40 Meter Horizontal Full-Wave Loop Antenna (CHA SKYLOOP 40) 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.

- 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.

- All information on this product and the product itself is the property of and is proprietary to Chameleon Antenna™. Specifications are subject to change without prior notice.

Introduction

Thank you for purchasing and using the Chameleon Antenna™ 40 Meter Horizontal Full-Wave Loop Antenna (CHA SKYLOOP 40). The CHA SKYLOOP 40, shown in plate (1), 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 horizontal loop antenna also has strong Near-Vertical Incidence Skywave (NVIS) propagation characteristics.

The CHA SKYLOOP is comprised of 141 feet of wire and a matching transformer unit. The integral broadband impedance matching network transformer allows broadband antenna tuning. The antenna will operate on the 40 and 20 meter Amateur Radio Service band without a tuner. It also covers 17 through 10 meters with an antenna tuner. The CHA SKYLOOP 40 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 and base camps. Its' low observable characteristics and short legs make it a good choice for hams living in developments with Homeowners Associations (HOAs), deed restrictions, or Covenants, Conditions & Restrictions (CCRs). It is also an outstanding shortwave listening (SWL) antenna. When mounted low, the CHA SKYLOOP 40 will provide good Near-Vertical Incident Sky wave (NVIS) communication. The CHA SKYLOOP 40 antenna requires an antenna tuner on most frequencies.

Plate 1. CHA SKYLOOP 40 Antenna.

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 40 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 II V3'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. LUF is the frequency below which successful communications are lost due to ionospheric losses. 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 selected frequency 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 SKYLOOP 40 is comprised of the following components, shown in figure (1).

A. Matching Transformer Unit. The Matching Transformer Unit is at one corner of the loop and contains the 2.5:1 matching transformer.

B. Line Winder. The Line Winder *(not shown)* is used store the Antenna Wire (C) when the antenna is not in use.

C. Loop Wire. The Loop Wire is 141 feet of 16-gauge wire

D. Carabiner. The Carabiners are stainless steel gate hook devices used to secure the ends of the Loop Wire (C) to the Eyebolt (E) to provide strain relief.

E. Eyebolt. The Eyebolt is located on top the Matching Transformer (A) and is used to suspend the corner of the loop and attach the Carabiners (D) at the ends of the Loop Wire for strain relief.

F. Isolation Ring. Isolation Rings are attached to one end of the Loop Wire and floating along the length of the Loop Wire. They are used to electrically isolate the Loop Wire, provide strain relief, and form the corners of the loop.

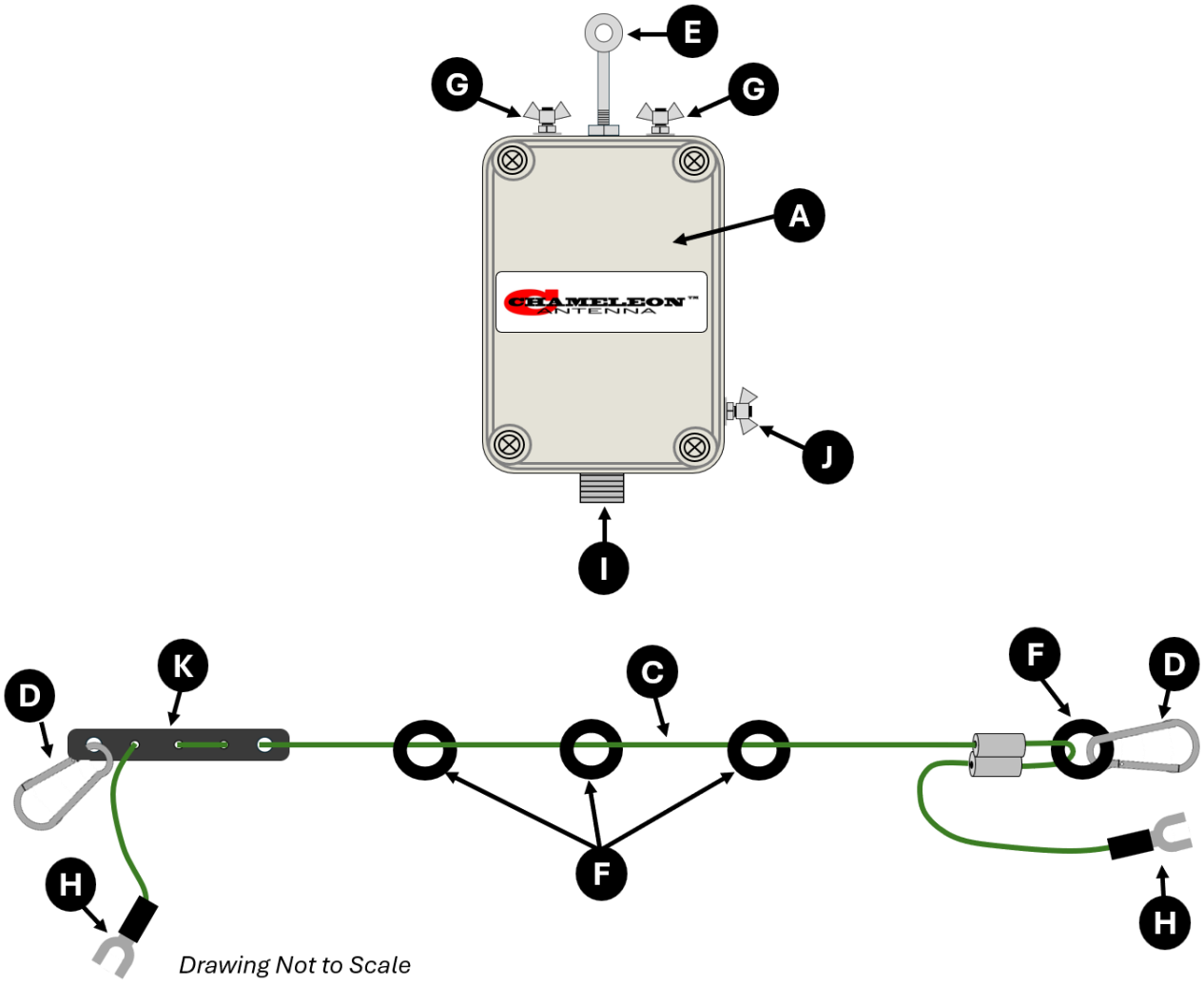


Figure 1. CHA SKYLOOP 40 Components.

G. Loop Wire Connection. The Loop Wire Connections are wing nut connectors on top of the Matching Transformer used to electrically connect the Spade Lugs (H) at ends of the Loop Wire.

H. Spade Lugs. The Spade Lugs are located at the ends of the Loop Wire and are used to electrically connect the wires to the Matching Transformer.

I. Coaxial Connector. The Coaxial Connector is a UHF Connector (SO-239) r used to attach the coaxial feedline to the Matching Transformer Unit.

J. Ground Connection. The Ground Connection is used to connect an earth ground to the Matching Transformer for lightning protection. A ground is not required.

K. End Insulator Strip. The End Insulator Strip is the end of one side of the Loop Wire and is used to attach that end of the Loop Wire to the Matching Transformer and enable the operator to field tune the antenna.

Installation Example

Figure (2) shows an ideal CHA SKYLOOP 40 installation with perfectly located mast and tree supports and the loop in a square. However, it is not usually possible to have a "perfect" installation. A more practical example of a small lot installation is shown in figure (3). This installation is discreet, using only one pole mast. The remaining supports are the top of the back fence and a convenient tree. Of course, it is better to have the loop up higher and in a perfect square, but the point of the example is to show that the loop will work -- even if it is lower, not perfectly square, and not perfectly horizontal. Our advice is that you do the best you can with your situation.

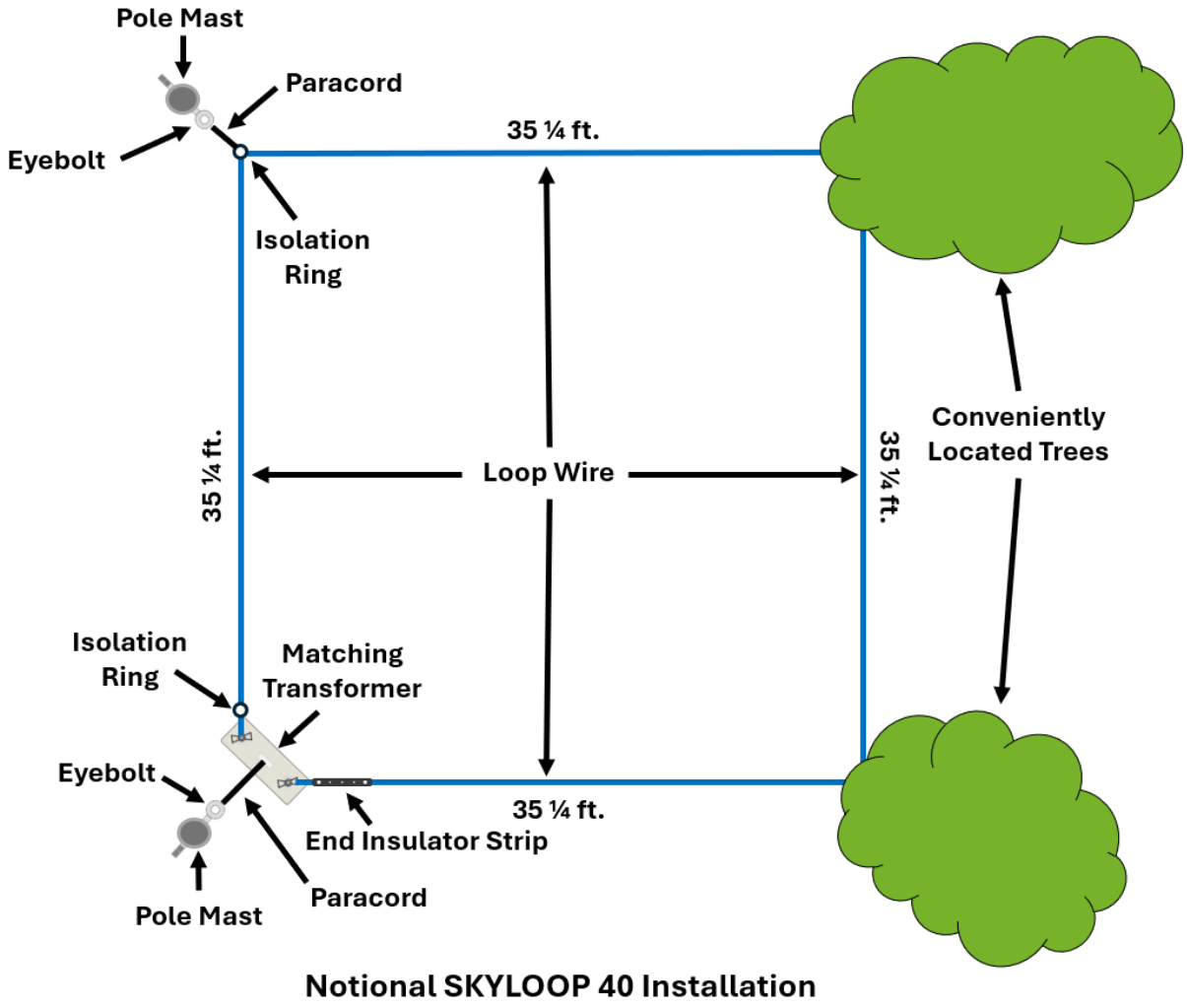


Figure 2. Ideal SKYLOOP 40 Installation.

Installation details are shown in figure (4). The left diagram shows connection details and the right diagrams shows how the three corners can be installed. Varying the length of the paracord in the corners will help shape and tension the loop.

The corners can be attached to many types of supports, such as the top of a fence post (as shown), a pole mast, the eaves of a building, or conveniently placed trees – depending on your lot layout.

Lowest optimal installation height is around 30-feet, but the antenna will still provide excellent results if installed lower.

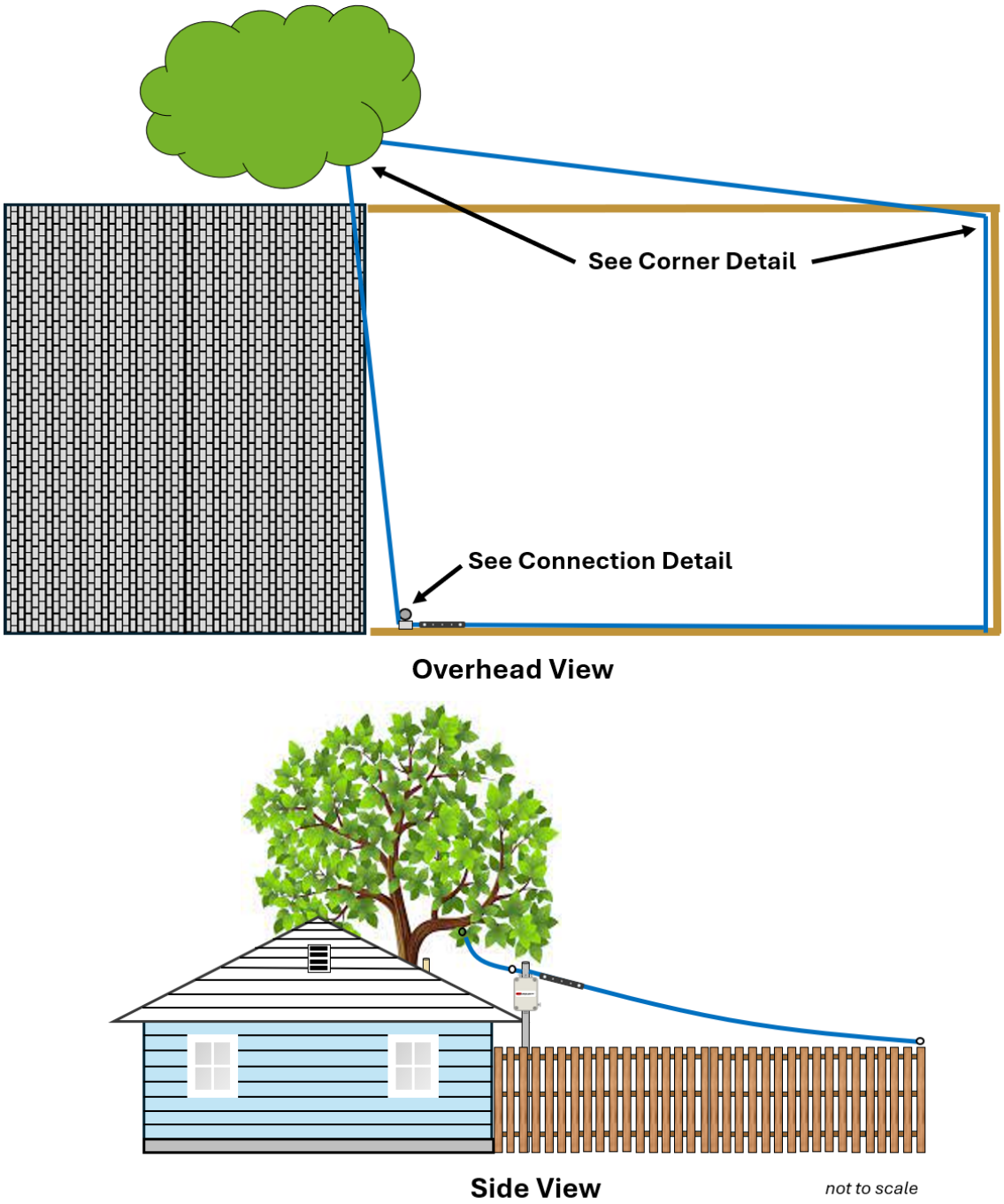
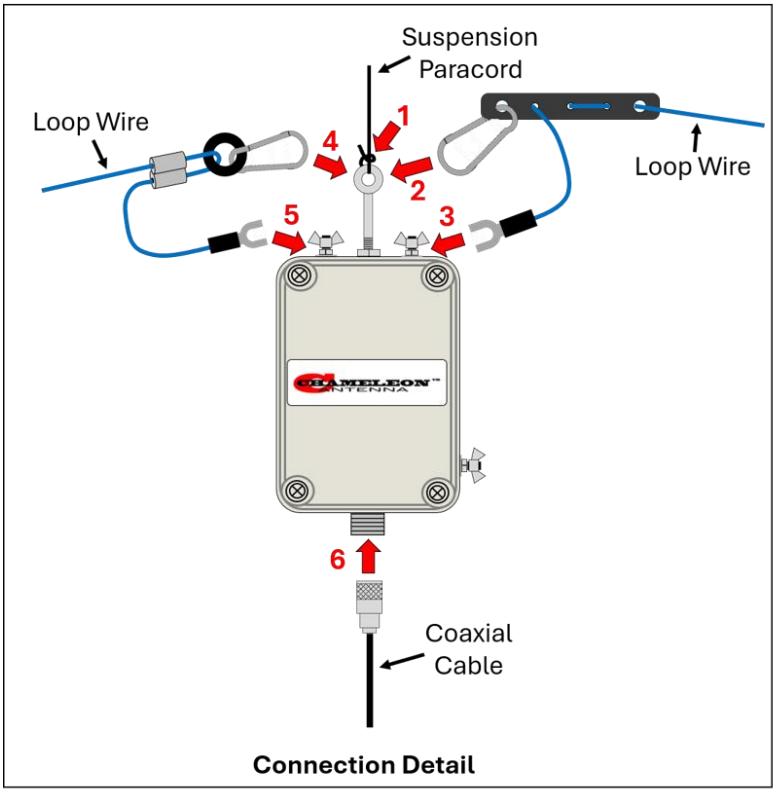
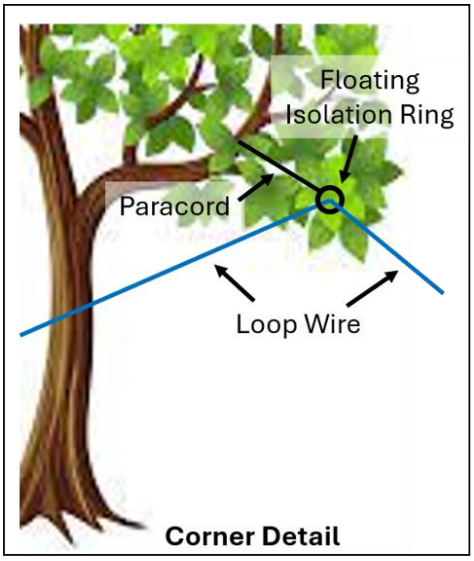
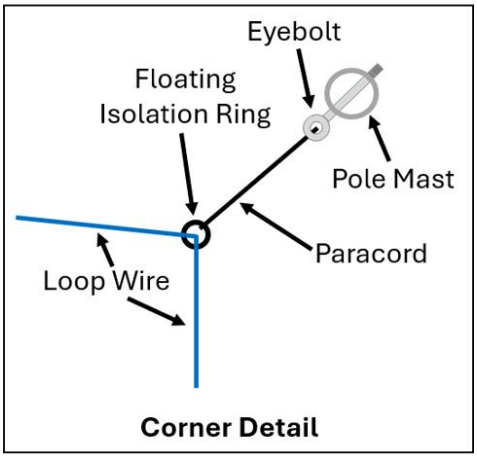


Figure 3. Small Lot SKYLOOP 40 Installation.







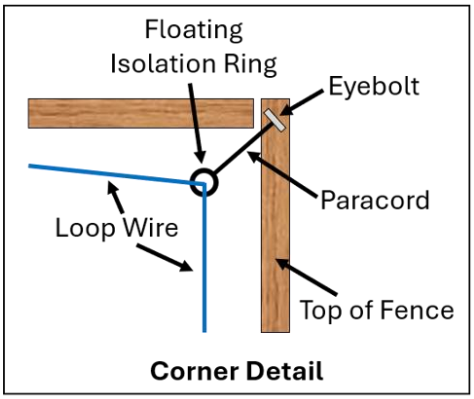


Figure 4. Installation Details.

Installation Procedure

Conduct site planning to determine where the four corners of the loop will be located. Optimally, each leg should be 35 ¼ feet long, but individual legs can be longer or shorter, depending on available supports and your lot situation. What can't be changed (other than for tuning) is the total length of the loop, which is 141 feet.

Use the following procedure to install the CHA SKYLOOP 40.

1. Using a Bowline Knot, tie a long length of paracord to the Eyebolt (E) on top of the Matching Transformer.
2. Attach the Carabiner (D) from one end of the Loop Wire (C) to the Eyebolt.
3. Connect the Spade Lug (H) from the same end of the Loop Wire from step (2) to one the Loop Wire Connections (G) on top of the Matching Transformer.
4. Attach the Carabiner from the other end of the Loop Wire to the Carabiner from step (2).
5. Connect the Spade Lug from the same end of the Loop Wire from step (4) to the other Loop Wire Connection on top of the Matching Transformer.
6. Connect the Coaxial Cable to the Coaxial Connector (I) on the bottom of the Matching Transformer. *Seal connection with "Coax-Seal" or other waterproof cable sealant.*
7. Raise the Matching Transformer to the desired height.
8. Proceed to the next corner of the loop and using Bowline Knot, tie a paracord to the next unattached floating Isolation Ring (F).
9. Raise the corner of the loop to the desired height.
10. Repeat steps (8) and (9) for the remaining two corners.
11. Check the shape and tension of the loop and adjust, as needed.
12. Perform an operational test.

Tuning

The CHA SKYLOOP 40 has been designed and cut to resonate at the lower (CW/digital) end of the 40-meter band. Installation height, ground conditions, surrounding objects, and many other factors can have a significant impact on the resonant frequency.

Figure (5) shows an example of the SWR sweep for the CHA SKYLOOP 40 during field testing. The red SWR sweep was the original length and the blue SWR sweep is after cutting 12 inches off the Loop Wire. After trimming, the resonant frequency increased from 6,988 KHz to 7,048 KHz, an increase of 60 KHz.

After installing your CHA SKYLOOP 40, If the SWR is 2.0:1 or less on both 7,000 and 7,300 KHz, we recommend you don't adjust it. However, if it is higher than 2.0:1 at the top (phone) end of 40 meters (and lower at the lower end), it indicates the antenna is too long. You can trim the antenna to resonate on a higher frequency using the End Insulator Strip and by crimping and soldering one of the extra Spade Lugs and Heat Shrink provided with the antenna. Leave around 7 inches coming out of the End Insulator Strip to allow for strain relief and connection to the Matching Transformer. Each foot removed from the Loop Wire increases the resonant frequency by roughly 60 KHz.

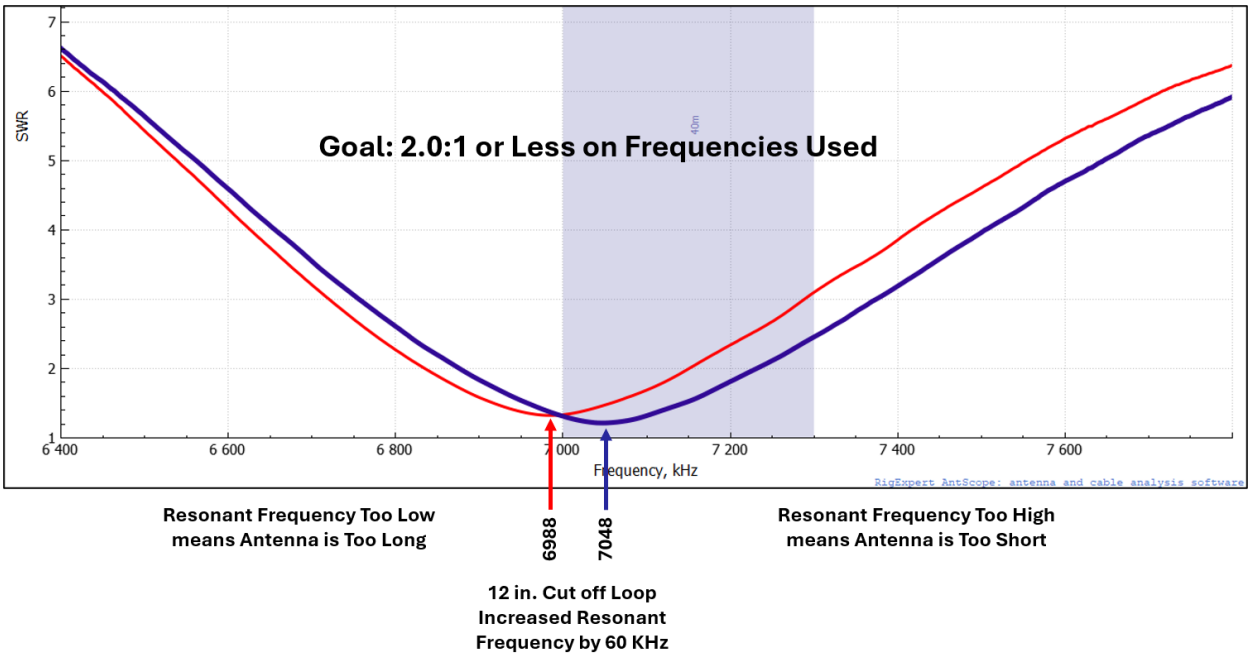


Figure 5. Loop Wire Tuning.

We recommend using an antenna analyzer (or using a series of measurements and graphing them) to visually verify the SWR curve. Trim carefully – it's hard to put wire back on once cut. This is not a Swiss watch, the SWR doesn't have to be perfect – the goal is an SWR of 2.0:1 or less on the frequencies you actually use.

Troubleshooting

1. Ensure the Loop Wire is connected correctly, per installation instructions and diagrams.
2. Ensure Loop Wire Connections are tight.
3. Check that the Coaxial Cable is securely connected to the Matching Transformer.
4. Inspect the Coaxial Cable for cuts in insulation or exposed shielding.
5. Inspect antenna components for signs of breakage, strain, or wear.
6. Inspect Coaxial Connectors Adapters, if used.
7. If it is still not operational, replace Coaxial Cable. *Most problems with antenna systems are caused by the coaxial cables and connectors.*
8. If still not operational (SWR > 3:1 on 40 meters), 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 recommended for use with your antenna. They are available from www.chameleonantenna.com or your great dealer.

- **CHA COAX CABLE.** Premium quality RG-58/U coaxial cable with an integrated RFI Choke. Available in 12, 50, 75, and 100 foot lengths.
- **CHA PORTA-MAST.** The PORTA-MAST is a heavy-duty telescoping mast made with industrial strength, aircraft grade (6005T6) anodized aluminum. It is designed for semi-permanent installation at home with no guy wires required. When installed at your home, it is HOA friendly because it can be lowered, so it is less than eight feet tall, or removed from the mount completely, and laid on the ground. It can even be camouflaged by adding a flag! Available in 25, 20, 15 and 15HD foot lengths.

Specifications

- Frequency:
  - 7.0 – 7.3 MHz (40m Amateur Radio Service Band) and 14.0 – 14.35 MHz (20m Amateur Radia Service Band) without an antenna tuner.
  - 18.068 – 18.168 MHz (17m) , 21.0 – 21.45 (15m), 24.89 – 24.99 (12m), and 28.0-29.0 MHz (10m) with an antenna tuner.
- 2:1 Bandwidth: 350 KHz (minimum).
- Power: 500W SSB, 250W CW and 100W Digital Modes.
- RF Connection: UHF Connector (SO-239).
- SWR: Less than 2.0:1 at resonance. See figures (6) and (7) for measured SWR graphs.
- Length: 141 ft. Loop.

- Weight: 2 lbs. 8 oz.
- Color: Gray, Black, and Green.

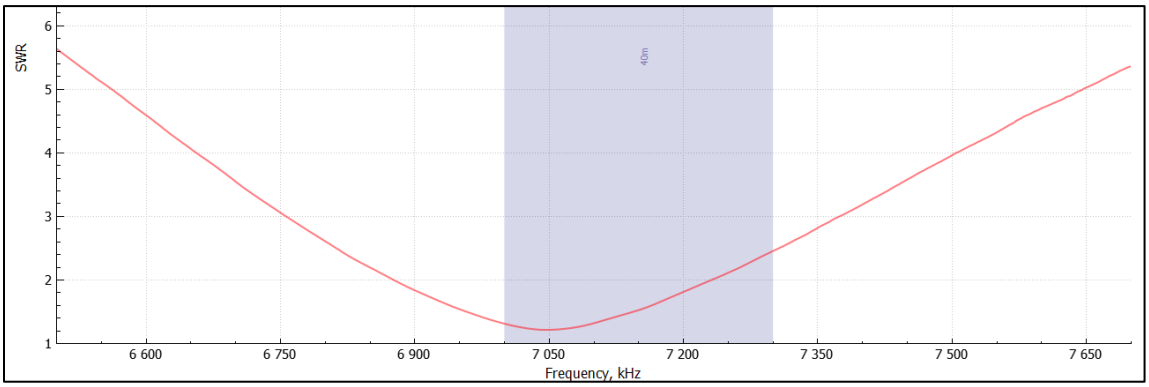


Figure 6. Measured SWR Graph (40m).

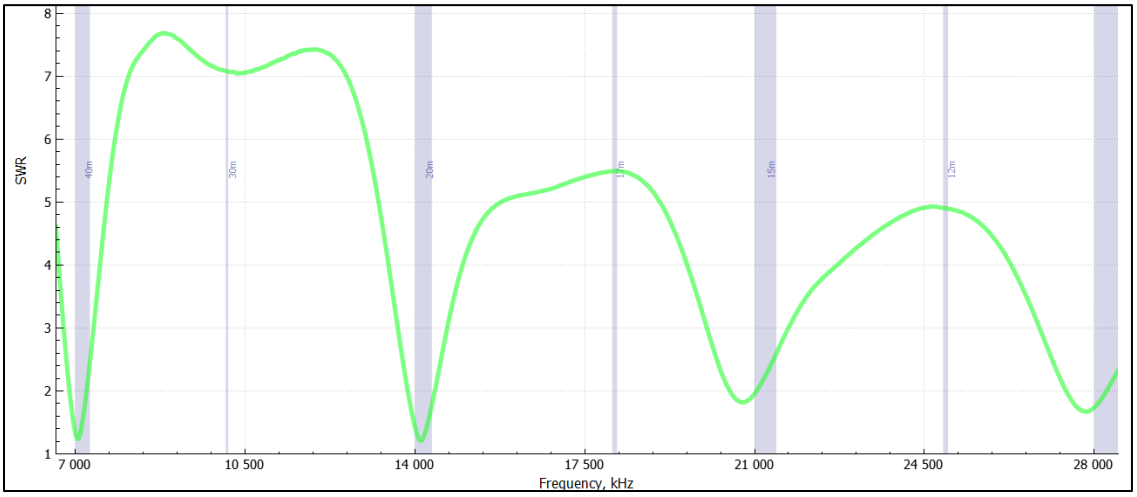


Figure 7. Measured SWR Graph (6.5 – 29.0 MHz).

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

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

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