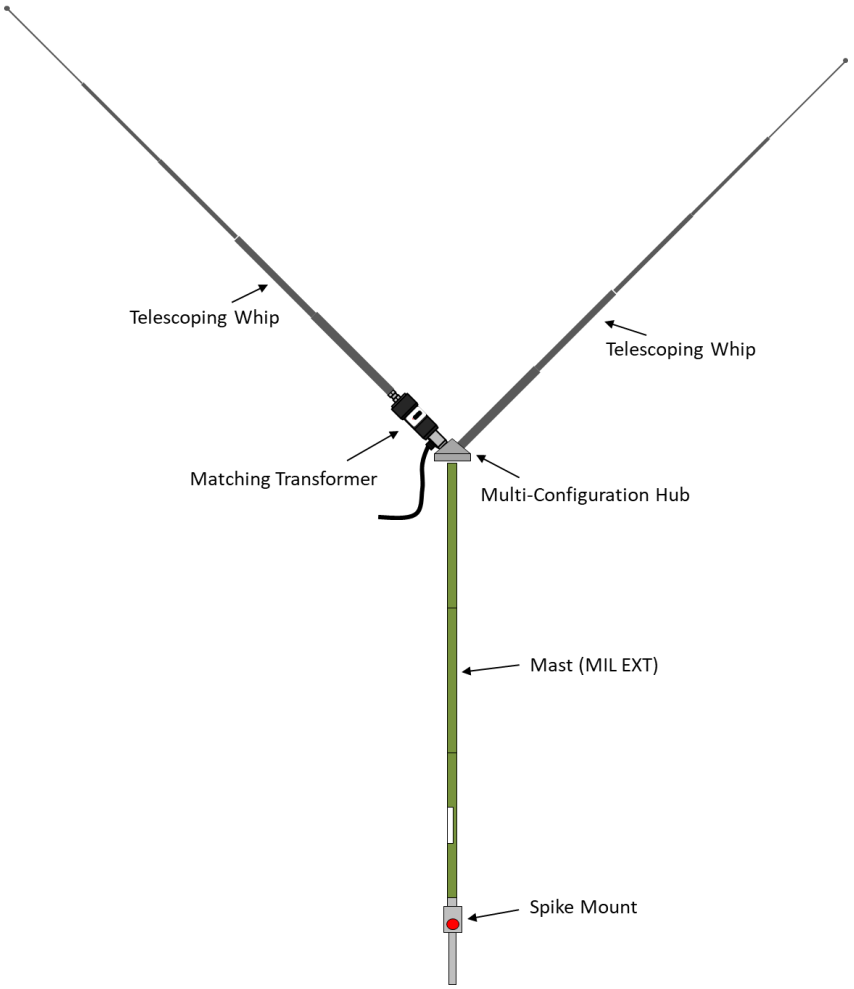


Figure 4. "V" Dipole.

The procedure for construction of the "V" Dipole and Horizontal Dipole configurations is similar to the that used for the Inverted Delta Loop.

Recovery Procedure

To recover the Tactical Delta Loop antenna, perform the following steps:

1. Disconnect the Coaxial Cable Assembly from the radio set.
2. Unscrew the Telescoping Whips.
3. Starting from the top, collapse one section at a time until the Telescoping Whips are completely collapsed.
4. Disconnect the Coaxial Cable Assembly from the Matching Transformer.
5. Unscrew the Matching Transformer and Hub (if used).
6. Pull the Spike Mont out of the ground.
7. If used, wind the Loop Wire onto the Line Winder and secure with attached shock cord.
8. Carefully roll (do not twist) the Coaxial Cable Assembly.
9. Remove dirt from antenna components and inspect them for signs of wear.
10. Store components together ready for next antenna deployment.

Troubleshooting

1. Inspect the Loop Wire for breakage or signs of strain.
2. Ensure UHF Plug from the Coaxial Cable Assembly is securely connected to the UHF Socket.
3. Inspect Coaxial Cable Assembly for cuts in insulation or exposed shielding.
4. If still not operational, replace Coaxial Cable Assembly. *Most problems with antenna systems are caused by the coaxial cables, connectors, and adapters.*
5. If still not operational, contact Chameleon Antenna™ at support@chameleonantenna.com for technical support, be sure to include details on the antenna configuration, symptoms of the problem, and what steps you have taken.

Accessories

The following accessories are available for purchase from Chameleon Antenna™. Please contact us at support@chameleonantenna.com for current prices and availability.

- **Counterpoises Kit.** The Counterpoises Kit is ideal for portable antenna deployment. The system will create an efficient ground-plane for the Tactical Delta Loop Vertical configuration. It contains four 25-foot wire radials secured around plastic wire winders and four steel Tent Stakes.
- **Fiberglass Mast.** The Fiberglass Mast is a 12 foot rugged portable six-section mast used to raise most antennas produced by Chameleon Antenna™.

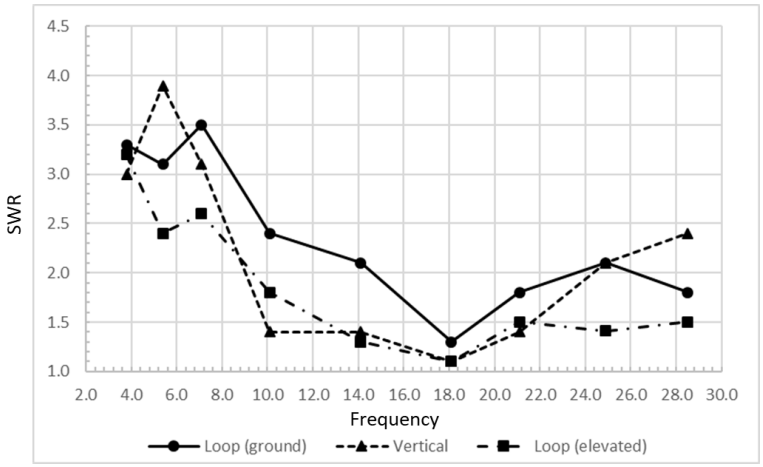
Specifications

- Frequency: Amateur Radio Service bands 3.5 MHz through 54.0 MHz (80 - 6m). Performance is limited on the 3.5 and 5.4MHz bands (80 and 60m) when using the inverted Delta Loop configuration.
- Power: HYBRID MICRO: 100W SSB Phone, 25W All Other Modes Intermittent Commercial and Amateur Service (ICAS)

  HYBRID MINI: 500W SSB Phone, 100W All Other Modes (ICAS)

Note: Prolonged transmissions or exceeding power specifications may damage antenna components.

- RF Connection: UHF Plug (PL-259)
- SWR: Subject to frequency and configuration, as measured see figure (3), but typically less than 2.5:1 above 10.1 MHz (30m). An antenna tuner or coupler will be required for operation on Amateur Bands from 3.5 to 7.0MHz (80 - 40m).
- Length: 25 ft 4 in.
- Weight: Approximately 5 lbs.
- Personnel Requirements and Setup Time: one operator, approximately 5 minutes
- Far Field plots for the Tactical Delta Loop antenna configurations are shown in figures (4) and (5)



Frequency (Mhz)	Loop SWR (ground)	Vertical SWR	Loop SWR (elevated)
3.8	3.3	3.0	3.2
5.4	3.1	3.9	2.4
7.1	3.5	3.1	2.6
10.1	2.4	1.4	1.8
14.1	2.1	1.4	1.3
18.1	1.3	1.1	1.1
21.1	1.8	1.4	1.5
24.9	2.1	2.1	1.4
28.5	1.8	2.4	1.5

Figure 3. Typical CHA TDL Measured SWR.

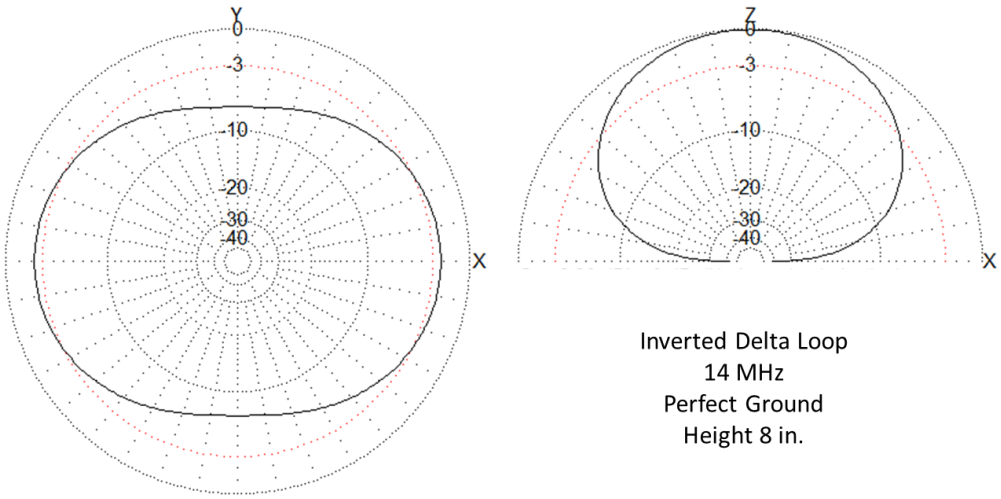


Figure 4. Inverted Delta Loop Far Field Plot.

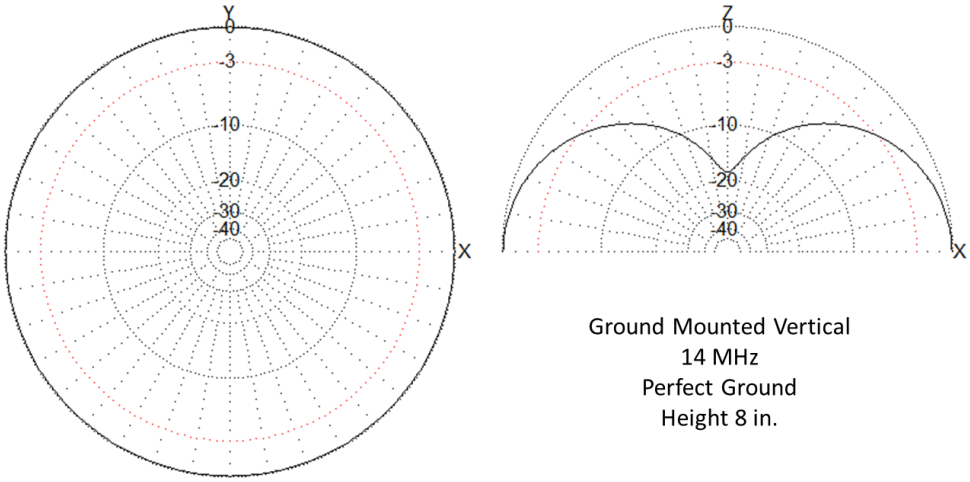


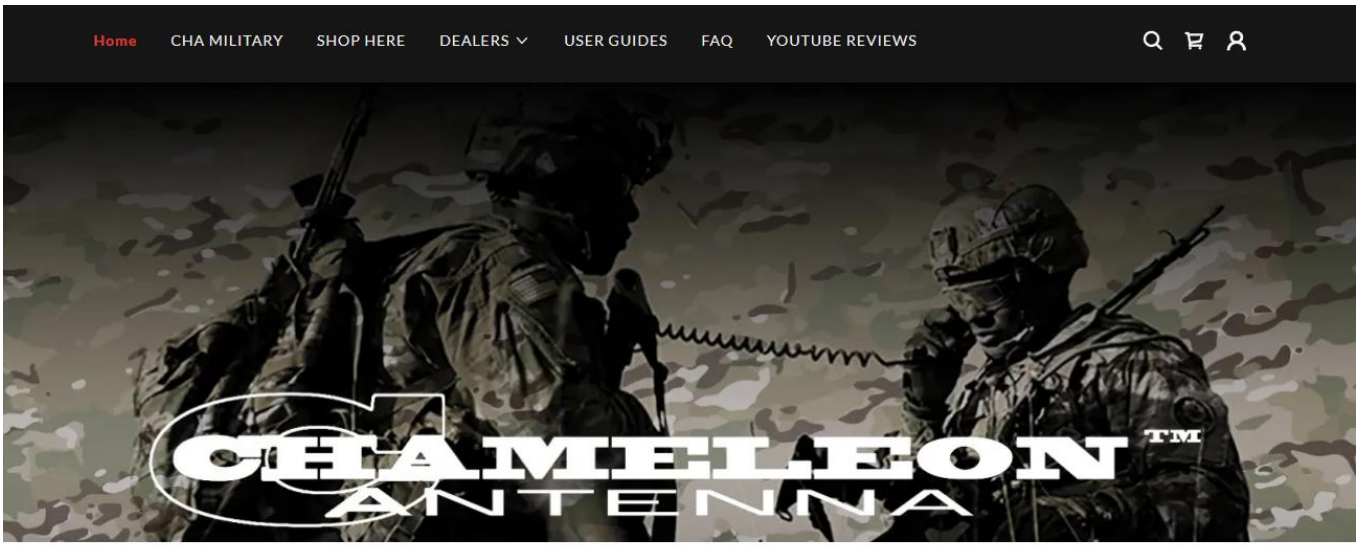
Figure 5. Ground Mounted Vertical Far Field Plot.

References

1. Silver, H. Ward (editor), 2013, *2014 ARRL Handbook for Radio Communications*, 91st Edition, American Radio Relay League, Newington, CT.
2. 1987*, Tactical Single-Channel Radio Communications Techniques (FM 24-18)*, Department of the Army, Washington, DC.
3. Turkes, Gurkan, 1990, *Tactical HF Field Expedient Antenna Performance Volume I Thesis*, U.S. Naval Post Graduate School, Monterey, CA.

Chameleon Antenna™ Products

Please go to http://chameleonantenna.com for information about additional quality antenna products available for purchase from Chameleon Antenna™ – The Portable Antenna Pioneer.



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