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Technical Manual

For Alpha Antenna

Model: Resonant Magnetic Loop

Inclusions: All Optional Accessories

User Guide Version 2.1-a
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WARNING

Be sure transmitter power is off before proceeding with antenna assembly. Electrical burns or death will result if contact is made with the antenna when the transmitter is keyed, and electrical burns will result if contact is made with the antenna.

WARNING

Antenna must be installed a distance equal to at least twice the height of the antenna from power lines.

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SECTION 1 – Concept of Operation

Introduction
The Resonant Magnetic Loop (RML) from Alpha Antenna behaves electrically as a coil (inductor), which efficiently radiates and receives RF. The inner and outer loops enables coupling to easily occur directly to the magnetic field in the region near the antenna. The magnetic field then enables an electric field to generate through Faraday's law of induction, where then a full blown electromagnetic wave is formed far from the antenna.

Description
RML systems from Alpha Antenna are designed for maximum efficiency. Maximum efficiency is achieved when the RML is mounted at a height of 1 loop diameter or more. This enables the RML to be used instead of any other antenna system, which is especially helpful when antennas with elements around a quarter of a wavelength in size would simply be too large for the physical space available.

Alpha Antenna greatly boosts radiation efficiency by maximizing the size of the outer loop. Efficiency is also increased for the RML as Alpha Antenna uses large conductors, and in order to reduce the loss resistance, low resistance LMR400 has been used in the construction of the RML.

In addition to being an excellent choice for DX (long distant communications) in residential or portable amateur radio operations, magnetic loops are also used in mobile radio. Their ability to simultaneously direct energy upwards, unlike a conventional vertical antennas, enables Near Vertical Incidence Sky-wave (NVIS) communication up to 300 miles in mountainous regions while still maintaining maximum DX effectiveness.

Theory
The efficient electrical coupling of the RML is accomplished with a specially designed small inner feed loop. This enable the inner loop to act as a step-up transformer, where power is inductively coupled from the feed loop to the main loop, which is connected to a proprietary adjustable resonating Variable Inline Capacitor (VIC).

Since the RML antenna is essentially a coil, its electrical impedance is inductive, with an inductive reactance much greater than its radiation resistance. In order to couple to a transmitter and receiver, the inductive reactance is canceled with parallel capacitance. Since the RML is highly efficient, it has a high Q factor, and can be adjusted anywhere on the given band that the RML is designed to operate.

Radiation pattern and polarization
Since the RML is smaller than a wavelength, the current at any one moment is nearly constant round the circumference. This enable voltages along the sides of the loop to cancel each other when a signal arrives along the loop axis. This enables a null through the center or the loop. The radiation pattern then peaks in ALL directions lying in the plane of the loop.

You may mount the loop horizontally to produce an omnidirectional signal pattern, or vertically to enable a null that can help desensitize the antenna to locally generated interference, where the signal is both received and transmitted off all sides of the antenna.

Insensitivity to locally generated interference

The RML is designed and is insensitive to electric-field noise from nearby sources. This is valuable inasmuch as most sources of interference with radio frequency content, such as from motors, transformers, corona discharge, and other devices that produce electric fields that would normally interfere with the received signal when other antennas are used.

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SECTION 2 – System Overview

This instruction manual contains technical data, installation procedures, theory of operation, maintenance instructions, and an illustrated parts list covering the Resonant Magnetic Loop from Alpha Antenna. The antenna is designed for use with HF radios.

Table 1-1 SUMMARY OF AVAILABLE EQUIPMENT	
PART NUMBER	DESCRIPTION OF EQUIPMENT
RML-OuterLoop	An outer loop for the magnetic loop antenna that includes a built in resonating capacitor.
RML-InnerLoop	The inner loop for the magnetic loop antenna that includes a built in SO239 where user supplied coax with a PL259 can be attached.
RML-FieldBag (Optional)	Field bag to store and transport the RML.
RML-MeterCap	Variable Inline Capacitor (VIC)

Equipment Description

The RML is represented in Figure 1-1 and shows the location of the VIC. Physically the RML antenna consists of two sections of LMR400. The total weight of the core system is 2.00 pounds. The antenna can be transported in an optional field bag. Deployment of the core RML antenna is accomplished in approximately 2 minutes.

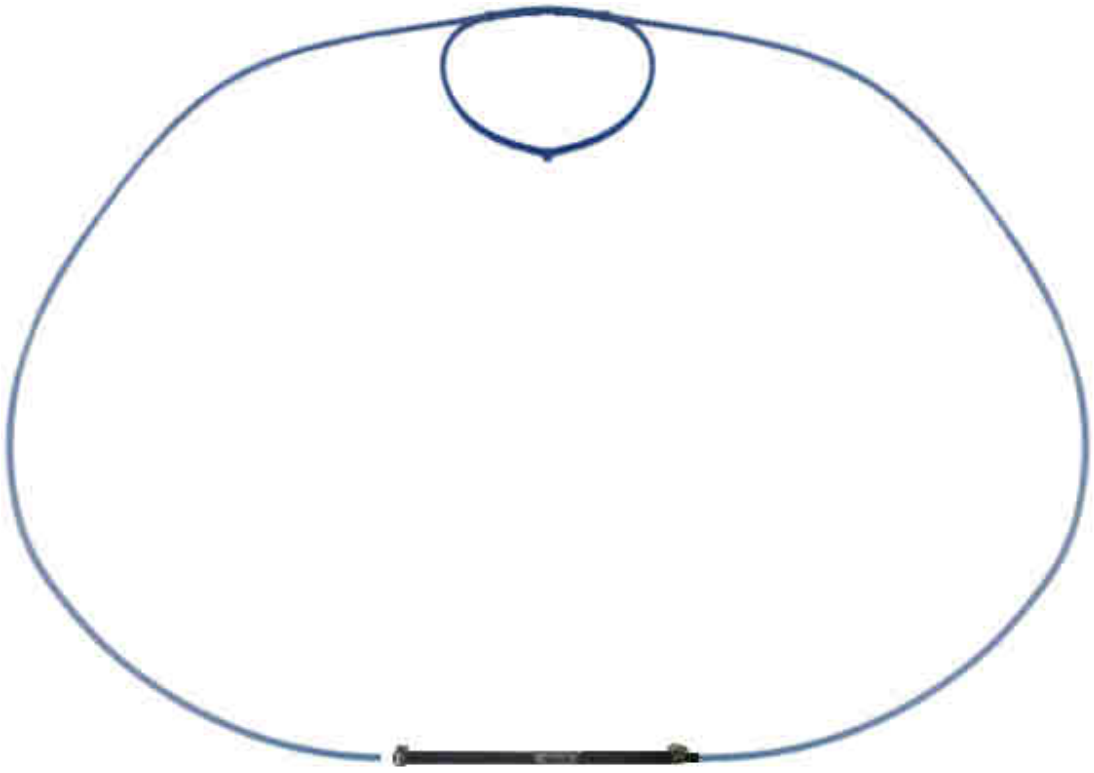

Figure 1-1 RML Antenna with VIC at base

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Equipment Characteristics

The RML antenna is designed to provide both high-angle radiation (near vertical incidence – NVIS) and low-angle radiation (long-range/DX) propagation. NVIS short-range sky wave propagation varies from 0 to 300 miles. Long-range & DX propagation enables communications at distances greater than 300 miles. The RML may be used with HF (high frequency) radios on the frequency the model is designed for. Maximum RF power of 100 watts PEP SSB.

Leading Particulars

Leading particulars and equipment for the RML are listed in Tables 1-2 through 1-4. Personnel should become thoroughly familiar with data and procedures contained in the entire technical manual before working on or using the antenna.

Table 1-2 Leading Particulars

ITEM	LEADING PARTICULARS
Electrical Characteristics:	
Frequency range	Frequency is loop specific
Polarization	Horizontal or Vertical polarization
RF power capacity (watts)	100 Watts PEP SSB
Radiation Pattern:	
Azimuth	Omnidirectional & Directional (Dependent upon angle of mounting)
Elevation	NVIS through DX
Physical Characteristics:	
Wind and ice	Survives 85 MPH wind with no ice
Maximum Height erected	Loop dependent
Weight	Loop dependent
Packed Dimensions:	
Height	5 inches
Circumference	18 inches

Table 1-3 Supplied Equipment		
ITEM	PART NUMBER	QUANTITY
Inner Loop	RML-OuterLoop	1
Outer Loop	RML-InnerLoop	1
Variable Inline Capacitor (VIC)	RML-MeterCap	1

Table 1-4 Optional Equipment		
ITEM	PART NUMBER	QUANTITY
Field Bag	RML-FieldBag	1

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SECTION 3 – Assembly

Assembly and disassembly procedures for the RML antenna are given in the following paragraphs. Assembly can be accomplished in approximately 2 minutes.

Site Selection

For maximum antenna operating efficiency, the RML should be mounted at a height of one loop diameter and located in the center of a clear area. Installation of the antenna near any tall object or under heavy foliage should be avoided. Under no circumstances should structures or people come in contact with the antenna.

Assembly Procedures

Pre-installation requirement: Select/prepare a user supplied mount/mast or other method of support for the RML.

a. Locate the Outer Loop, which is the longest section of LMR400.

b. Locate the black pipe that is the VIC, and loosen the stainless steel clamps on either side of the VIC.

c. Insert both ends of the Outer Loop coax into each side of the VIC, as to form an approximate circle/oval, and slightly tighten (do not overtighten) the stainless steel clamps on either side of the VIC so that the coax does not move freely in and out of the VIC.

d. Locate the top Inner Loop and affix it inside and at the approximate center of the Outer Loop, as depicted in Figure 1-1.

e. Install the outer loop on a user supplied mount/mast that has already been selected and prepared prior to assembly of the RML.

Disassembly/Repackaging Procedures

Disassembly is performed in the reverse order of assembly. Loosen the stainless steel ring clamps and remove the inserted outer loop from the capacitor, and then tighten the ring clamp as not to lose them. Removal of the Inner Loop from the Outer Loop is not necessary. Roll the antenna in the natural direction that it is coiled, otherwise kinks may result and. Secure and stow the antenna.

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SECTION 4 – Tuning & Deployments

Tuning Procedures

Once the RML is assembled, tuning occurs in the similar way that one could tune a dipole. Where in as much a dipole is tuned by trimming the end of each wire till a meter shows a minimum SWR. Similarly, the RML is tuned by sliding either end of the Outer Loop in or out of the VIC till a meter shows a minimum SWR. Once minimum SWR is reached, then the LMR400 is once again secured using the stainless steel clamps on the VIC.

Deployments

This is a multipurpose antenna that can be deployed and mounted in many different locations. The mounting of the RML is only limited by your creativity. Some of the mounting locations that are possible include;

a) Attic installations; where the antenna is located greater than 18 inches from electrical wiring and other metallic or flammable materials.
b) Vehicle installations; where the antenna is kept a minimum of 18 inches from surrounding metal and mounted inside a fiberglass camper shell or on a roof rack with user supplied standoff insulators,
c) Tripod installations; there are aftermarket and creative ways to build a PVC mounts using a tripod as the support.
d) Tower installations; we haven't figured this one out yet, but we know the creative genius of amateur radio operators will.

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Appendix A – Error Reporting

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail or email us a marked copy to the contact information on the last page of this manual.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your RML Antenna needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Mail or email us an EIR to the contact information on the last page of this manual.

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Appendix B – Support

If you have questions about your antenna, please feel free to contact us.

Email: support@AlphaAntenna.com

Phone: 1-888-482-3249

WEB: www.AlphaAntenna.com

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