Base HF Antenna
(CHA SKYLOOP)
Operator's Manual

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VERSATILE – DEPENDABLE – STEALTH – BUILT TO LAST

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

Introduction

Thank you for purchasing and using the Chameleon Antenna™ High Frequency (HF) Base Antenna (CHA SKYLOOP). The CHA SKYLOOP is an extreme performance horizontal full-wave loop antenna. The main advantages of a horizontal loop antenna are reduced background noise and a better gain over a dipole—which means signals will be stronger. In fact, most operators can't believe the increase in performance over their old dipole antenna. The antenna is comprised of 250 feet of wire, insulators, and a matching transformer unit. The integral broadband impedance matching network transformer allows broadband antenna tuning. The antenna will operate from 3.5 - 54 MHz (including 80m – 6m amateur bands) without any adjustment with a wide range antenna tuner. The CHA SKYLOOP is suitable 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 hams looking for a high performance wire antenna for HF base stations. Its low observable characteristics also make it a good choice for hams living in developments with homeowners associations, deed restrictions, or CCRs (Covenants, Conditions & Restrictions). It is also an outstanding shortwave listening (SWL) antenna. When mounted low, the CHA SKYLOOP will provide good Near-Vertical Incident Sky wave (NVIS) communication. The CHA SKYLOOP antenna requires a wide range antenna tuner or coupler. 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 SKYLOOP 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 CHA SKYLOOP 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 multihop 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 SKYLOOP is comprised of the following components, see plate (1):

a. Matching Transformer

The Matching Transformer provides a starting mounting point and impedance matching for the CHA SKYLOOP antenna.

b. Antenna Wire

The Antenna Wire is a 250 foot length of black insulated wire.

c. Isolation loop

The Isolation Loops *(not shown)* are permanently attached to the ends the Antenna Wire (b).

d. Carabiner

The Carabiner is a removable pear-shaped stainless steel hooks with a spring-loaded gate.

e. Insulator

Three Insulators *(style may vary)* are permanently attached to the Antenna Wire (b) and are used to suspend three corners of the loop.

Plate 1. CHA SKYLOOP Antenna.

f. Wire Connector

The Wire Connectors are located at each end of the Antenna Wire (b).

g. Ground Connection

The Ground Connection is located on the bottom of the Matching Transformer (a) and provides an optional electrical ground for lightning protection.

h. UHF Socket

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

i. Transformer Eyebolt

The Transformer Eyebolt is located on the top of the Matching Transformer (a).

j. Antenna Connection.

The two Antenna Connections are located on the top of the Matching Transformer (a).

SKYLOOP Installation

The CHA SKYLOOP, see figure (1), is installed horizontally and requires four supports at least 60 feet apart that, when the antenna wire is suspending from them, will form the CHA SKYLOOP approximately in the shape of a square. The supports should also be 30 to 40 feet high, although heights as low as 10 feet will work, but with reduced performance. An optional electrical ground wire may be used for lightning protection. The coaxial cable should be at least 25 in length.

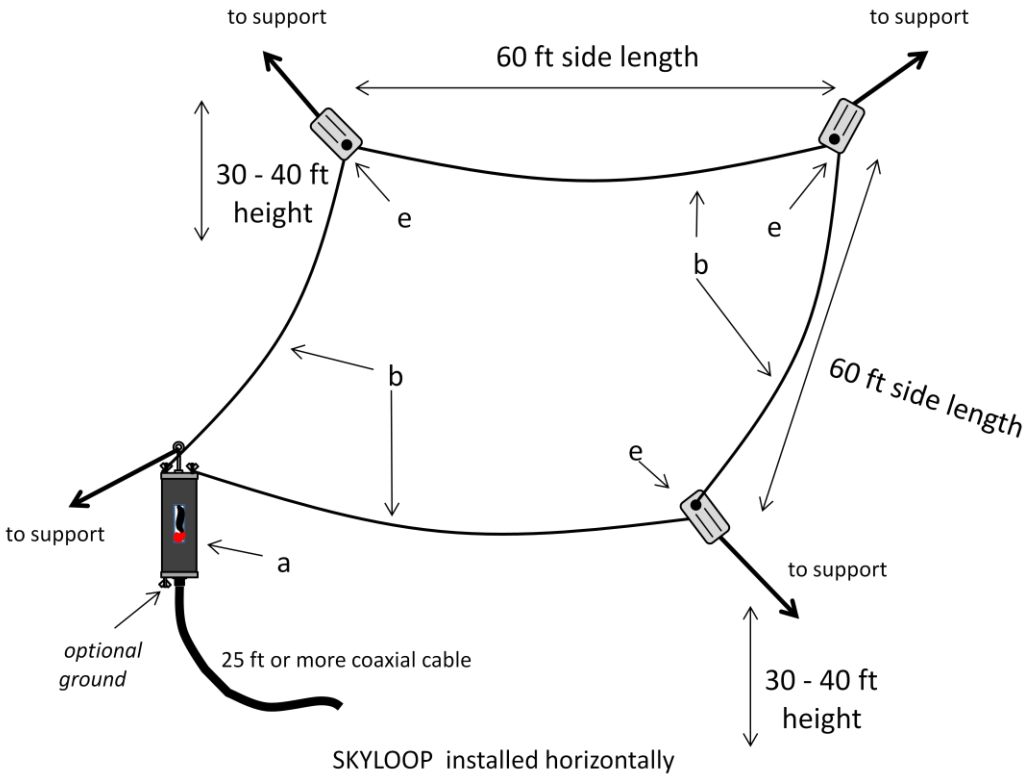

Figure 1. SKYLOOP Antenna Installation.

Site Selection and Preparation.

1. Select a site to deploy the CHA SKYLOOP horizontal loop antenna. The site must have four supports that will position the corners of the antenna at least 60 feet apart and 30 to 40 feet high. Further apart is better as it will allow for shaping and leveling the antenna loop.
2. If not already attached, connect a Carabiner (d) to the Isolation Loops (c) at the ends of the Antenna Wire (b).
3. Lay out the Antenna Wire on the ground approximately under where the antenna will be erected.
4. Move the Insulators (e) along the Antenna Wire until they are near the support where they will be suspended.
5. Using a Bowline, or similar knot, tie a long length of Polyester or Nylon rope (around 50 feet in length) to each of the three Insulators.

6. Place the Matching Transformer (a) on the ground near the support where it will be suspended.

Connect the Matching Transformer. Refer to Figure (2) for steps (7) – (13).

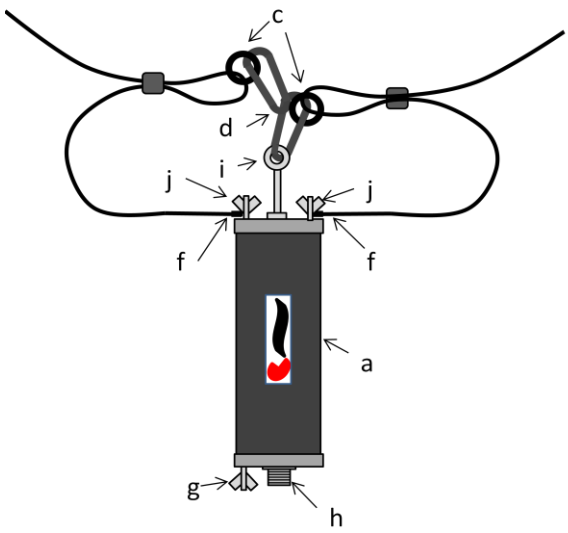

Figure 2. SKYLOOP Matching Transformer Electrical and Mechanical Connections.

7. Attach the Carabiner from one of the Antenna Wires to the Transformer Eyebolt (i).
8. Attach the Wire Terminal (f) on the end of the Antenna Wire to one of the Antenna Terminals (j) on the Matching Transformer.
9. Attach the Carabiner from the end of the other Antenna Wire to the Carabiner in step (7).
10. Attach the Wire Terminal on the end of the Antenna Wire to the other Antenna Terminal.
11. Using a Bowline, or similar knot, attach a long length (50 feet) or Polyester or Nylon rope to the Carabiner in step (9).
12. If used, connect the ground wire to Ground Connection (g) on the Matching Transformer.
13. Connect a CHA RFI CHOKE and coaxial cable or Integrated RF Choke end of the CHA Coaxial Cable assembly to the UHF Socket (h) on the Matching Transformer.

Raise the Antenna.

14. For each corner of the antenna, using a throw weight or other method, loop the rope attached to the Insulator or Matching Transformer over the closest support.
15. Alternately raise each corner of the antenna to the desired height, ensuring the antenna retains a mostly square shape, see Figure (3). *Also, be sure to not pull the antenna too tight, as you don't want the only thing keeping your trees from swaying is the antenna wire!* Secure the ropes to the supports using a Round Turn and two Half Hitches, or similar knot.

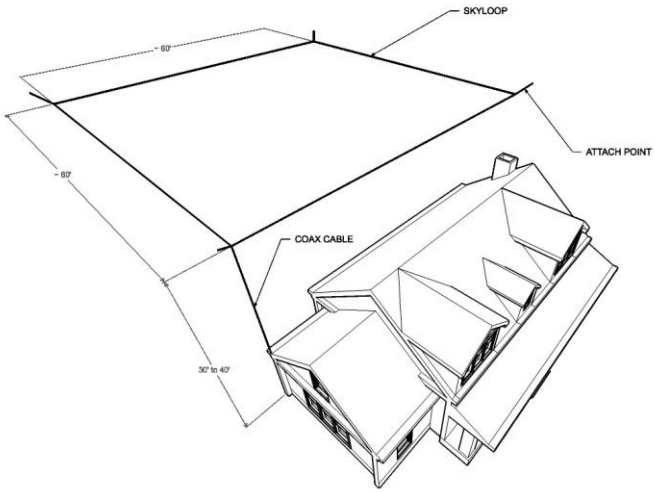

Figure 3. Installed SKYLOOP antenna.

Connect the Ground.

16. If using a ground, connect it to a ground rod under the location of the Matching Transformer.
17. Perform operational test.
18. This completes installation of the CHA SKYLOOP.

Troubleshooting

1. Ensure Wire Connectors are securely connected.
2. Inspect Antenna Wire breakage or signs of strain.

3. Ensure UHF Plug is 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 greater than 10:1, check antenna tuner or coupler 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 or coupler.
7. If still not operational, replace Coaxial Cable assembly. *Most problems with antenna systems are caused by the coaxial cables and connectors.*
8. Connect a Multi-Meter to the Antenna Wire to check continuity. Replace assemblies that do not pass a continuity check.
9. If still not operational, replace Matching Transformer (a).

Specifications

- Frequency: 3.5 – 54 MHz (80m through 6m ham bands) *require a wide range antenna tuner or coupler*
- Power: 500 W continuous duty cycle (CW, AM, FM, RTTY), 1000W intermittent duty cycle (SSB and SSB-based digital modes)
- Length: 250 feet wire, 62.5 feet each of four sides.
- RF Connection: UHF Plug (PL-259)
- SWR: Subject to frequency, but within limits of most wide range antenna tuners or couplers.
- Weight: 3 lbs
- Orientation: Horizontal
- Personnel Requirements and Setup Time: one operator, less than one hour

Accessories

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

- **Coaxial Cable Assembly.** 50 feet of RG-58 with integrated RFI Choke. Used to connect the CHA SKYLOOP to the radio set. This is a highly recommended accessory if you are not using a CHA RFI CHOKE.
- **RF Choke Assembly.** The CHA RFI CHOKE will prevent, greatly reduces or totally eliminates the RFI carried by the coax cable. It can be installed either at the antenna feed point or right behind the antenna tuner. This accessory is highly recommended if you are not using the Chameleon Antenna™ Coaxial Cable Assembly.

Recommended non-supplied accessories:

- Wide range antenna tuner or coupler (*required for most configurations).*
- Flashlight.
- Multi-tool.
- Throwing weight and string.
- Mallet.
- SWR Power Meter.
- Multi-Meter.

Chameleon Antenna™ Products

The following products are available for purchase at Chameleon Antenna™.
Go to http://chameleonantenna.com *for ordering and more information.*

CHA Zepp - The CHA Zepp Antenna has been specially designed for apartments, condominiums, homeowners associations, deed restrictions and CCRs (Covenants, Conditions & Restrictions), ARES, RACES, MARS, EMCOMM, NVIS, First Responders, Emergency Preparedness and attic antenna installation. It's a true base station or portable stealth antenna.

CHA EMCOMM II - The CHA EMCOMM II Antenna has been specially designed for backup emergency HF system or permanent installation. The integral broadband impedance matching network allows broadband antenna tuning.

CHA HYBRID Vehicular Base - The CHA HYBRID Vehicular Base is designed to enhance the capabilities of the common HF radio application by allowing faster tuning operation across the HF bands including MARS/CAP frequencies. This antenna base has an integral broadband impedance matching network allowing broadband antenna tuning. The CHA HYBRID can be used mobile with the CHA V1L and V2L mobile antennas or stationary with the provided 30' wire.

CHA V1 Mobile Antenna - The CHA V1 antenna is our first and classic broadband HF mobile antenna that we designed. It has been updated from fiberglass to 7075 alloy and stainless steel.

CHA V1L Mobile Antenna - The CHA V1L antenna is a rugged multiband HF mobile antenna that can be erected in a minimum of time and space.

CHA V2L Mobile Antenna - The CHA V2L is a rugged multiband HF antenna designed for smaller vehicles.

CHA VHF/UHF Magnetic Mount Mobile Antenna - The CHA VHF/UHF is a simple but great dual band antenna for 2M and 70CM.

CHA Hybrid Mini – Portable HF Antenna Base - The CHA HYBRID-MINI Base is the portable version of the regular HYBRID. The unit can be differentiated by the color of the lid and the base connector, which is black instead of gray. The HYBRID-MINI is also smaller and about 50% lighter than the regular HYBRID. An external antenna tuner is required to provide a low VSWR. The connector provided with the antenna is a SO-239 sealed. The entire unit is also waterproof. The HYBRID-MINI will serve as impedance transformer matching network (transformer 5:1) and will greatly reduce the VSWR at the load for the following antennas: V1, V1L, V2L and MIL.

CHA Hybrid Micro - Portable HF Antenna Base -
The CHA HYBRID-MICRO is a lightweight highly portable broadband antenna system designed to offer maximum portability and performance. The antenna weights about 1 lb. The antenna will operate at all frequencies in the 1.8-54 MHz band without any adjustment with most modern external antenna tuners. No masts or guying are required. The antenna will work successfully supported by trees, masts, the tops of vehicles or any convenient object or structure. The antenna works most effectively when elevated at a reasonable height.

CHA MIL Whip - The CHA MIL whip is a broadband (28 to 54 MHz) monopole antenna designed for portable or man-pack radios requiring compact but rugged antenna systems. Its design has been borrowed from similar antennas utilized by many armies all over the world. The CHA MIL is very hardy, sturdy and portable (being collapsible). Un-mounted the entire antenna length is less than 29". The 5 aluminum sections are hold together by a piece of 1/8th inch US GI MIL SPEC shock cord. The CHA MIL Whip and a CHA HYBRID-MINI Base perfectly complements the capability of the CHA SKYLOOP.

CHA MIL EXT Whip Extension - The CHA MIL EXT whip has been designed to offer maximum portability and performance for those already using the portable CHA MIL whip for man-pack antenna system. This collapsible antenna extension needs to be used with the CHA MIL to create a 17'4" long portable antenna. When combined with any HYBRID series antenna bases the CHA MIL EXT will operate at all frequencies in the 1.8-54 MHz band without any adjustment with most modern external antenna tuners.

CHA TD Tactical Dipole LITE - The CHA TD LITE (Tactical Dipole LITE) is a HF broadband antenna specially designed for portable HF communication where rapid deployment and simplicity of operation is essential but compactness is primordial. The antenna will operate at all frequencies in the 1.8-54 MHz band without any adjustment with most modern external antenna tuners. No masts or guying are required.

CHA TD Tactical Dipole - The CHA TD (Tactical Dipole) Antenna has been designed as an add-on for the CHA SKYLOOP. The CHA TD is a HF broadband antenna specially designed for portable HF communication where rapid deployment and simplicity of operation is essential. The antenna will operate at all frequencies in the 1.8-30 MHz band without any adjustment with most modern internal antenna tuners. It is ideal for use in conjunction with modern, digitally configured, HF communication transceivers where features such as ALE and frequency hopping require true broadband capability. No masts or guying are required. The CHA TD can also be used without antenna tuner, as the SWR will stay under 2.5:1 between 10M and 80M and under 2.75:1 on 160M.

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.