Tactical Dipole Lite Version 2
(CHA TD LITE V2)
Operator's Manual

Nevada - USA
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VERSATILE – DEPENDABLE – STEALTH – BUILT TO LAST

Table of Contents

Be aware of overhead power lines when you are deploying the CHA TD LITE V2. You could be electrocuted if the antenna gets near or contacts overhead power lines.

Photographs and diagrams in this manual may vary slightly from current production units due to manufacturing changes that do not affect the form, fit, or function of the product.

Introduction

Thank you for purchasing and using the Chameleon Antenna™ Tactical Dipole Lite Version 2 (CHA TD LITE V2) antenna. The CHA TD LITE V2, shown in plate (1), is a broadband High Frequency (HF) antenna specially designed for use in short to long range portable and base station HF communication where rugged and dependable operation is essential. The CHA TD LITE V2 is the result of experience gained from over six years of daily on-the-air base station usage of the original CHA TD Lite. The CHA TD LITE V2 is an excellent choice for a permanent base station antenna, due to its' rugged design and ability to operate on all ham bands from 160 – 6m, using your rig's built-in antenna tuner. The CHA TD LITE V2 will operate from 1.8 - 54 MHz without any adjustment, making it ideal for military, government agencies, non-governmental organizations (NGOs), Military Affiliate Radio System (MARS), Civil Air Patrol (CAP), Amateur Radio Emergency Service (ARES) / Radio Amateur Civil Emergency Service (RACES), Salvation Army Team Emergency Radio Network (SATERN), and amateur radio operators (hams) involved in field communication. The CHA TD LITE V2 is configurable to facilitate Near-Vertical Incident Sky wave (NVIS) communication and its broadband design supports Automatic Link Establishment (ALE), frequency-hopping, and spread-spectrum modes when used with an automatic antenna tuner. The CHA TD LITE V2 can be deployed by the operator in the field in less than 15 minutes, using almost any available support, with no masts or guying required.

Plate 1. CHA TD Lite V2.

Antennas built by Chameleon Antenna™ are versatile, dependable, stealthy, and built to last. Please read this operator's manual so that you may maximize the utility you obtain from your CHA TD LITE V2.

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 CHA TD LITE V2'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.

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.

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. 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 shows 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 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 TD LITE V2 is comprised of the following components, refer to plate (1):

A. Matching Transformer, EMCOMM III. The EMCOMM III Matching Transformer provides broadband impedance matching for the CHA TD LITE V2.

B. Transformer Eyebolt. The Transformer Eyebolt is located on the top of the Matching Transformer and is used to suspend the Matching Transformer.

C. Top Antenna Connection. The Top Antenna Connection is located on the top of the Matching Transformer. It is marked “A”.

D. Bottom Antenna Connection. The Bottom Antenna Connection is located on the bottom of the Matching Transformer.

E. UHF Socket. The UHF Socket, SO-239, is located on the bottom of the Matching Transformer.

F. Antenna Wire. The Antenna Wires are two 60 foot lengths of insulated wire.

G. Wire Connector. The Wire Connectors are located at one end of the Antenna Wires and connect them to the Matching Transformer.

H. Insulator Loop. Three Insulator Loops are permanently attached to the Antenna Wires; one on each end and one floating along the length of the Antenna Wire.

I. Carabiner. The Carabiners are removable pear-shaped stainless steel hooks with a spring-loaded gate.

J. Line Winder. The Line Winders are used to store the Antenna Wires. They enable rapid deployment and recovery of the CHA TD LITE V2.

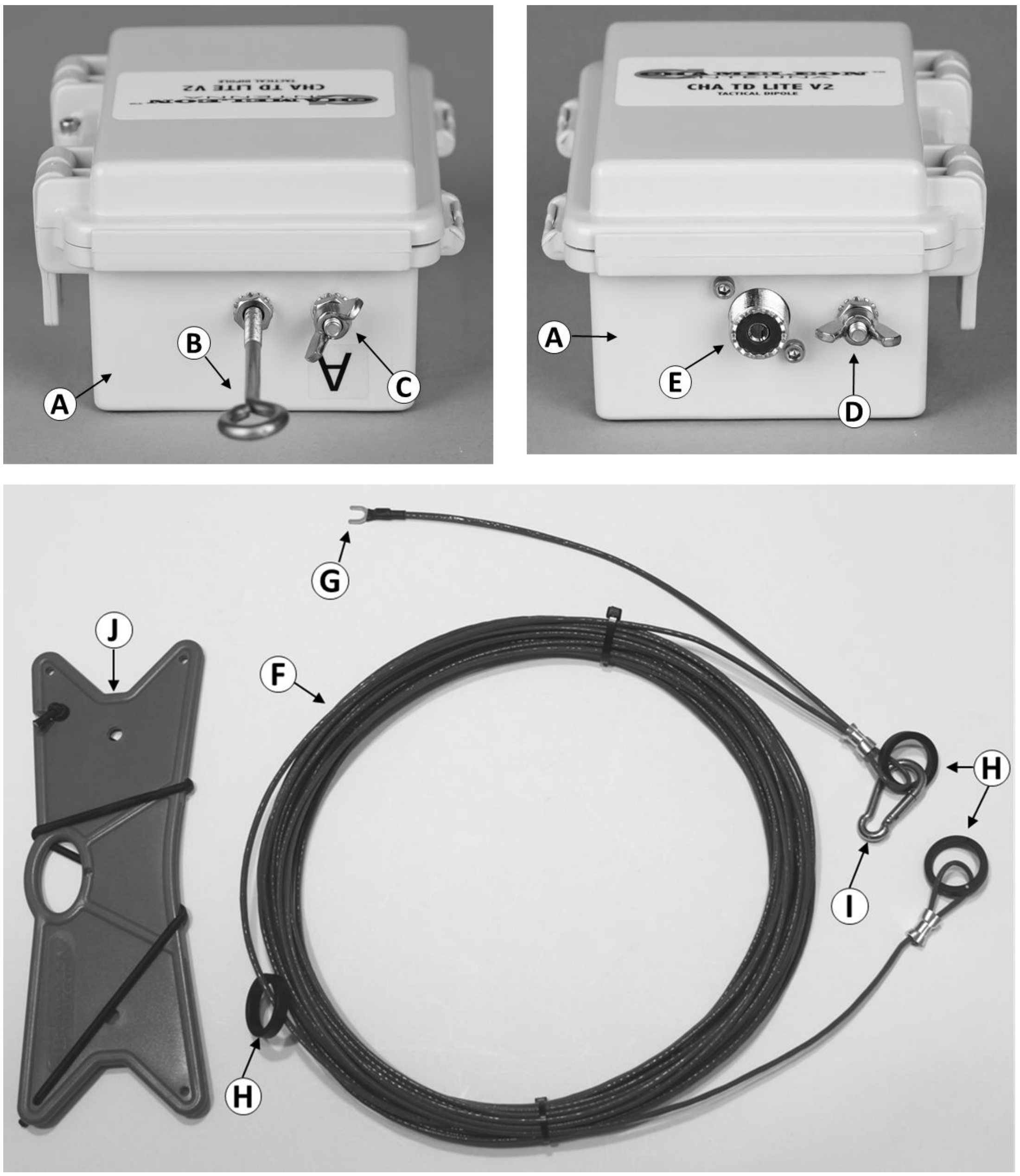


Plate 1. Tactical Dipole Lite V2 Components.

Antenna Configurations

Using the supplied components, the CHA TD LITE V2 can be configured as various kinds of wire antennas. Four of the most operationally useful configurations are described in this manual, each with unique performance characteristics, see table (2). The table can assist the operator to quickly select the most appropriate antenna configuration to meet their operational requirements.

Configuration	Ground	Short	Medium	Long	Directionality
Inverted "V"	↓		↕	↑	Bidirectional
Horizontal Dipole		↓	↕	↑	Bidirectional
Sloping Wire	↓		↕		Omnidirectional
Inverted "L"		↓	↓		Bidirectional

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 CHA TD LITE V2 configuration with the corresponding symbol in the appropriate distance column. All CHA TD LITE V2 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 characteristics of the antenna configuration. The directionality characteristics are highly dependent on antenna height and frequency and when using NVIS, all the configurations are omnidirectional. Most configurations and frequency combinations will require an antenna tuner.

Inverted "V"

The CHA TD LITE V2 Inverted "V" configuration, see figure (1), is a broadband medium to long range HF antenna. It provides good medium range sky wave propagation on all frequencies and long range sky wave propagation on 14 MHz and above. When mounted at a height of around 25 feet, the Inverted "V" will provide good overall performance and on lower frequencies, tends to be bidirectional broadside to the antenna. The Inverted "V" is the most often used configuration as it is fast and easy to deploy because it requires only a single support and provides good performance.

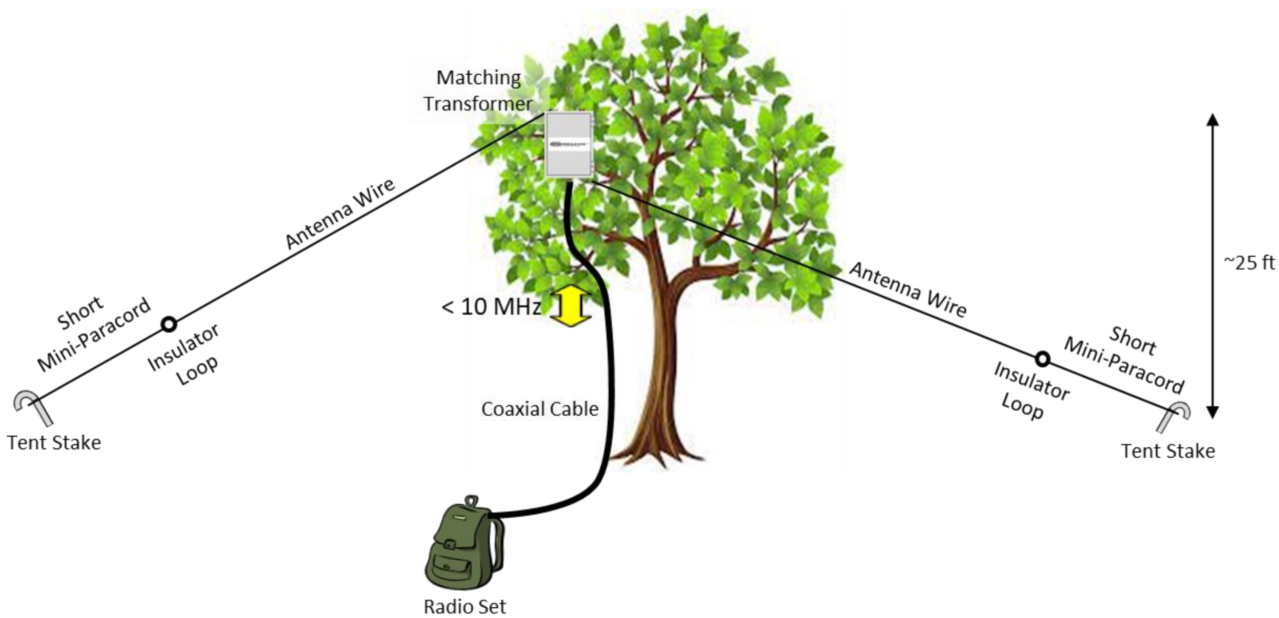


Figure 1. Inverted "V" Configuration.

Site Selection and Preparation.

1. Select a site to deploy the CHA TD LITE V2 Inverted "V" configuration. The best site should have a tree or other support that would enable the Matching Transformer to be at a height of around 25 feet. If a tall support is unavailable, any convenient object, such as a fence post or the top of a vehicle, may be used as a field expedient support with reduced performance.
2. Connect a Carabiner (I) to the Insulator Loops (H) at the Wire Connector (G) ends of the Antenna Wires (F).

Connect the Matching Transformer. Refer to plate (2) for steps (3) – (8).

3. Connect the Carabiner from one of the Antenna Wires to the Transformer Eyebolt (B).
4. Connect the Wire Connector from the Antenna Wire to the Bottom Antenna Connection (D). Tighten the wing nut finger tight.

5. Connect the Carabiner from the other Antenna Wire to the Transformer Eyebolt.

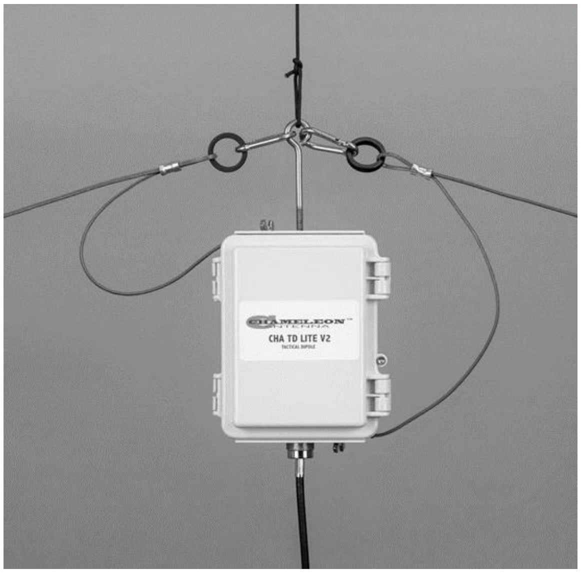


Plate 2. Matching Transformer Electrical and Mechanical Connections.

6. Connect the Wire Connector from the Antenna Wire to the Top Antenna Connection (C). Tighten the wing nut finger tight.
7. Using a Bowline or similar knot, tie one end of a long length (around 50 feet) of Paracord to the Transformer Eyebolt.
8. Connect the UHF Plug from the Coaxial Cable to the UHF Socket (E) on the Matching Transformer.

Raise the antenna.

9. Using a throw weight or some other method, loop the long length of Paracord over the support.
10. Raise the antenna to the desired height and secure the Paracord to the support with a Round Turn and two Half Hitches, or similar knot.

Extend the Antenna Wires to make an Inverted "V".

11. Using a Bowline of similar knot, tie a short length of Paracord (around 4 feet) to the Insulator Loops (H) at the unconnected ends of both Antenna Wires.
12. Extend one Antenna Wire to its full length.
13. Drive a Stake in the ground around two feet beyond the end of the Antenna Wire.
14. Using two Half Hitches, tie the short length of Paracord from the Antenna Wire to the Stake, such that the Antenna Wire is not quite taut.
15. Extend the other Antenna Wire to its full length in the opposite direction from the other Antenna Wire.
16. Drive a Stake into the ground around two feet beyond the end of the Antenna Wire.
17. Tie the Paracord from the Antenna Wire to the Stake, such that the Antenna Wire is not quite taut.
18. Perform operational test.

Horizontal Dipole

The CHA TD LITE V2 Horizontal Dipole configuration, see figure (2), is a broadband short to long range HF antenna. The Horizontal Dipole is the standard for wire HF antennas and will provide good sky wave (including NVIS) propagation. It requires three supports - one at each end and one in the middle. The Horizontal Dipole should be mounted at a height of around 25 feet for good overall performance. When mounted at this height, on lower frequencies the antenna tends to be bidirectional broadside to the antenna. The pattern becomes a clover leaf at higher frequencies. NVIS propagation characteristics are enhanced if the antenna is mounted lower (around 10-15 feet) at the expense of overall performance and the antenna becomes omni-directional.

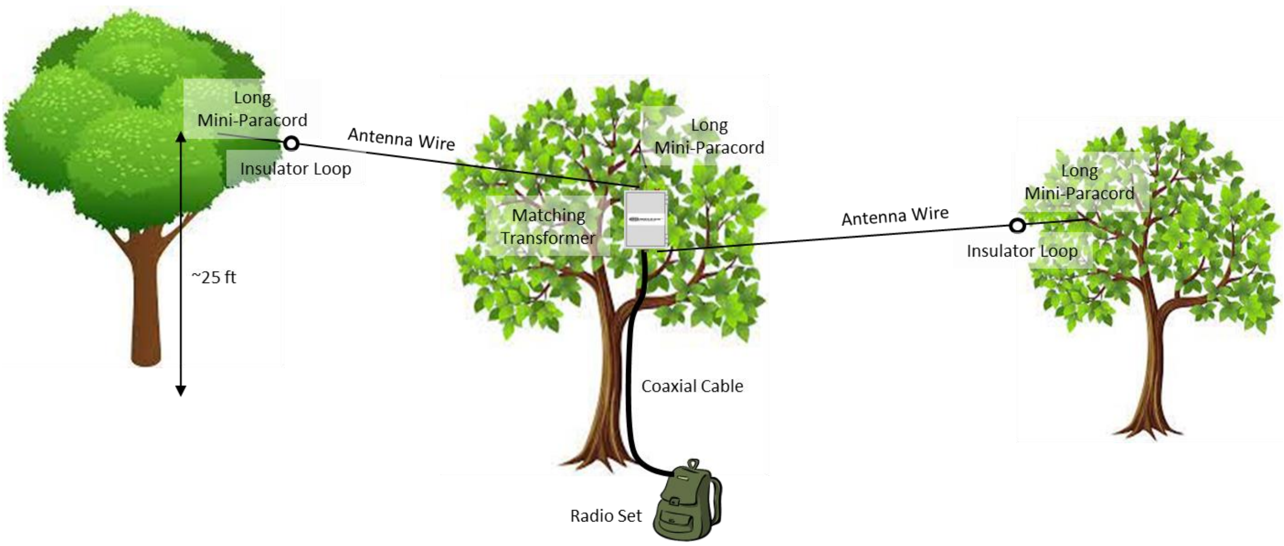


Figure 2. Horizontal Dipole Configuration.

Site Selection and Preparation.

1. Select a site to deploy the CHA TD LITE V2 Horizontal Dipole configuration. A good site should have two trees or other supports that are more than 120 feet apart and are tall enough that the ends of the antenna will be at a height of around 25 feet. The site must also have center support for the antenna. If the right supports are not present, any convenient objects, such as fence posts or the tops of vehicles, may be used as field expedient supports with reduced performance.
2. Connect a Carabiner (I) to the Insulator Loops (H) at the Wire Connector (G) ends of the Antenna Wires (F).

Connect the Matching Transformer. Refer to plate (2) for steps (3) – (8).

3. Connect the Carabiner from one of the Antenna Wires to the Transformer Eyebolt (B).
4. Connect the Wire Connector from the Antenna Wire to the Bottom Antenna

Connection (D). Tighten the wing nut finger tight.

5. Connect the Carabiner from the other Antenna Wire to the Transformer Eyebolt.
6. Connect the Wire Connector from the Antenna Wire to the Top Antenna Connection (C). Tighten the wing nut finger tight.
7. Using a Bowline or similar knot, tie one end of a long length (around 50 feet) of Paracord to the Transformer Eyebolt.
8. Connect the UHF Plug from the Coaxial Cable to the UHF Socket (E) on the Matching Transformer.

Raise the antenna center.

9. Using a throw weight or some other method, loop the long length of Paracord over the support.
10. Raise the antenna to the desired height and secure the Paracord to the support with a Round Turn and two Half Hitches, or similar knot.

Extend the Antenna Wires.

11. Fully extend both Antenna Wires in a straight line in opposite directions along the ground.
12. Using a Bowline or similar knot, tie a long length (around 50 feet) of Paracord to the Insulator Loops (H) at the free ends of the Antenna Wires.

Raise the antenna ends.

13. Using a throw weight or some other method, loop the Paracord over the end supports.
14. Raise the ends of the antenna to the desired height and secure the Paracord to the supports with a Round Turn and two Half Hitches, or similar knot.
15. Perform operational test.

Sloping Wire

The CHA TD LITE V2 Sloping Wire configuration, see figure (3), is a broadband short to medium range HF antenna. It is designed to provide acceptable ground wave and sky wave propagation, while also being quick and easy to put up. This configuration is somewhat unidirectional above 10 MHz, becoming more omni-directional on lower frequencies. The Sloping Wire requires one support, is a good general-purpose antenna, and is excellent for hasty deployment. It should be mounted at a height of around 25 feet for best performance.

Site Selection and Preparation.

1. Select a site to deploy the CHA TD LITE V2 Sloping Wire configuration, see figure (4). The best site should have a tree or other support that would enable the end of the antenna to be at a height of around 25 to 40 feet. If a tall support is unavailable, any convenient object, such as a fence post or the top of a vehicle, may be used as a field expedient support with reduced performance.
2. Connect a Carabiner (I) to the Insulator Loops (H) at the Wire Connector (G) ends of the Antenna Wires (F).

Connect the Matching Transformer. Refer to plate (2) for steps (3) – (8).

3. Connect the Carabiner from one of the Antenna Wires to the Transformer Eyebolt (B).
4. Connect the Wire Connector from the Antenna Wire to the Top Antenna Connection (C). Tighten the wing nut finger tight.

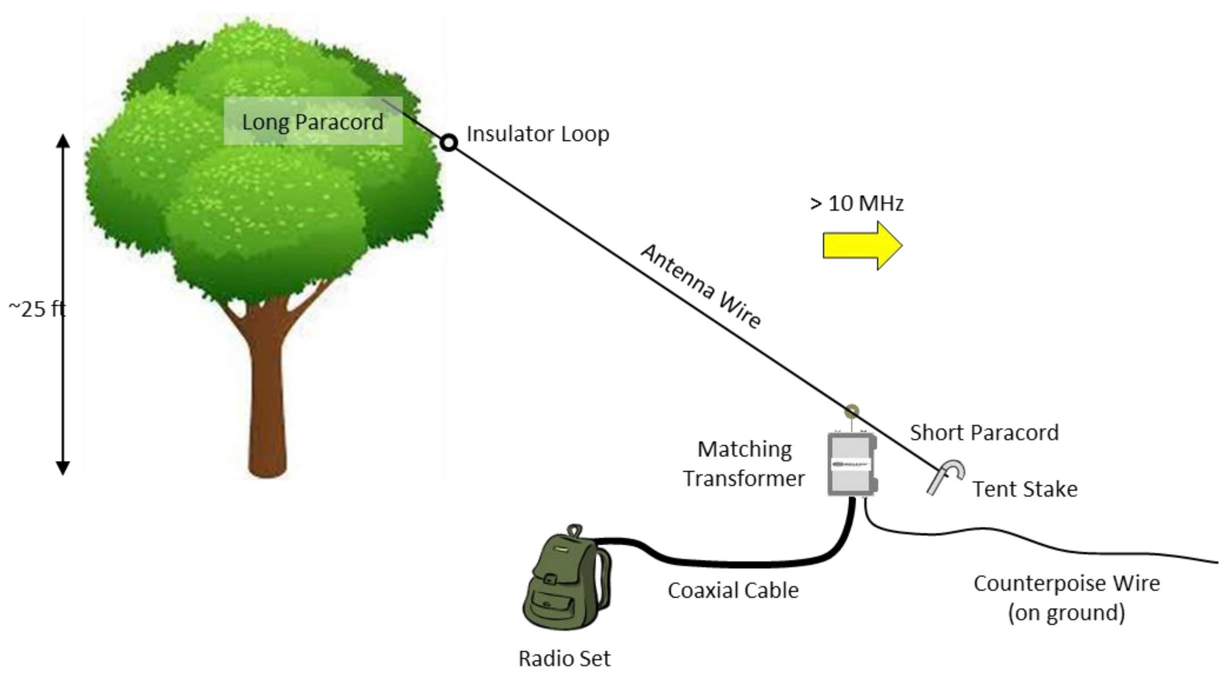


Figure 3. Sloping Wire Configuration.

5. Connect the Carabiner from the other Antenna Wire to the Transformer Eyebolt.
6. Connect the Wire Connector from the Antenna Wire to the Bottom Antenna Connection (D). Tighten the wing nut finger tight. *This Antenna Wire becomes the counterpoise in this configuration.*
7. Using a Bowline or similar knot, tie one end of a short length (around 4 feet) of Paracord to the Transformer Eyebolt.

Raise the Antenna.

8. Using a Bowline or similar knot, tie a long length (around 50 feet) of Paracord to the Insulator Loop (H) at the free end of the Antenna Wire connected in step 4.
9. Using a throw weight or some other method, loop the long length of Paracord over the support.
10. Raise the end of the Sloping Wire antenna to the desired height and secure the Paracord to the support using a Round Turn and two Half Hitches or similar knot.

Extend the Antenna Wire and Counterpoise Wire.

11. Fully extend the Antenna Wire.
12. Drive a Stake around two feet beyond the low end of the Antenna Wire.
13. Using two Half Hitches, tie the short length of Paracord from the Matching Transformer to the Stake, such that the Antenna Wire is not quite taut.
14. Extend around 25 feet of the counterpoise Antenna Wire along the ground in any convenient direction. The rest of the wire may be left on the Line Winder.
15. Connect the UHF Plug from the Coaxial Cable to the UHF Socket (E) on the Matching Transformer.
16. Perform operational test.

Inverted "L"

The CHA TD LITE V2 Inverted "L" configuration, see figure (4), is a broadband short to medium range HF antenna for frequencies below 12 MHz. One of the primary uses for this antenna is NVIS propagation, however the take-off angle of this antenna below 4 MHz may be good for nighttime long distance communication. This configuration is somewhat bidirectional, favoring the ends of the antenna wire. This configuration will provide effective ground waves communication during the daytime on frequencies between 1.8 – 4 MHz without using sky wave propagation. The Inverted "L" requires two supports and should be mounted at a height of around 25 feet for best overall performance. It will have increased NVIS characteristics when mounted at height of 10 to 15 feet, at the expense of overall performance.

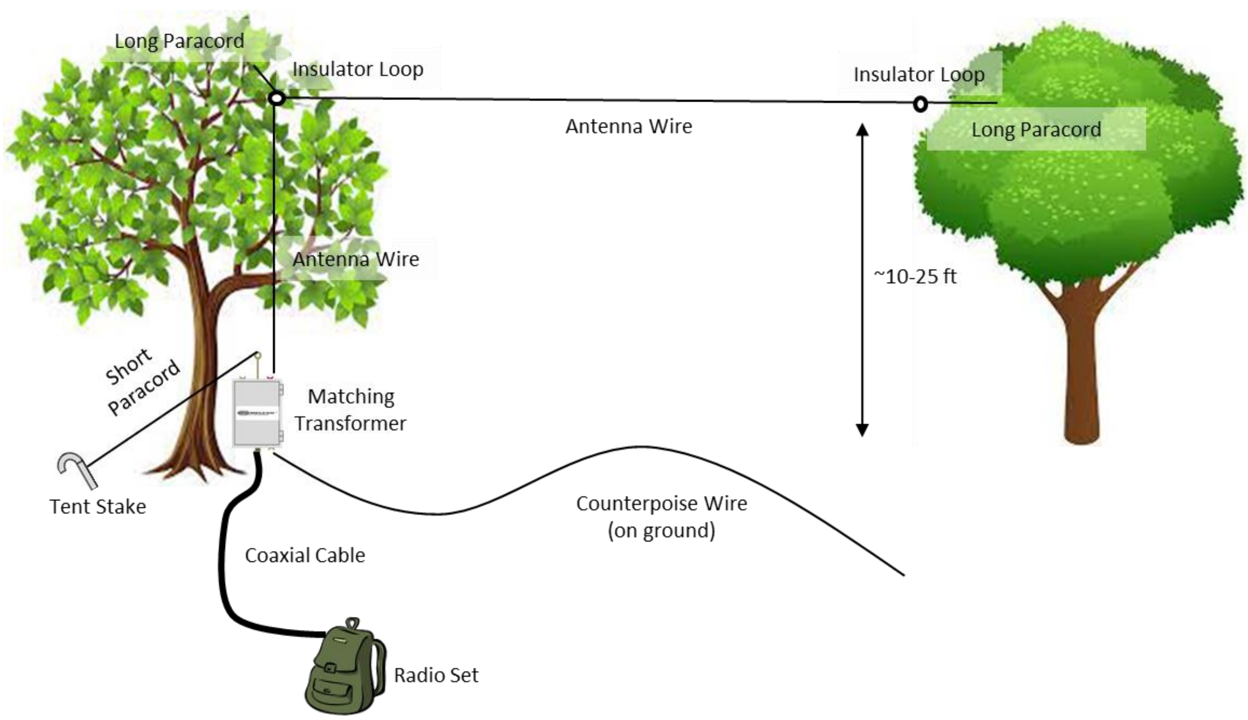


Figure 4. Inverted L Configuration.

1. Select a site to deploy the CHA TD LITE V2 Inverted "L" Wire configuration. The best site should have two trees or other support around 35 feet apart that would also enable the ends of the antenna to be at a height of around 25 feet (10 – 15 feet for NVIS). If tall supports are unavailable, any convenient objects, such as fence posts or the tops of vehicles, may be used as a field expedient support with reduced performance.
2. Connect a Carabiner (I) to the Insulator Loops (H) at the Wire Connector (G) ends of the Antenna Wires (F).

Connect the Matching Transformer. Refer to plate (2) for steps (3) – (8).

3. Connect the Carabiner from one of Antenna Wires to the Transformer Eyebolt (B).
4. Connect the Wire Connector from the Antenna Wire to the Top Antenna Connection (C). Tighten the wing nut finger tight.
5. Connect the Carabiner, from the other Antenna Wire to the Transformer Eyebolt.
6. Connect the Wire Connector from the Antenna Wire to the Bottom Antenna Connection (D). Tighten the wing nut finger tight. *This Antenna Wire becomes the counterpoise in this configuration.*
7. Using a Bowline or similar knot, tie one end of a short length (around 4 feet) of Paracord to the Transformer Eyebolt.

Raise the Antenna.

8. Drive a Stake next to the first support.
9. Using two Half Hitches, tie the short length of Paracord from the Matching Transformer to the Stake.
10. Using a Bowline or similar knot, tie a long length (around 50 feet) of Paracord to the Insulator Loop (H) at the free end of the Antenna Wire connected in step 4.
11. Using another long length of Paracord, tie a Bowline or similar knot to the floating Insulator Loop.
12. Using a throw weight or some other method, loop the long lengths of Paracord over the supports.

Extend the Antenna Wire and Counterpoise Wire

13. Extend the Antenna Wire between the two supports.
14. Raise the floating Insulator Loop and the end Insulator Loop so the Antenna Wire is horizontal and at the desired height. *The Antenna Wire from the Matching Transformer to the floating Insulator Loop should be vertical. The full length of the Antenna Wire should form a sideways "L", as shown in figure (5).*
15. Secure the Paracords to the supports using a Round Turn and two Half Hitches or similar knot.
16. Extend around 25 feet of the counterpoise Antenna Wire along the ground in any convenient direction. The rest of the wire may be left on the Line Winder.
17. Connect the UHF Plug from the Coaxial Cable to the UHF Socket (E) on the Matching Transformer.
18. Perform operational test.

Recovery Procedure

To recover the CHA TD LITE V2, perform the following steps:

1. Disconnect the Coaxial Cable from the radio set.
2. Lower the antenna to the ground.
3. Disconnect the Coaxial Cable from the Matching Transformer.
4. Carefully roll (do not twist) the Coaxial Cable.
5. Untie the Paracord from the Matching Transformer and Antenna Wires.
6. Disconnect the Antenna Wires from the Matching Transformer.
7. Wind the Antenna Wires onto their Line Winders and secure with attached shock cord.
8. Pull the Stakes from the ground, if used.
9. Remove dirt from antenna components and inspect them for signs of wear.
10. Store components together to avoid loss and facilitate the next deployment.

Troubleshooting

1. Ensure Wire Connectors are securely connected.
2. Inspect Antenna Wires for breakage or signs of strain.
3. Ensure UHF Plugs are securely tightened.
4. Inspect Coaxial Cable assembly for cuts in insulation or exposed shielding. Replace if damaged.
5. If still not operational, connect a Standing Wave Ratio (SWR) Power Meter and check SWR.
6. If SWR is close to infinite (∞), check antenna tuner using the technical manual or manufacturer's procedure. Be sure to check the Coaxial Patch Cable that connects the radio set to the antenna tuner.
7. If still not operational, replace Coaxial Cable assembly. *Most problems with antenna systems are caused by the coaxial cables, end connectors, and even adapters.*
8. Connect a Multi-Meter to the Antenna Wires to check continuity. Replace assemblies that do not pass a continuity check.
9. If still not operational, contact Chameleon Antenna™ for technical support.

Specifications

- Frequency: 1.8 MHz through 54.0 MHz continuous (including all Amateur Radio Service bands 160m to 6m). An antenna tuner is required for most configurations and frequencies.
- Power: 100 W continuous duty cycle (AM, FM, RTTY, and all digital modes), 250W CW, and 500W PEP SSB Telephony.

- RF Connection: UHF Plug (PL-259)
- Water Resistant equivalent to IPX-4 *(not laboratory tested)*
- SWR: Typically, less than 3:1 (subject to configuration and frequency), see figure (5).
- Length: 120 ft (maximum), 60 ft (minimum)
- Color: subdued - green, brown, black, and light gray
- Weight: Less than 3 lbs.
- Personnel Requirements and Setup Time: one trained operator, less than 15 minutes for the Inverted "V" or Sloping Wire configurations.

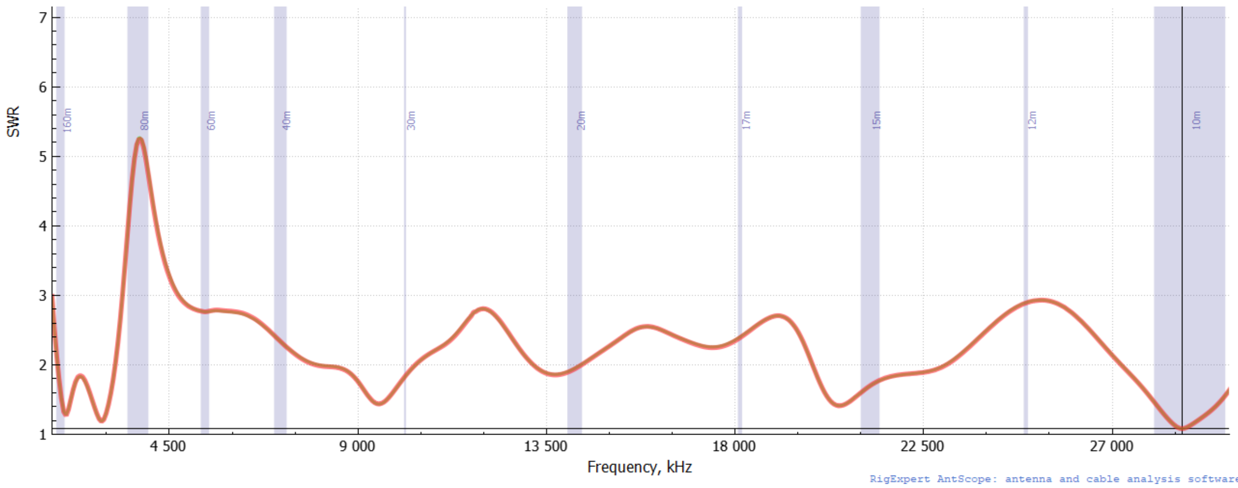


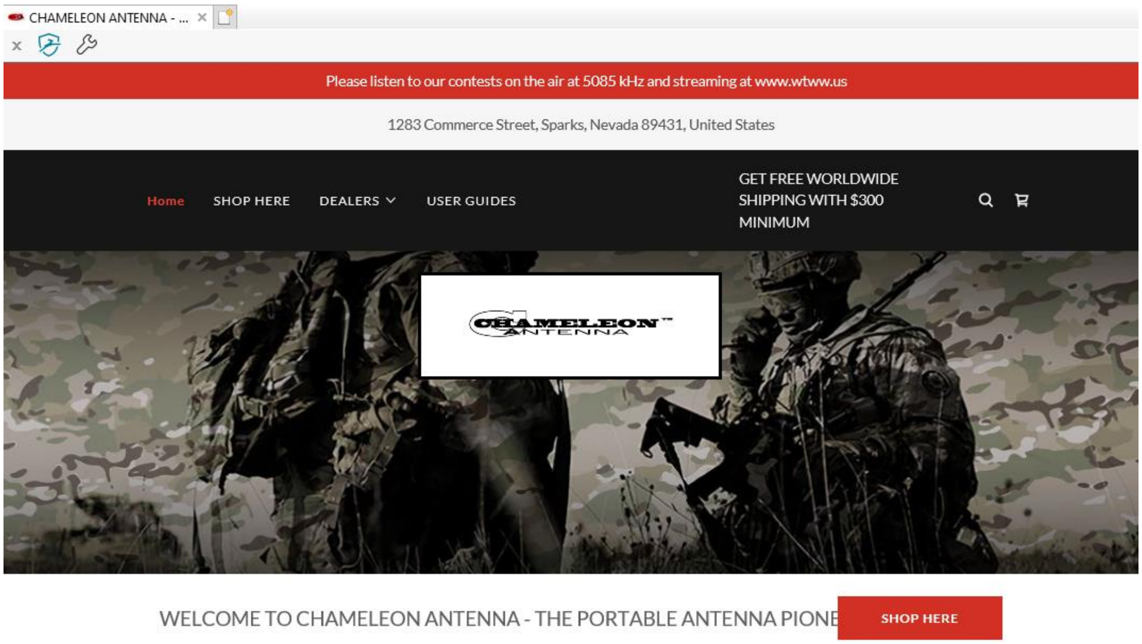
Figure (5). Inverted "V" Configuration SWR Plot.

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 and accessories available for purchase from Chameleon Antenna™ – The Portable Antenna Pioneer.



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