HF Faraday Loop Antenna
(CHA F-LOOP)
Operator’s Manual
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.

WARNING! A tuned loop can exhibit several hundred Volts and concentrated electromagnetic radiation when operating at QRP power levels (5-10 W). At higher RF levels, several thousand volts will be present at resonance! Exercise caution when using this antenna. Operate this antenna at your own risk.

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™ High Frequency (HF) Faraday Loop Antenna (CHA F-LOOP). The unique craftsmanship of the CHA F-LOOP distinguishes itself from the competition. You are now part of the magnetic loop HF antenna craze that is sweeping the amateur radio community. Easily deployable HF magnetic loop antennas, also called small transmitting loops, have been routinely used for many years in professional defense, military, diplomatic, and shipboard HF communication links, where robust and reliable general coverage radio communication is deemed mandatory. These antennas have only recently become commercially available for amateur radio. You will be amazed by the performance of this antenna. The real practical advantage of the small loop, compared to a short vertical whip tuned against earth or a full sized vertical antenna, is the loop’s freedom from dependence on a ground plane and earth for achieving efficient operation; this unique characteristic has profound significance for small restricted space antenna operation. In comparison, the bottom of a vertically oriented the loop does not need to more than a loop diameter above ground making it very easy to site in a restricted space location. There is no significant improvement in performance when a small loop is raised to great heights; all that matters is the loop is substantially clear of objects in the immediate area and towards the desired direction of radiation. Field trials of the CHA F-LOOP demonstrated that an inside magnetic loop antenna was only around one to two S-units lower, on both transmit and receive, than an outside full size quarter wave vertical antenna. Remarkable for an antenna that is only less than three foot in diameter and covers 5.3 MHz to 29.7 MHz (60 – 10 meter ham bands)! The magnetic loop is different than typical antennas because it emphasizes the magnetic part of the radio wave (H field) rather than the electric part (E field) of the radio wave. It also has a high Q resonance of around 15 KHz on 60 meters, providing immunity from interference outside the bandpass. The CHA F-LOOP Antenna was designed with weight, portability, versatility and cost in mind and is ideal for RV/camping, hotels, apartments, condominiums, homeowners associations, deed restrictions and CCRs (Covenants, Conditions & Restrictions), Shortwave Listening (SWL) and other places where it is not feasible to erect a multi-band wire or vertical antenna.

The standard CHA F-LOOP, see plate (1), is comprised of a three foot diameter flexible radiator loop, a Faraday loop, a proprietary takedown hardline feeder section that minimize SWR variation, a specially designed tuning unit, and coaxial feedline – all of which fit in the supplied Flat Dark Earth (FDE) / Coyote Brown military-style MOLLE bag. A high-efficiency 1” collapsible aluminum tubing radiator loop, which increases efficiency an average of 142% over the standard flexible radiator loop, is available as an option. The CHA F-LOOP doesn’t require a ground-plane and doesn’t need to be mounted up high. Do not use an antenna tuner or coupler, as it may cause you to mistune the 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 F-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 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.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Distance</th>
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<tbody>
<tr>
<td>2 MHz</td>
<td>88 miles</td>
<td>14 MHz</td>
<td>33 miles</td>
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<tr>
<td>4 MHz</td>
<td>62 miles</td>
<td>18 MHz</td>
<td>29 miles</td>
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<td>7 MHz</td>
<td>47 miles</td>
<td>24 MHz</td>
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<tr>
<td>10 MHz</td>
<td>39 miles</td>
<td>30 MHz</td>
<td>23 miles</td>
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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.

A magnetic loop antenna radiates at all angles from horizon to zenith, making it an equally effective antenna for both local and long-distance (DX) communication. While not specifically designed for NVIS, during field testing of the CHA F-LOOP, both DX and NVIS contacts were made on the 30 meter ham band within minutes of each other.

**Parts of the Antenna**

The CHA F-LOOP is comprised of the following components, see plates (2) and (4):

![Plate 2. Standard CHA F-LOOP Antenna.](image)

- **a. Tuning Unit**
  
The Tuning Unit adjusts the resonant frequency of the CHA F-LOOP antenna.

- **b. Standard Flexible / Optional High-Efficiency Radiator Loop**
The Standard Flexible Radiator Loop consists of a 2.44 foot diameter insulated flexible metal loop with UHF Plugs (PL-259) at both ends. The Optional High-Efficiency Radiator Loop consists of three sections of rigid aluminum tubing with end fittings.

c. **Faraday Loop**

The Faraday Loop is a small aluminum loop attached to the end of the Takedown Hardline Section (d).

d. **Takedown Hardline Section**

The two Takedown Hardline Sections connect the Tuning Unit (a) to the Faraday Loop (c). There are UHF Plugs on each end of the sections. They are not used in the High-Efficiency CHA F-LOOP Antenna configuration.

e. **Takedown Hardline Connection**

The Takedown Hardline Connection is located on top of the Tuning Unit (a).

f. **Flexible Radiator Loop Connections**

The Flexible Radiator Loop Connections are UHF sockets (SO-239) located on the right and left sides of the Tuning Capacitor Box (a). These connections are not used in the High-Efficiency CHA F-LOOP Antenna configuration.

g. **Coaxial Cable Connection**

The Coaxial Cable Connection is a UHF socket located on the rear of the Tuning Unit (a) and is used to connect the Coaxial Cable (k) to the radio. It is not used in the High-Efficiency CHA F-LOOP Antenna configuration.

h. **Tuning Knob**

The Tuning Knob is located on the front of the Tuning Unit (a) and is used to adjust the resonant frequency of the loop. The relative position of the tuning capacitor, which rotates around 2 ¾ revolutions is shown on the front panel Tuning Quadrant Indicator. Left, or counter-clockwise, increases the resonant frequency of the antenna. Right, or clockwise, decreases the resonant frequency of the antenna.

i. **Band Switch**

The Band Switch, see plate (6), is located on the top of the Tuning Unit (a). It has two positions, marked “A” and “B”. When using the Standard Loop, the “A” position covers 5.3 to 7.299 MHz and the “B” position covers 7.3 to 29.7 MHz. The “A” position covers 3.5 to 10.0 MHz when the optional 80 Meter Conversion Kit is installed.

j. **UHF Barrel**

The UHF Barrel connects the two Takedown Hardline Sections (d) together. The barrel connector is not used in the High-Efficiency CHA F-LOOP Antenna configuration.

k. **Loop Connection**
The Loop Connection is a UHF socket located on the bottom of the Faraday Loop (c).

l. Coaxial Cable Assembly

The Coaxial Cable Assembly (not shown) is a 12 foot length of coaxial cable, with an RF isolator at the antenna end, used to connect the CHA F-LOOP Antenna to your radio.

m. Aluminum Base Plate

The Aluminum Base Plate, see plate (3), is on the bottom of the Tuning Unit (a). It is used to mount the CHA F-LOOP to a tripod or other antenna mount with a 3/8” stud.

n. Portable Bag

The Portable Bag, see plate (1), is a Flat Dark Earth (FDE) / Coyote Brown military-style MOLLE bag used to store and transport the components of the CHA F-LOOP, making it highly portable.

o. Faraday Loop Strap

The Faraday Loop Strap is a sticky strap used to hold the Faraday Loop (c) to the Radiator Loop (b).

p. High-Efficiency Radiator Loop Connections

The connections for the optional High-Efficiency Radiator Loop (b), see plate (5) are brackets located on the rear edge of the Tuning Unit (a). They are not used in the Standard CHA F-LOOP configuration.

q. High-Efficiency Radiator Loop Joints

The High-Efficiency Radiator Loop Joints, see plate (5), are used to connect together the three sections of the Optional High-Efficiency Radiator Loop tubing.

r. High-Efficiency Radiator Coaxial Cable Assembly

The High Efficiency Radiator Coaxial Assembly, see Plate (4), is a 25 inch length of coaxial cable used to connect the Tuning Unit (a) to the Faraday Loop (c).

s. Flexible Radiator Loop Extension

The Flexible Radiator Loop Extension consists of a 2.44 foot diameter insulated flexible metal loop with UHF Plugs (PL-259) at both ends.

t. Loop Extension Barrel Connector

The Radiator Loop Barrel Connector is used to join the Flexible Radiator Loop (b) to the Flexible Radiator Loop Extension (s).
Standard Flexible Loop Assembly

The CHA F-LOOP antenna should be installed near the radio set; either indoors or in a sheltered outside area, such as a balcony or porch. Because the magnetic component of an electromagnetic wave is maximum at the boundary between the ground and the space above, loop performance is usually best when the loop is located near the ground at a distance outside of the loop’s close-in induction field (just a loop diameter or two). The CHA F-LOOP is not waterproof and must be installed in an area protected from the weather. Do not use an antenna tuner or coupler with this antenna, as it may cause you to mistune the antenna.

Perform the following steps to assemble the Standard Flexible Loop Antenna, see plates (2) and (3).

1. Select a location to setup the CHA F-LOOP antenna. The location can be indoors or in an outdoors area protected from the weather. The location must facilitate accessibility by the operator to the Tuning Knob (h). The operator needs to be able to adjust the Tuning Knob while listening to the receiver, activating the transmitter, and observing the SWR meter. If used indoors, the location should also be reasonably away from switching power supplies, Internet routers, and other sources of electrical and electronic interference.

2. Remove the CHA F-LOOP components from the Portable Bag (n).

3. Connect the two Takedown Hardline Sections (d) together using the UHF Barrel Connector (j).

4. Connect one end of the assembled Takedown Hardline Section to the top of the Tuning Unit (a).

5. Connect the Faraday Loop (c) to the unconnected end of the Takedown Hardline Section.

6. Connect one end of the Flexible Radiator Loop (b) to the left Radiator Loop Connection (f).

7. Connect the other end of the Flexible Radiator Loop to the right Radiator Loop Connection.

Plate 3. Standard Loop Assembly.
8. Secure the top middle of the Flexible Radiator Loop to the top middle of the Faraday Loop with the attached Faraday Loop Strap (o).
9. Place the CHA F-LOOP on a table top or attach the Aluminum Base Plate (m) to a tripod or other antenna mount.

10. Connect the Coaxial Cable Assembly (l) to the Coaxial Cable Connection (g) on the back of the Tuning Capacitor Box.
11. Perform an operational test (see procedure below).
12. This completes installation of the Standard CHA F-LOOP Flexible Loop configuration.

High Efficiency Loop Assembly

The High Efficiency Loop configuration requires the purchase of the optional high-efficiency collapsible aluminum tubing radiator loop. The high-efficiency radiator loop increases performance of the CHA F-LOOP Antenna, particularly on 40 through 20 meters. The CHA F-LOOP antenna should be installed near the radio set; either indoors or in a sheltered outside area, such as a balcony or porch. Because the magnetic component of an electromagnetic wave is maximum at the boundary between the ground and the space above, loop performance is usually best when the loop is located near the ground at a distance outside of the loop’s close-in induction field (just a loop diameter or two). The CHA F-LOOP is not waterproof and must be installed in an area protected from the weather. Do not use an antenna tuner or coupler with this antenna, as it may cause you to mistune the antenna.

Perform the following steps to assemble the High-Efficiency Loop Antenna, see plates (4) and (5).

1. Select a location to setup the CHA F-LOOP antenna. The location can be indoors or in an outdoors area protected from the weather. The location must facilitate accessibility by the operator to the Tuning Knob (h). The operator needs to be able to adjust the Tuning Knob while listening to the receiver, activating the transmitter, and observing the SWR meter. If used indoors, the location should also be reasonably away from switching power supplies, Internet routers, and other sources of electrical and electronic interference.
2. Remove the CHA F-LOOP components from the Portable Bag (n).
3. Connect one of the lower loop tubing sections to one side of the Tuning Unit (a) by inserting a hex bolt through the curved side of the tubing section end fitting. Then position the flat edge of the tubing section end fitting against front of the bracket on the side of the Tuning Unit and push the hex bolt through the hole in the bracket. Place a flat washer on the hex bolt on the back of the bracket. Place a wing nut on the end of hex bolt and tighten securely (finger tight). See Plate (5).
4. Attached the other lower tubing section to the other side of the Tuning Unit as in step (3). The Flexible Radiator Loop Connections (f) are not used in this configuration.
5. Attach the top tubing section of the loop to the top ends of the two lower tubing sections, from steps (3) and (4). Inserting a knurled bolt through the round side of one of the bottom tubing sections, placing the hole in the end fitting of one end of the top section over the knurled bolt on the flat side of the lower tubing section. Place a flat washer over the end of the knurled bolt. Place a wing nut on the end of the knurled bolt and tighten securely (finger tight). Repeat for the other side of the top tubing section. See Plate (5).
6. Secure Faraday Loop (c) top the top middle of the upper tubing section using the Faraday Loop Strap (o).
7. Connect one end of the Coaxial Cable Assembly (r) to the Loop Connection (k). Connect the remaining end to the Takedown Hardline Connection (e) on the top of the Tuning Unit.
8. Place the CHA F-LOOP on a table top or attach the Aluminum Base Plate (m) to a tripod or other antenna mount.
9. Connect the Coaxial Cable Assembly (l) to the Coaxial Cable Connection (g) on the back of the Tuning Capacitor Box.
10. Perform an operational test (see procedure below).
11. This completes installation of the Optional CHA F-LOOP High-Efficiency loop configuration.
80 Meter Conversion Kit Installation

The CHA F-LOOP 80 Meter Conversion Kit allows you to use the CHA F-LOOP on the 80m ham band by extending the lower frequency range of the Cha F-LOOP down to 3.5 MHz. It is easy to install, simply perform the following steps. See plate (6) which shows the kit installed on the CHA F-LOOP.

1. Disconnect one end of the Flexible Radiator Loop (b) from the Flexible Radiator Loop Connection (f).
2. Connect the free end of the Flexible Radiator Loop to the Loop Extension Barrel Connector (t).
3. Connect one end of the Flexible Radiator Loop Extension (s) to the open Flexible Radiator Loop Connection from step 1.
4. Form the Flexible Radiator Loop Extension into a loop, like the Flexible Radiator Loop.
5. Attach the top of the Flexible Radiator Loop Extension to the Faraday Loop (c) using a Faraday Loop Strap (o).
6. Connect the free end of the Flexible Radiator Loop Extension to the open end of the Loop Extension Barrel Connector.
7. Set Band Switch (i) to the “A” position.
8. This completes installation of the 80 Meter Conversion Kit.

Plate 5. High Efficiency Loop Assembly.

Plate 6. Installed 80 Meter Conversion Kit.
Loop Operation
The CHA F-LOOP is very easy to use. Perform the following steps whenever you change frequency.

1. The CHA F-LOOP is bidirectional favoring the sides, see plate (7). If possible, point one side toward the target signal and rotate the antenna for maximum signal strength.
2. Set the Band Switch (i) to the desired frequency range.
3. Adjust the Tuning Knob (h) for maximum receive signal strength. Turn the Tuning Knob counterclockwise to decrease the resonant frequency. You will know when you are close to resonant frequency because you will start hearing signals and a marked increase in receiver background noise.

Plate 6. CHA F-Loop Antenna Tuning.

The Tuning Knob uses a 6:1 reduction drive which allows for fine adjustment and will rotate approximately 2¾ revolutions from lowest to highest frequency. Do not attempt to force the Tuning Knob past the stops.
4. Ensure your transmitter is set for no more than 5 Watts during tuning.

Plate 7. CHA F-LOOP Antenna Directivity.

5. Transmit a carrier and gradually turn the Tuning Knob counterclockwise and then clockwise, around the highest receive signal point found in step 3, to obtain the lowest SWR. An SWR of 1.5:1 or less is satisfactory. Your hand may slightly influence the resonance of the loop while turning the Tuning Knob. This is completely normal and you may have to “touch up” the adjustment slightly. The bandwidth of the loop at 60 meters is only 15 KHz, so once you are close to resonance, make only the slightest of Tuning Knob adjustments.
6. Increase transmitter power to no more than 15 Watts, see specifications.

Troubleshooting
1. Ensure the loop is away from metal surfaces. Sometimes simply reorienting, relocating, or elevating the loop around two to four feet higher will reduce the SWR.
2. Ensure Takedown Hardline Connections (e) and Radiator Loop Connections (f) are securely tightened.
3. Inspect Takedown Hardline Sections for damage. Replace if damaged.
4. Inspect Flexible Radiator Loop (b) for damage. Replace of damaged.
5. Ensure the Coaxial Cable Connection (g) is securely tightened.
6. Inspect Coaxial Cable assembly for cuts in insulation or exposed shielding. Replace if damaged.
7. Ensure Band Switch (i) is set for your frequency range.
8. Turn Tuning Knob (h) fully counterclockwise.
9. Adjust Tuning Knob over entire range listening for a marked increase in received signal strength and receiver background noise.
10. If still not operational, replace Coaxial Cable assembly. *Most problems with antenna systems are caused by the coaxial cables and connectors.*
11. If still not operational, contact us for technical support.

**Specifications**

- **Frequency:** 5.3 – 29.7 MHz (60 through 10 meter ham bands), 3.5 – 10.0 Mhz (80 through 40 meter ham bands) with optional 80 Meter Conversion Kit.
- **Power:** 25W intermittent duty cycle (SSB and SSB-based digital), 10W continuous duty cycle (CW, AM, FM, RTTY).
- **Diameter:** 2.44 feet
- **RF Connection:** UHF Plug (PL-259)
- **SWR:** Operator tunable, not greater than 1.5:1 at resonance and less than 2:1 for 15 KHz bandwidth
- **Weight:** 4 lbs
- **Personnel Requirements and Setup Time:** one operator, around 2 minutes
- **Do not use an antenna tuner or coupler with this antenna**

**Accessories**

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

- **High-Efficiency Radiator Loop.** A high-efficiency 1” collapsible aluminum tubing radiator loop, which increases efficiency an average of 142% over the standard flexible radiator loop, is available as an option.
- **Coaxial Cable Assembly.** 50 feet of RG-58 with integrated RFI Choke. Used to connect the CHA F-LOOP to the radio set. This is a 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 Tuning Unit. This accessory is recommended if you are not using the Chameleon Antenna™ Coaxial Cable Assembly.
- **80 Meter Conversion Kit.** The CHA F-LOOP 80 Meter Conversion Kit allows you to use the CHA F-LOOP on the 80 meter ham band by extending the lower frequency range of the Cha F-LOOP down to 3.5 MHz.

Recommended non-supplied accessories:

- **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 SKYLOOP - The CHA SKYLOOP is a 250' full wave loop antenna cut for 80M. With the help of an antenna tuner, the CHA SKYLOOP will cover all the bands between 80M and 6M.

CHA WINDOM 40 – The CHA WINDOM 40 Antenna is designed for 40, 20, and 10 meters. Amateur Bands from 60 through 10 meters can be operated using an antenna tuner. Built with the portable operator in mind, it is very light weight, easy to set up, and comes with a military-style pouch.

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 F-LOOP.

**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.

**References**