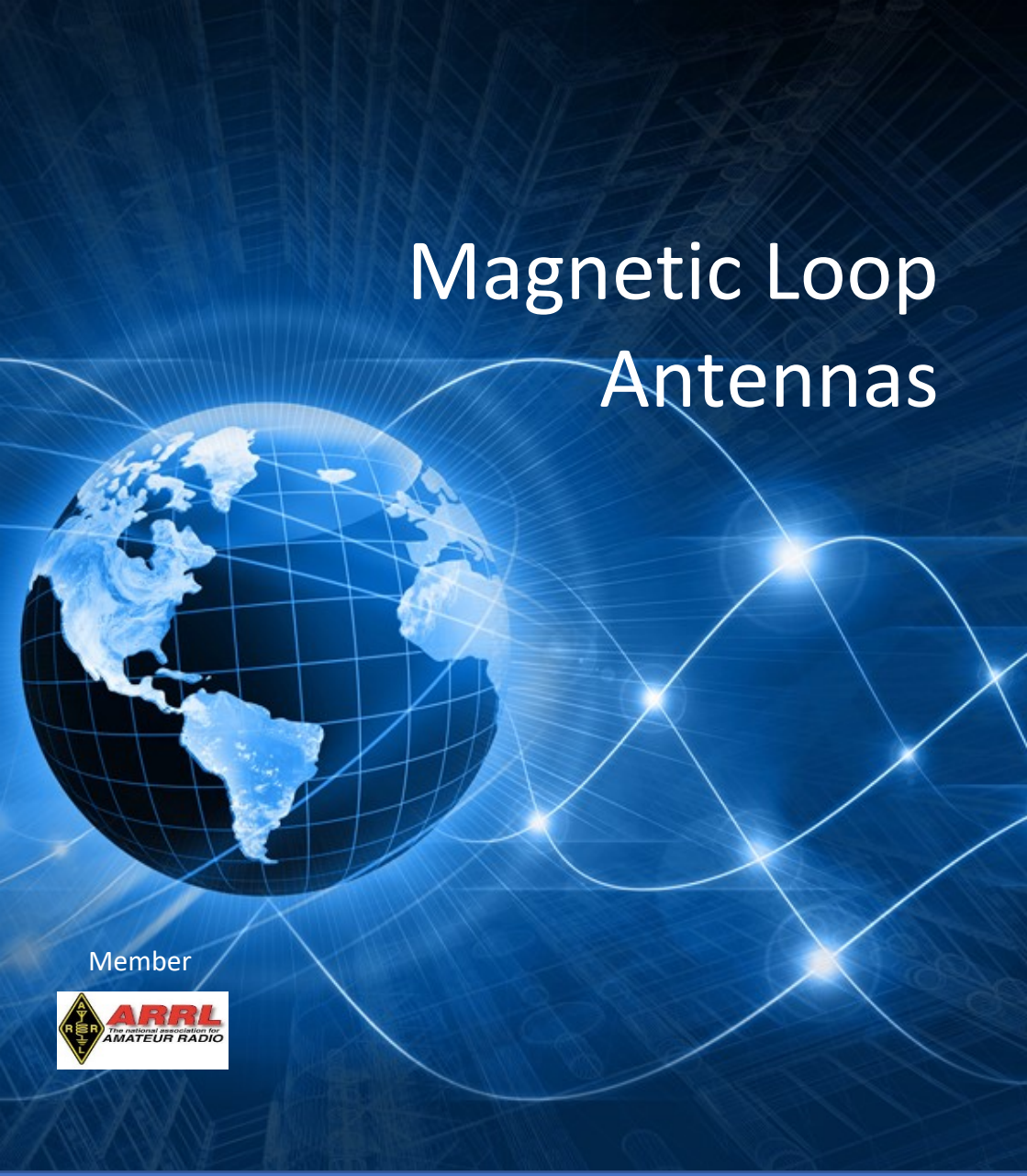
Magnetic Loop Antennas



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Spring 2019 Antenna Catalog

The Magnetic Loop Antenna

Magnetic loop antennas (MLA) are well known for their superior selectivity, low noise and high directivity. Proper design plays a big part in this. It is a very simple antenna. It is just an inductor formed by a wire loop and a capacitor tuned to resonance. An MLA is a convenient and lightweight antenna. It can be deployed quickly and is ideal for use in places where HOA restrictions make full size wire antennas impossible. They are also a favorite for Field Day and summit on the air (SOTA) operations. When designed and constructed properly, an MLA can perform as well or even better than a dipole antenna. When considering an MLA, check these factors:

Radiation Resistance

For any antenna to radiate efficiently, it should have high radiation resistance (*Rrad)*. This may seem counter intuitive, but recall *E=IR,* it is the voltage developed across *Rrad* which induces the electromagnetic flux (radiation). *Rrad* of the average MLA is very low, in the range of milliohms. So lossy equivalent series resistance (*ESR*) in the radiator must be kept to a minimum.

Losses

Losses can be high, especially with skinny radiation loops. With proper design, ESR losses can be made negligible or at least sufficiently low compared to the loop's *Rrad*. The tuner should be designed for low loss and high reliability. All connectors should be silver plated and soldered. Our PreciseLOOP® HG-1 tuner uses a low ESR capacitors, PCB construction for low loss. The loop's radiator is made of a larger surface area low loss LMR600 coax.

Circulating Loop Current

It is only the current through the loop's *Rrad* that is converted to electromagnetic radiation. The current in an MLA is high, about 3-5 Amps for a 10-watt power output. Resonating circuit losses are the product of I^2R copper losses manifested as *Joule* heating. They are comprised of the lumped values *(Rlmp)* of *Rgnd+Rloss+Rrad.* At higher power levels this heat is quite noticeable when touching the loop surface. It can actually change the loop tuning during extended RTTY QSOs. PreciseLOOP® MLAs are designed for maximum loop current with minimum I^2R copper losses providing the highest efficiency.

HG-1 EXPRESS MLA

This portable MLA covers the 40m through 10m bands. It is a low cost, no-option MLA. It is designed for portable receive and transmit use. It is a lower cost model using an LMR400 radiation loop. It includes just the basics but with the same high quality and performance.

The HG-1 EXPRESS Loop is optimized for portable operations featuring greater power handling capability (45W PEP), a precision 6:1 reduction dial with calibrated dial marking, a high surface area 38" LMR400 radiation loop and copper tube induction loop. The package includes:

- 40m-10m Band Coverage (45W PEP)
- Ready for optional 80m-60m Resonators (10W PEP Max)
- Low-loss LMR400 Radiator
- Matched 50 Ω Copper Induction Loop
- Low ESR Dual-Stator Tuning Capacitor
- UV Resistant PVC three Section Mast
- Durable ABS Case with Auxiliary Inputs

Note: Not included are the tripod and adaptor, cables, and premium embroidered padded carrying bag.

Order: HG-1 EXPRESS MLA

HG-1 DELUXE EXPEDITION MLA

The HG-1 is a high gain MLA for receive and transmit use. It covers the 40m through 10m bands (80m-60m with optional resonator). Many operators favor the MLA for Field Day and SOTA operations. It is convenient and lightweight which deploys quickly. It's an ideal solution in places where HOA restrictions make full size wire antennas impossible, or where there's not enough room for a conventional antenna.

When designed and constructed properly, an MLA can perform as well or even better than a dipole antenna. The HG-1 is optimized for portable use, featuring higher gain and greater power handling capability (45W PEP), a precision 6:1 reduction dial with calibrated dial marking, a high surface area, a 38" LMR600 radiation loop, copper tube induction loop and 12' 50Ω feed line. The package includes:

- Covers 40m through 10m Bands (45W PEP)
- Low ESR Dual-Stator Tuning Capacitor
- 80m Resonators (10W PEP Max)
- Low Loss LMR600 Radiator
- Matched 50Ω Copper Induction Loop
- UV Resistant PVC three Section Mast
- Durable ABS Case with Auxiliary inputs
- 12' Coax Feedline T-1U Universal Tripod

Order: HG-1 DELUXE EXPIDITION MLA

SOTA-1 QRP MLA

This MLA is a very light weight compact and portable MLA. It covers 40m-10m. It is ideal for summit on the air (SOTA) operations where backpacking requires light weight, for receive and transmit use. The SOTA-1 QRP MLA is optimized for portable and SOTA operations featuring portability and QRP power handling capability (15W PEP). It features a precision 3:1 reduction dial with calibrated dial marking, a high surface area LMR400 radiation loop, copper tube induction loop and a twelve-foot 50Ω feed line. It comes in a light weight convenient premium nylon bag. Package includes:

- 40m-10m Band Coverage (15W PEP)
- Matched 50Ω Copper Induction Loop
- Lightweight LMR400 Radiation Loop
- QRP Low ESR Dual-Stator Tuning Capacitor
- UV Resistant PVC three Section Mast
- Durable ABS Tuner Case
- 12’ Coax Feedline
- Lightweight Tripod
- Compact Carry Bag

Order: SOTA-1 QRP MLA

NEW! HG-1 WR MLA

This outdoor deployable MLA covers the 40m through 10m bands (80m-60m with optional resonator). Many hams want to use their MLA outdoors in harsher weather conditions with remote operation capability. It is ideal for HOA and other fixed installations. It features remote tuning in a weather sealed enclosure. Control is via the new HG-2 universal controller and common CAT-6 cable. The remote tuner features end-of-cap travel limit switches for long life.

While there is a shallow learning curve to get used to remote tuning, SWR is as low as the manually tuned HD-1 which uses the identical tuning capacitor (See HG-1 WR REMOTE LOOP TUNER page 9 & Deployment page 10). We recommend, for convenient and quick tuning to lowest SWR, using an auto tuner such as those found in the KX2 or similar transceivers. For permanent installations, the HG-1 WR requires a mounting mast (10' TV antenna type mast and "U" brackets which are available from home improvement stores). Remote operation has been tested to 150'. Package includes:

- 40m-10m Band Coverage (45W PEP)
- Low Loss LMR600 Radiator & Matched 50Ω Copper Induction Loop
- Low ESR Dual-Stator Tuning Capacitor
- ABS Water Resistant Case with Aux Inputs
- UV Resistant PVC three Section Mast
- HG-1 WR Remote Tuner & HG-2 Universal Controller
- 12' Coax Feedline and CAT-6 Control Cable

Order: HG-1 WR MLA

NEW! HG-1 WR/AR1 DELUXE MLA

In addition to having all the performance and features of the standard HG-1 WR MLA, the HG-1 WR/AR1 Deluxe MLA package can be deployed temporarily using the supplied T-1U UNIVERSAL TRIPOD or mounted permanently. It comes with the new REMOTE AR-1 ANTENNA ROTATOR. It covers the 40m through 10m bands (80m-60m with optional resonator). It is outdoor deployable, water-resistant and ideal for HOA and other fixed installations. It features remote tuning and rotation capability. It uses the new HG-2 universal controller. While there is a shallow learning curve to get used to remote tuning, SWR is as low as the manually tuned HD-1 which uses the identical tuning capacitor. We recommend, for convenient and quick tuning to lowest SWR, using an auto tuner, such as those found in the KX2 or similar transceivers. (See HG-1 WR REMOTE LOOP TUNER page 9 and Deployment page 10). Remote operation has been tested to 150'. Package includes:

- All Features of the HG-1 WR MLA plus:
- T-1U Universal Tripod
- HG-1 WR Remote Tuner
- AR1 Remote Rotator
- HG-2 Universal Controller
- 12' Coax Feedline and CAT-6 Cable

Order: HG-1 WR DELUXE MLA

HG-2 REMOTE LOOP TUNER

This tuner is a compact, easy-to-use, remote tuner option for the HG-1 MLA. It replaces the manual tuning knob as a retrofit for the HG-1 MLA. It uses the new HG-2 universal controller. The controller features an efficient, low noise, pulse-width modulated motor controller. A custom designed current limiter detects the end of the tuning range and alerts the operator when the tuning limit is reached by an LED indicator. A 6:1 reduction gear and fail-safe slip clutch mechanism protects the motor and tuning capacitor as well. Remote operation has been tested to 150'. Some assembly required.

HG-2 Controller, Motor and CAT-6 cable shown mounted on HG-tuner

Differences Between Manual and Remote Tuning

Using a remote tuner is different than tuning by hand manually. It takes a little practice. When tuning by hand the operator tunes for a peak receiver signal. Tune rapidly for a peak receive signal and then make small adjustments to fine tune and to achieve the lowest SWR. If you were to tune slowly, you might never notice the increased noise level indicating a peak signal (as is done by a competitor's remote tuner).

Adjusting the Stall Limit Light Threshold

1. Locate the limit adjustment potentiometer located on the interface circuit board
2. Adjust the limit potentiometer so that the Stall light stays on as the CCW and CW limits are reached. Slight flickering of the Stall light is normal.
3. Replace the cover. Do not over tighten the cover screws.

Order: HG-2 REMOTE LOOP TUNER

NEW! HG-1 WR REMOTE LOOP TUNER

This remote is designed for harsher outdoor and fixed installations. It is a durable, easy-to-use, remote tuner upgrade to your existing HG-1 MLA using its radiation and induction loops and mast. It features end-of-cap travel limit switches for long life. It uses the new HG-2 universal controller. To maximize reliability found in the harsher environmental conditions outdoors, this remote tuner uses a lower RPM motor and no reduction gear. For this reason, there is a shallow learning curve to get used to remote tuning. SWR is as low as the manually tuned HD-1 which uses the identical tuning capacitor. We recommend, for convenient and quick tuning to lowest SWR, using an auto tuner, such as those found in the KX2 or similar transceivers. Remote operation has been tested to 150'. In summary, the HG-1 RS features:

- Covers the 40m through 10m bands (80n-60m with optional resonator).
- Water and UV resistant case with a split rotor 45W PEP tuning capacitor.
- Includes the tuning motor and CAT-6 cable.

Differences Between Manual and Remote Tuning

Using a remote tuner is different than tuning by hand manually. It takes a little practice. When tuning by hand the operator tunes for a peak receiver signal. Tune rapidly for a peak receive signal and then make small adjustments to fine tune and to achieve the lowest SWR. If you were to tune slowly, you might never notice the increased noise level indicating a peak signal (as is done by a competitor's remote tuner).

Order: HG-1 WR REMOTE LOOP TUNER

Deploying the HG-2 Remote Tuner

1. Make sure the HG-1 MLA is placed in an obstruction free area.
2. For better water protection, the HG-1 motor drive assembly may be mounted facing down.
3. Connect both ends of the supplied cable (common CAT-6 cable) to the motor assembly and controller.
4. Turn the HG-1 Remote Tuner on; the green SBY LED should illuminate.
5. Set the Rate control to a mid-scale position.
6. While observing the motor assembly, push the red Up or green Down buttons. Note the motor turning CCW or CW depending on the button pushed. This is an indication that the system is correctly connected and everything is in order. If the red Stall LED comes on, that is also OK. It just means you have reached the limits of the tuning range.

Tuning with the HG-2 Remote Tuner

1. If possible, turn the receiver AGC off or set it to slow; bypass any external or automatic antenna tuner and set the mode to SSB (it has the loudest background noise).
2. Turn the HG-1 Remote Controller to SBY (on) and set the Rate control to a mid-range setting.
3. Using the red Up or green Down buttons, tune for a peak receive signal (use your ears or the S meter). The maximum peak will be brief, but obvious. You may have to momentarily push the Up or Down buttons to get close.
4. Once you receive an obvious peak signal, reduce the Rate control to about 1/3 and alternately make small adjustments by briefly tapping the Up or Down buttons for the strongest peak signal.
5. Note, when checking SWR, transmit a low power carrier. You should be able to achieve an SWR of 3:1 or better. Once you achieve 3:1 or better, use an external or built-in auto tuner to touch up the SWR. You should easily achieve an SWR of 1:1.5 or better.
6. Set the receiver to the desired mode and turn the HG-2 Remote Controller off.

NEW! REMOTE AR-1 ANTENNA ROTATOR

This rotator was designed as a companion product to the HG-1 WR REMOTE LOOP TUNER. It is ideal for medium weight antennas such as the HD-1, HD-1 WR, and Buddipole® antennas. It includes the CAT-6 cable. It is constructed with a heavy-duty motor, water resistant assembly and UV resistant PVC for permanent installations. It uses end-of-rotation limit switches for reliability and long service life suitable for outdoor deployment.

Tripod mounting is simple. It uses the popular ½" thread mount used on many antenna tripods. It can also be mounted directly to a TV mast with "U" clamps. Remote operation has been tested to 150'. The AR-1 features sufficient torque to handle wind loads up to about 45 knots when deployed on symmetrical loop and dipole antennas. It uses the new HG-2 universal controller.

- Rotates +/- 180 Degrees
- Water and UV Resistant PVC Construction
- Heavy Duty High Torque Tuning Motor and CAT-6 Cable

Order: REMOTE AR-1 ANTENNA ROTATOR

NEW! HG-1 WR/AR1 REMOTE TUNER PACKAGE

Save big when you upgrade your existing HG-1 MLA for the efficiency and convenience of remote operations. This package uses your existing HG-1 MLA radiation loop(s) and mast. It is designed for fixed outdoor installation and comes with a water-resistant case, tuning capacitor and tuning motor. This package is great for those living in restricted HOAs wanting a high-performance DX operation while saving big over buying the items separately. See the detailed description for the HG-1 WR REMOTE LOOP TUNER and HG-1 WR/AR1 REMOTE for more information. It includes:

- HG-1 WR Remote Tuner
- AR1 Remote Antenna Rotator
- HG-2 Universal Controller
- CAT-6 Cables

Order: HG-1 WR/AR1 REMOTE TUNER PACKAGE

NEW! ML-1 MAG LOOP TUNER

There are times under some circumstances when it is not possible to achieve low SWR (less than 2:1). This is especially true when working the lower band 80m-40m and when an external tuner is not available. Enter the MLT-1 Mag Loop Tuner. It uses an "L" network to match an MLA's 50Ω induction loop Z when using extended frequency coverage. It is not designed to resonate an MLA. Recommended for those without an auto tuner and the external 80-40 meter resonators.

Order: ML-1 MAG LOOP TUNER

CMB-300 1:1 BALUN

This common mode balun was specially designed for MLAs with longer feedline runs. It features a common mode rejection ratio (CMR) of 30dB and provides excellent common mode current rejection. When used with the PreciseLOOP® antennas, the CMB-300 1:1 Common Mode Balun increases the efficiency and reduces the losses of your antenna on the HF bands such as 10, 20, 40, 60 and 80 meters. It operates from 1.8 to 30 MHz at power levels up to 300 watts.

Order: CMB-300 1:1 BALUN

60M-1 RESONATOR

This water-resistant resonator plugs into the tuner's accessory plug. It uses a high Q capacitor tuned to the 60-meter band. It provides superior tuning selectivity and excellent receiver sensitivity. Maximum transmitting power is 10W PEP. By plugging the 60M-1 resonator into the accessory banana plugs on the PreciseLOOP® antenna, it places additional capacitance in parallel with the main tuning capacitor. Tuning to resonance is done by adjusting the main tuning capacitor to the desired frequency.

Order: 60M-1 RESONATOR

80M-1 RESONATOR

This water-resistant resonator plugs into the tuner's accessory plug. It uses a high Q capacitor tuned to the 80-meter band. It provides superior tuning selectivity and excellent receiver sensitivity. Maximum transmitting power is 10W PEP. By plugging the 80M-1 resonator into the accessory banana plugs on the PreciseLOOP® antenna, it places additional capacitance in parallel with the main tuning capacitor. Tuning to resonance is done by adjusting the main tuning capacitor to the desired frequency.

Order: 80M-1 RESONATOR

NEW! VARIABLE 60-80M RESONATOR

If you wish to operate on 80m through 40m with just one external resonator, this is what you need. It plugs into the PreciseLOOP® antenna accessory plug. It uses a high Q capacitor. It tunes the 3.5-6.5MHz HF bands providing superior tuning selectivity and excellent receiver sensitivity. By plugging this resonator into the accessory banana plugs on the PreciseLOOP® antenna, it places additional capacitance in parallel with the main tuning capacitor. You can now tune the MLA to resonance by using the variable dial or by adjusting the main tuning capacitor to the desired frequency. Not water resistant. Maximum transmitting power is 10W PEP.

Order: VARIABLE 60-80M RESONATOR

40-10M RESONATOR/TUNER

This tuner/resonator is a replacement or spare for the HG-1 Mag Loop Antenna. It covers the 40m through 10m bands (80m-60m with optional resonator). It is the tuning-resonator module only. It does not include the radiation loop, induction loop, mast, bag or tripod. Maximum transmitting power is 45W PEP.

Order: 40-10M RESONATOR/TUNER

NEW! T-1U UNIVERSAL TRIPOD

This antenna tripod extends to six feet using two telescoping sections. Wide legs provided added stability. Included are both a standard 25mm tripod fitting for HG-1 Loop antennas and ½" pipe thread adaptor for use with the AR-1 Rotator and Buddipole® antennas. Includes a durable padded carrying bag (does not fit in the PreciseLOOP® Deluxe Bag).

Order: T-1U UNIVERSAL TRIPOD

MLA-1 TRIPOD

This tripod comes with the custom-made MLA-25mm Adaptor. The adaptor has the standard 25mm threads and mounts directly on to the tripod. The loop antenna mast fits snuggly into the adaptor. When not in use, the tripod collapses to 7.1" and weighs just 2.2 lb. It fits in the PreciseLOOP® Deluxe Bag.

Order: MLA-1 TRIPOD

MLA-25 TRIPOD ADAPTOR 25mm

This custom-made adaptor is designed for the HG-1 and SOTA masts and fits third party camera standard 25mm tripods heads.

Order: MLA-25 TRIPOD ADAPTOR 25mm

THE PeciseLOOP® MAGNETIC LOOP ANTENNA (MLA)

Roger Stenbock W1RMS September 12, 2017

An MLA is a very simple antenna. It is just an inductor formed by a wire loop and a capacitor tuned to resonance. An MLA is a convenient, lightweight antenna, which can be deployed quickly and is ideal for use in places where HOA restrictions make full size wire antennas impossible, or where there just is not enough room to erect a conventional antenna.

Many operators favor the MLA for field day and SOTA operations. When designed and constructed properly, an MLA can perform as well or even better than a dipole antenna. How well this antenna works depends on several factors:

Radiation Resistance

For an antenna to radiate efficiently, it should have high radiation resistance. The radiation resistance of the average MLA is very low, in the range of milliohms. Radiation efficiency and good performance can be achieved. The PreciseLOOPs use low loss radiators.

Losses

Losses can be high, especially with skinny radiation loops. With proper design these series equivalent circuit losses can be made negligible or at least sufficiently small compared to the loop's radiation resistance. The tuner should be designed for low loss and high reliability. All connectors should be silver plated and soldered. Our PreciseLoop® HG-1 tuner uses PCB construction for low loss, solid connections and superior performance.

Circulating Loop Current

It is only the current through the loop's radiation resistance that results in RF power being converted to electromagnetic radiation. The current in an MLA is high, about 3-5 amps for 10 watt power. Losses are the result of IR losses in resonating circuit. They are composed of the lumped values (Rlmp) of Rgnd+rloss+Rrad +Rrad. PreciseLOOPs are designed for maximum loop current providing the highest efficiency.

Loop Losses

Because of skin effect, loop losses are primarily determined by the conductor's total surface area. The greater the area, the lower the losses. Recall that the surface area increases by the square of the conductor's diameter. This is true for both braided and copper clad loops. That is why PreciseLOOPs use more expensive copper braided LMR600 and copper clad Cell-flex radiation loops.

Tuning Capacitor

The voltage across the tuning capacitor is high (in the kV range) depending on power. For portable operations under 50 watts, an air variable capacitor can be used, usually of a dual stator type. PreciseLOOPs use premium grade and larger high voltage capacitors.

Tuning Dial

Most MLAs will have some kind of reduction drive, and the better models have a calibrated dial. The PreciseLOOP® HG-1 uses a 6:1 drive and the PreciseLOOP® SOTA model uses a 3:1 reduction drive with clearly marked band coverage.

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Receiver Mode Advange

The high-Q resonator imparts a very narrow band frequency selective bandpass filter ahead of the Rx front-end stages. Such an incidental preselector comprising the antenna itself imparts greatly improved receiver performance on the congested lower HF bands with high power broadcast stations and particularly when lightning strikes and atmospheric electrical discharges are present in the regional area.

Gain Parameters

The MLA with its doughnut shaped radiation pattern exhibits a typical gain of 1.5 dBi over average ground and a gain of 5 dBi when deployed with either short radials (the length of each radial need only be twice the loop diameter) or mounted over a conductive ground plane surface. The front to side ratio of a loop is typically 20 to 25 dB.

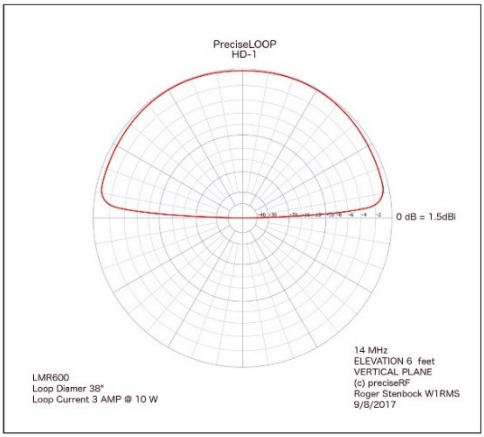

Fig.1 PreciseLOOP radiation vertical plane

In comparison a large ½ λ horizontal dipole mounted ¼ λ above average ground has a gain of 5.12 dBi, and a ¼ λ Vertical, with 120 radials each ¼ λ long, has a gain of 2 dBi over average ground.

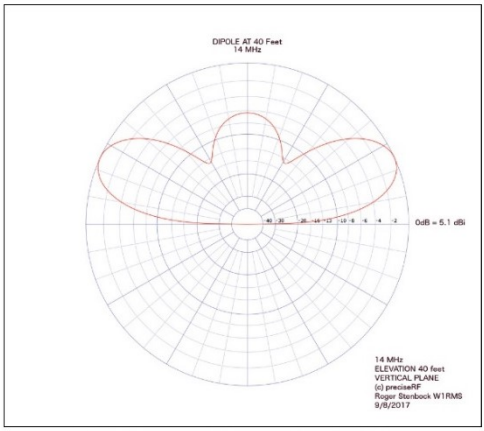

Fig.2 Dipole radiation at 40' vertical plane

Gain v. Dipole

An MLA is usually deployed under portable operations such as field day and Summit On The Air (SOTA). In these applications the questions arrises how does the MLA compare to a dipole erected at lower levels. Since the dipole's takeoff angle is considerably higher, an MLA can outperform a low dipole by as much as 6 dB at the lower takeoff angles for DX use.

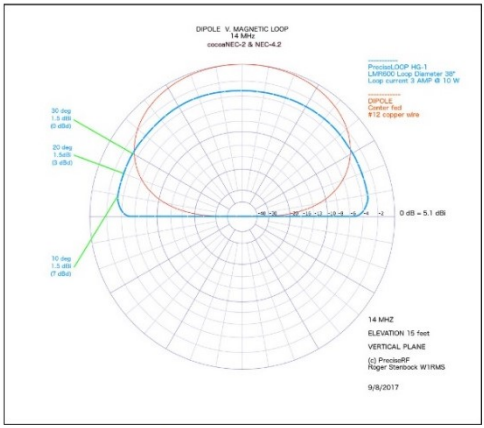

Fig. 3 Gain of MLA (blue) v. low dipole (red) at 15'

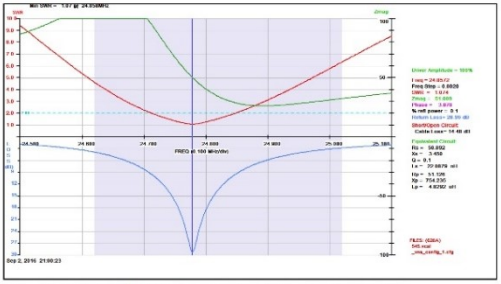

Fig. 10 12M SWR 1.07, Z=51.00 Ω, RL 28.86dB

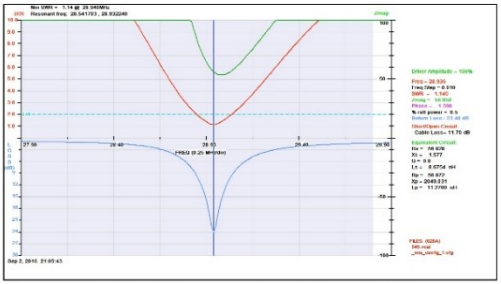

Fig. 11 10M SWR 1.14, Z=56.85 Ω, RL 23.40dB

Current Measurements

Fig. 14 MFJ RF Clamp-on current meter.

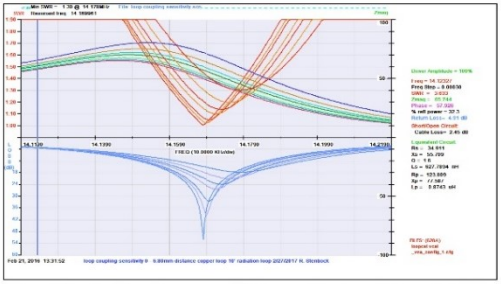

Fig. 12 Induction loop sensitivity, vertical position +/- 1/4"

Measurements taken with an Array Solutions VNA-UHF two port Vector Network Analyzer, 4 kHz to 1200 MHz

Fig. 13 Vector Network Analyzer

EZNEC is a great simulation tool, but it only provide a starting point. Whenever possible, I back-up the simulations with actual measurements. Short of an antenna range, the loop current is the most reliable way to check loop performance. While not a lab grade instrument, the MFJ-853 is a good tool for this measurement. It was calibrated agains a NIST traceable lab RF current probe and calibrated to be accurate to 5%.

In Fig. 14 at left, the meter is indicating 100% of full scale in the 3A position. The clamp disturbance is negligible. VSWR variations were minuscule with the clamped on meter. In all measurements, maximum current was observed at minimum VSWR. I tested a number of loop diameters ranging from 3/8" to 1/2" "hard line (Cell-flex) and LMR600. There was no observable difference between braided and solid coper shielding. The most significant differences was attributed to loop surface area. The test correlated well with SWR Rlmp of Rgnd+Rloss+Rrad+Rrad and power measurements.

Specifications

Item	PreciseLOOP® HG-1		PreciseLOOP® SOTA	
	14 MHz @ 10 W	29 MHz @ 10 W	14 MHz @ 10 W	29 MHz @ 10 W
SWR / RL	1.01 / 41.09 dB	1.14 / 23.40 dB	1.01 / 41.09 dB	1.14 / 23.40 dB
Bandwidth	31.2 kHz	279 kHz	43.1 kHz	321 kHz
Impedance (Ω)	59.17 Ω	56.85 Ω	59.17 Ω	56.85 Ω
Induction Loop	Copper tube 26"	Copper tube 26"	Copper tube 26"	Copper tube 26"
Radiation Loop	MLR600 120"	MLR600 120"	Cellflex 3/8 120"	Cellflex 3/8 120"
Conductor surface area	113 sq. in	113 sq. in	70.7 sq. in	70.7 sq. in
Tuning capacitor	Air variable dual stator	Air variable dual stator	Air variable dual stator	Air variable dual stator
Tuning method	6:1 calibrated dial	6:1 calibrated dial	3:1 marked dial	3:1 marked dial
Quality Factor (Q)	448	104	339	90.4
Rrad	0.074 Ω	1.36 Ω	0.074 Ω	1.36 Ω
Rloss	0.093 Ω	0.134 Ω	0.124 Ω	0.179 Ω
Current loop Imp	3.5 A	3.0 A	3.0 A	2.8 A
Current Irad	1.54 A	2.73 A	1.11 A	2.46 A
Current Iloss	1.96 A	0.297 A	1.89 A	.330 A
Power rad	4.44 W	9.10 W	3.70 W	8.8 W
Efficiency %	44% -3.5 dB	91% -0.4 dB	37% -4.3 dB	88% -.5 dB
Gain dBi / dBd	1.5dBi 3-7 dBd (fig 2.)	1.5dBi 3-7 dBd (fig 2.)	1.5dBi 3-7 dBd (fig 2.)	1.5dBi 3-7 dBd(fig 2.)
Max input power	45 W PEP (SSB)	45W PEP (SSB)	15 W PEP (SSB)	15W PEP (SSB)
Mast with tripod adaptor	3 feet 6" PVC 1" dia.	3 feet 6" PVC 1" dia.	3 feet 6" PVC 1" dia.	3 feet 6" PVC 1" dia.
Weight with bag	4 lb.	4 lb.	3 lb.	3 lb.
Included items	12' 50 Ω BNC cable, Tripod Adaptor, 80M Resonator socket	12' 50 Ω BNC cable, Tripod Adaptor, 80M Resonator socket	12' 50 Ω BNC cable, Tripod Adaptor	12' 50 Ω BNC cable, Tripod Adaptor

Specifications based actual measurements and/or computer models. All products are calibrated and tested to meet or exceed published specifications. The optional NIST calibration certificate is provided for users needing a calibration reference showing the actual performance achieved. This calibration is done using NIST traceable instruments. Some test and measurement equipment was calibrated at the PreciseRF laboratory using NIST traceable instruments. The item calibrated may be used as a calibration reference only, and shall not be used as a NIST calibration standard. This certificate shall not be reproduced without the express written permission from the calibration facility. PreciseRF warrants its products to be free from defects in material and workmanship for one (1) year from the date of purchase. If you need support or repair for your PreciseRF product, whether the product is under warranty or otherwise, please contact PreciseRF and arrange for a return or repair authorization. Manufacture's Suggested Retail Price (MSRP). Prices and specifications subject to change without notice.

Not withstanding the useful information available from the ARRL, engineers and hams such as Leigh Turner VK5KLT, who in his excellent article wrote "It seems one of the best kept secrets in the amateur radio community is how well a small diminutive magnetic loop antenna can really perform in practice compared with large traditional HF antennas", there still are a few nay-sayers who fail to appreciate the MLA.

Julian OH8STN, a retired broadcast engineer, in part, puts it this way. "These days it seems like everyone is attacking the very popular, small, lightweight, and extremely portable, magnetic loop antenna (MLA). Lately there's been a few forum threads, blog posts, and video comments, reportedly comparing the performance differences between a magnetic loop antenna and dipole antenna in various deployment scenarios. For the most part, these comparisons are absolutely valid and well meaning. Unfortunately, there are those instances, when comparisons present a very one sided view, leaving much to be desired. Often the "comparisons" only focus on the 40 meter amateur radio band."

As did this "expert" who fancies having a superior grasp of mathematics and NEC modeling skills. In a review of a new MLA, without hands on the product, he based MLA efficiency primarily from VSWR & bandwidth data using his model. (However, when his model was compared to measurements, loop current was not given, and MLA dBi gain did not agree with the accepted values). He then opined the published gain was an obfuscation. Those who disagree with him have their work belittled as "appeals to the innumerate."

ARRL technical editor, Jerry Hall K1TD, in describing MLS gain concluded "in fact it (MLA) considerably exceeds the gain of a dipole when the MLA is mounted close to the ground, the gain increases to 8.16 dBi for a perfect ground (for 20M to 10M band) Jul 1985 QST.

Julian continues..."Small portable loops are at a distinct disadvantage on 40, 60, & 80 meters, in comparison to a full size antenna. Everyone knows this, but none of the tests or comparisons will ever show you 30, 20, 17, 15, 12 or 10 meters because the test results, would no longer be as "clear". Loop performance (efficiency) increases as we head higher up the band. So much so, that a dipole and MLA could be indistinguishable on higher band results. In fact, it actually becomes an outright fair fight! Focusing solely on the 40 meter band is not a lie, it's just doesn't tell us the whole truth ... these comparisons usually ignore the larger diameter magnetic loops as add-ons, multi-turn loops, and larger "less portable" loops, since doing so would completely debunk the results as presented in these tests. So their focus is usually the less efficient, but very much smaller, more portable, lightweight and easy to deploy little brothers. For example, MLAs like the Chameleon P-Loop, F-Loop in their default configuration, AlexLoop, [PreciseLOOP] and so on.

So let's point out for the record that operators don't usually build or buy small portable magnetic loops for their excellent performance on 40 meters. They use these systems because of their portability and very small deployment footprint. In a way, these comparisons are as ridiculous as saying "lets test a dipole versus a small magnetic in my kitchen."

73'

Roger W1RMS

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QST REVIEW JUNE 2019

PreciseRF HG-1 Magnetic Loop Antenna

Reviewed by Phil Salas, AD5X
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Small magnetic loop antennas are popular for portable/QRP operation due to their small size and ease of deployment. A recent entry into this market is the PreciseLOOP HG-1 from PreciseRF.

Overview

The HG-1 is rated at 45 W PEP and covers 7 to 30 MHz. Optional 80- and 60-meter, high-voltage/high-current resonating capacitors are available, though the maximum power rating is reduced to 10 W PEP on those two bands. The website cautions that the HG-1 is not waterproof.

Bottom Line

For portable or low-profile home operation, the Precise RF HG-1 magnetic loop antenna offers ease of deployment, good performance and directivity at a low height, and easy tuning.

The basic (Express) package includes a 38-inch-diameter radiation loop made from LMR400 coaxial cable; a copper tube induction loop; a manually adjusted loop tuning unit with a precision 6:1 reduction dial and calibrated dial marking (see Figure 11); a three section PVC mast; and a basic carrying bag. The Deluxe package adds the 80M-1 resonator for operation on 80 meters; the MLA-1 desktop tripod with tripod adapter; a 12-foot coaxial cable feed line; and a premium padded nylon carrying case (see Figure 12) that easily fits the antenna and accessories.

Assembling the HG-1 takes just 1 to 2 minutes. If you wish to operate on 80 or 60 meters, simply plug the resonating capacitor assembly into the bottom of the tuning unit, as shown in Figure 13.

Figure 11 — The HG-1 manual loop tuning unit uses a 6:1 reduction drive with amateur bands marked on the dial.

Figure12 — The Deluxe HG-1 package in the supplied carrying case. The entire package, including antenna, mast, tabletop tripod, and controller weighs about 8 pounds.

Figure 13 — The 80-meter resonating capacitor plugs into the bottom of the tuning unit.

A new addition is the HG-1 remote tuning unit, which permits tuning from a remote control head connected to the loop with up to 100 feet of CAT-6 cable (see Figure 14). The remote tuning option includes a dc motor assembly that mounts on the manual tuning unit, a pulse width modulated (PWM) motor controller, and 25-foot coax and CAT-6 cables. The controller shown in Figure 15 uses either an internal 9 V battery or an external 9 V dc wall power supply.

Adding the remote tuning option requires removing the tuning knob and pointer, opening up the manual tuning unit, removing the vernier assembly mounting screws, and attaching the tuning motor assembly. It is not difficult and only requires a few minutes. The ARRL review antenna included the HG-1 Deluxe package and the remote tuning unit.

Operating the HG-1

Like all small transmitting loops, the HG-1 radiates a bidirectional signal with maximum radiation in the plane of the loop, and it exhibits deep nulls perpendicular to the loop when vertically mounted. I use this knowledge to position myself perpendicular to the HG-1 when I am in close proximity to it when transmitting. That can occur often with a manually tuned loop, as you must retune the antenna with even fairly small frequency changes due to the very narrow bandwidth of the antenna.

The Deluxe package include a desktop camera tripod that supports the HG-1 just fine, but I prefer a full-size tripod that places the HG-1 several feet above the ground without having to use a table. The picnic tables are all metal in the city park where I operated, and sometimes tables are not available. My 50-inch camera tripod collapses to 15 inches and easily fits within the padded carrying case. The PreciseRF tripod adapter works with any camera tripod, or you can build your own adapter (see the sidebar, "Making a Tripod Adapter").

Figure 15 — The controller for the remote-tuned loop.

Figure 14 — The remote-control motor on the tuning box replaces the manual tuning knob and reduction drive.

I first checked the SWR on the different bands. I began with the basic manual tuning unit, and then added the remote tuning option. I found that I could easily adjust the SWR to less than 1.5:1 on 40 through 12 meters. My best SWR on 80 meters (with the 80 meter resonating capacitor) was 2.2:1. On 10 meters, the best SWR I could realize was 2:1.

It was easy to tune the HG-1 by adjusting the tuning capacitor for maximum receiver noise, then transmitting a low-power CW carrier and

Mark Wilson, K1RO

Phil, AD5X, didn't hear any signals on 80 meters in his noisy location in Texas, so I set up the HG-1 at my station in New Hampshire to give it a try. Over the course of two evenings, with 10 W and the HG-1 on a tripod outside my station window, I made a couple dozen 80-meter FT8 and CW contacts, mostly with stations in the eastern half of the US. The best DX contact was with V31MA in Belize. As you might expect, only the strongest stations copied me, and I generally got weak signal reports, but I thought the results were impressive for a 3-foot loop, 3 feet off the ground on 80 meters.

The HG-1 worked even better on receive. I heard a number of European stations on 80-meter CW and FT8, and I even decoded a couple of Australian FT8 stations at sunrise. Under the right conditions, 80 meters is viable with this antenna.

Phil Salas, AD5X

A standard camera tripod uses a ¼-20 screw for mounting the camera. To build a tripod adapter for a magnetic loop, purchase the following from your local home center or online: a ¼-20 × ⅞-inch threaded coupling nut and two in-ground sprinkler fittings — a ½-inch plastic barb coupling (Orbit part #94349) and a ½ × 6-inch plastic cut-off riser (Orbit part #37227).

Cut the 6-inch riser to 4 inches. Using a bench vise, press the ¼-20 × ⅞-inch coupling nut into the ½-inch barb coupling, and then press this assembly into the ½ × 4-inch riser.

This assembly easily screws onto the camera tripod, and then you can slip the lower tube of the HG-1 support mast over the adapter. You may wish to wrap a few turns of electrical tape around the adapter to create a friction fit between the adapter and the HG-1 lower tube.

The parts for the tripod adapter are shown on the right, with the finished adapter on the left. (A standard ½-inch PVC barb is shown, and it had to be filed down to fit inside the riser without splitting it. Use a matching sprinkler system barb if available.)

The finished adapter on a camera tripod. The loop support mast slips over the adapter.

touching up the tuning for best SWR, if necessary. And incidentally, I found that removing my hand from the tuning knob had no noticeable effect on the loop tuning.

Tuning the antenna with the remote option was also quite easy. The remote tuning controller provides stall warning lights when you hit the tuning capacitor extremes. Normally, I would tune the unit for a stall at the lower or upper end of the frequency range, and then tune up or down from that spot in order to obtain the receiver noise peak. The remote tuning controller has a **SPEED** control, which makes it easy to tweak the tuning once you get close to the desired frequency. With just a bit of practice, I was remotely tuning the HG-1 as easily as I could tune it with the manual unit.

I operated primarily on 40, 30, and 20 meters due to band conditions during the review period. Transmit power was 10 W with my Elecraft KX3 portable transceiver. On CW, I could pretty much work anyone I could hear. In fact, my first contact occurred when I was just familiarizing myself with setting up the HG-1 in my ground-floor family room. I heard a station in Michigan calling CQ on 20 meters, so I answered him, and we had a surprisingly good contact. He said that my signal was peaking at S-6. SSB was challenging on 40 meters, though I did have success calling some strong stations. SSB contacts were much easier on 20 meters.

Conclusion

The PreciseRF HG-1 is an effective antenna worth considering for lightweight quick setup/tear-down portable operation at power levels up to 45 W. I particularly liked the remote tuning option, which keeps the high-intensity RF field well away from the operator, and would be convenient for tuning a balcony-mounted HG-1 from inside an apartment or condo. Finally, a PreciseLOOP application note on the PreciseRF website provides detailed technical information on the HG-1.

Manufacturer: PreciseRF, 960 S. Gribble Rd., Canby, OR 97013; **www.preciserf.com**. Price: Express PreciseLOOP HG-1, $299.50. Deluxe PreciseLOOP HG-1, $435. HG-1 Remote Loop Tuner, $195.50. 80-meter resonator, $65. 60-meter resonator, $65. CMB-300 common-mode 1:1 balun: $65.00. MLA-1 desktop tripod with adapter, $79. Tripod adapter only, $19.95.

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