MLA-T

Magnetic Loop Antenna - Topbands

Instruction Manual

Thank you for purchasing this new product small Magnetic Loop Antenna Topbands. Manual contains important information. Please read all instructions carefully before operating the antenna.

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Description

The MLA-T Magnetic Loop Antenna for Top Bands is a "Plug & Play" product. It is primarily destined for use at portable QTHs and can be operated with up to 100 W input *. The sophisticated design of the MLA-T offers relatively high efficiency even with a relatively small loop diameter (at 160 m band, the d/ ratio is only 0.5%) while full-size magnetic loop antennas for 160 m band use a diameter around 4 meters.

By using several turns of a larger-diameter copper pipe, an extremely high Q was achieved; this allows a high equivalent radiated power (related to antenna size) which is a product of antenna size and loop current. A perfect impedance matching of this antenna over all specified bands is achieved by a user-adjustable "gamma match", see Fig.1.

Contrary to other commercial MLAs which cannot vary antenna input impedance, the tunable "gamma match" in the MLA- allows to optimize the SWR also with respect to the ambient situation of antenna location.

The MLA-T extends the selection of magnetic loop antennas for the radio-amateur bands 1.8, 3.5 and 7 MHz and may offer a solution for mobile hobbyists who want to transmit from a portable QTH. In many locations where installing a long-wire antenna is not allowed, like protected town sites, senior homes, house boats and campings, the use of MLA-T may be the only available option.

We would recommend to use the MLA/T in a digital-mode operation, where even signals one cannot hear can be processed. Against other phenomena of wave propagation, like ionospheric attenuation, MLA-T loss is lower by several orders of magnitude.

In a practical on-band operation, the MLA-T is excellent mainly in 80-m band. While the tuning is done remotely, switching to another band must be done manually. The use of the MLA-T in rain is limited. To prevent corrosion, the copper pipe is protected with a special "Komaxite" varnish.

fig. 1

Technical design

Over a selected band, the remote tuning of MLA-T is done remotely by a 12VDC motor through a 1:600 gear, turning a variable capacitor. As the high Q causes an extremely narrow antenna selectivity (several kHz typically), even this gear is too rough. To reduce the RPM, the pulse-width control(PWM) is used to achieve the fine tuning with the full motor drive. Each motor start has a 3-second slow drive against the full-speed, so the tuning is fast and precise. The up/down drive is controlled by two push-buttons, all other operations are controlled by a uP and firmware in the control electronics. Three color LEDs indicate the tuning procedure. The tuning motor is fed by the RF coaxial cable using DC bias tees on each end, so no other wire connections are needed. To power the electronics, a standard wall-plug AC/DC adapter, 220V AC/ 12 VDC, 1A, is included.

The antenna is connected to the control box by one RF coaxial cable, 50 Ohms. The outdoor cable connector is type N, sealed, while its indoor end uses a common type PL connector. Another (supplied) cable, 2m long, with PL connectors, is used to connect a transceiver to the control box.

While all components of the MLA-T meet the IP53 standard for environmental effects, it was observed that during a heavy rain the efficiency is degraded. Only under a roof or covered with a plastic bag, MLA-T can be used in rain under a full power and with a good efficiency.

The band switching of the MLA-T is done by mechanical jumpers located on antenna box, see Figs.2 and 3. The complete manual band switching takes only a couple of seconds. Tuning over a selected band is then done remotely by the described motor-driven variable capacitor.

We must emphasize that the precision MLA-T tuning is only possible with a SWR meter which is a standard component of all modern transceivers. A precision tuning to resonance at a desired frequency is the important physical condition of an efficient MLA operation. The MLA-T really is extremely selective an offset of several kHz from the resonance point requires re-tuning, as otherwise a loss of more than 2S-units is to be expected. The big advantage is that the antennas acts as very hi-Q preselector, highly attenuating out-of-band and even in-band unwanted signals. Thus, RX intermodulation is dramatically reduced, and receiving performance is greatly enhanced. Due to the varying L/C ratio over band, and the fact that at 7 MHz some of loop turns are shorted, the Q values are not constant. The same fact also causes air breakdown in the HV capacitors, see *).

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Band Switching

There are three manual switch settings:

1). 1.8 MHz Band The external jumper adds one parallel capacitor to the circuit as shown in Fig.2. The jumper on loop turn is removed, Fig.3. The "gamma match" has the longest length.

2) 3.5 MHz Band The external jumper, Fig.2, is off. The jumper on loop turn, Fig.3, is off. The "gamma match" at its shortest length.

3) 7 MHz Band The external jumper, Fig.2, is off, the jumper on loop turn Fig.3, is on. The "gamma match" is at its shortest length.

fig. 2

fig. 3

Operation

First interconnect the transceiver, the control box with its power supply, and the remote MLA-T. Upon setting the desired band, see Band Switching, Figs. 2 and 3, and setting the transceiver to the same band, adjust receiver gains so that a noise can be heard. While in reception, push UP or DOWN push-buttons on the Control box, and wait till you hear a noise peak or some useful signal. The noise burst is typically quite short; you can return the variable capacitor, or wait till it turns by 180 degrees. Therefore, either push the other button or keep pushing the same. After several trials you can hear the strongest band noise; then stop tuning. After this adjustment in reception, you can continue with transmission. Adjust TX output of ~10 W and try to improve the tuning by the SWR meter. The goal should be as close as possible to the ideal of 1:1. Due to the high loop Q, mainly at 80-m band, the training will take some time. When the best tuning by SWR is finished, increase the TX power to ~100W. Caution: with high humidity, the antenna may not be able to handle full 100 W on 80 meters in all cases. In this case internal discharges (arcing over) could occur within the capacitor. This is indicated by jumping SWR while the power is increased, but does not damage the antenna. Back off to keep the SWR low.

To those not familiar with magnetic loop antennas, here are some important points:

The horizontal radiation pattern of the MLA-T is shaped like number eight, with a wide maximum and a sharp minimum. This is only valid for the antenna in a vertical position (its plane normal to the earth's surface). The depth of the minimum is very much affected by the ambient environment (conductors around, even within walls), type of wave propagation, the state of the ionosphere, i.e. the angle of wave incidence on the antenna, etc., etc.

The vertical radiation pattern, with the loop plan is normal to ground, can be seen in Fig.4. Magnetic loop antennas located low above ground are ideal for NVIS ("Near Vertical Incidence Skywave", for short range HF communication) wave propagation. This particular feature of a MLA allows to effectively use ionospheric reflections over short distances. Mostly useful in mountains.

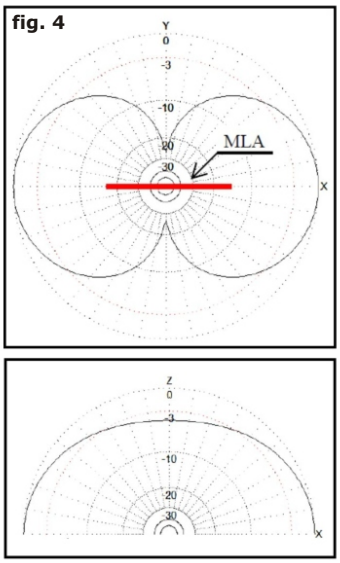

fig. 4

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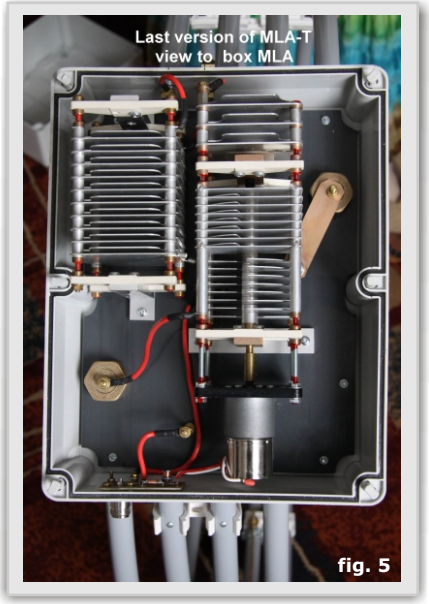
Photo



Important caution

The MLA-T can be used indoors with a maximum input of 10 W. With higher power, never use MLA-T as a room antenna, with which you would want to run a round-the-clock contest! Limit your exposure to the RF magnetic field to a necessary minimum. With more than 10W input, operator shouldn't be located near the loop! The RF magnetic field passes also through walls. While the side effects of RF magnetic field component have not been proven by science, stay safe and keep also others in a safe distance.

Do not touch the antenna loop under RF power, it can cause RF skin burns or even death. Expect EMC problems to surrounding electronics as the usual screens are not efficient for high-intensity magnetic field component. Individuals with pacemakers and similar implants should never approach a running MLA-T.

Technical parameters

Frequency range	1.8 to 1.95 MHz, and 3.3 to 4.0 MHz (7 MHz)
Input impedance	50 Ohm
Maximum RF Input	100W
SWR after Tuned	1:1.1 max.
RF Connector at Control Box	2x PL
RF Connector at MLA	N
Maximum Antenna Size	82 cm W, 105 cm H, 22 cm D
Antenna Weight	10 kg
Loop Diameter	800 mm

Conclusion

The MLA-T Magnetic Loop Antenna was developed following a marketing evaluation of the indoor MLA-M type which was designed or QRP operation. Repeated requests and interest in a remotely tuned higher-power antenna for Top Band operation stimulated the development of MLA-T. A reserved view of a MLA-T located in a concrete-building basement indicates that such antenna cannot compete with a dipole stretched between two such buildings high above ground. Nevertheless we believe there are many situations where the new MLA-T can find its customers.

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Measurement protocols

fig. 7

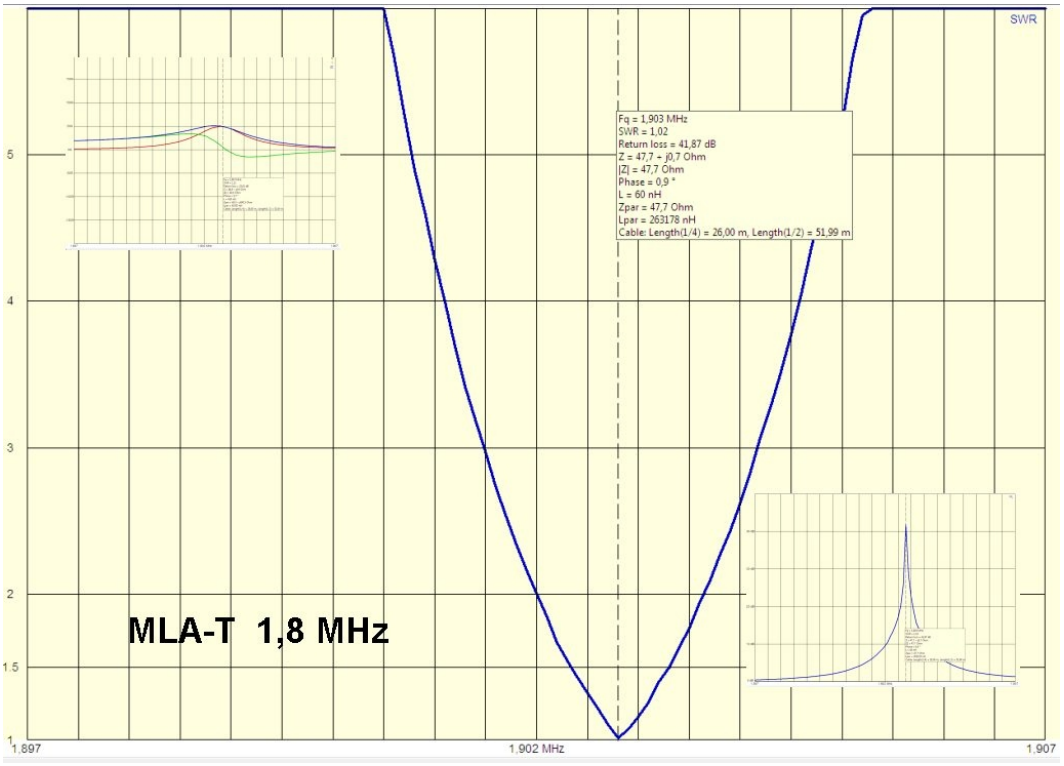
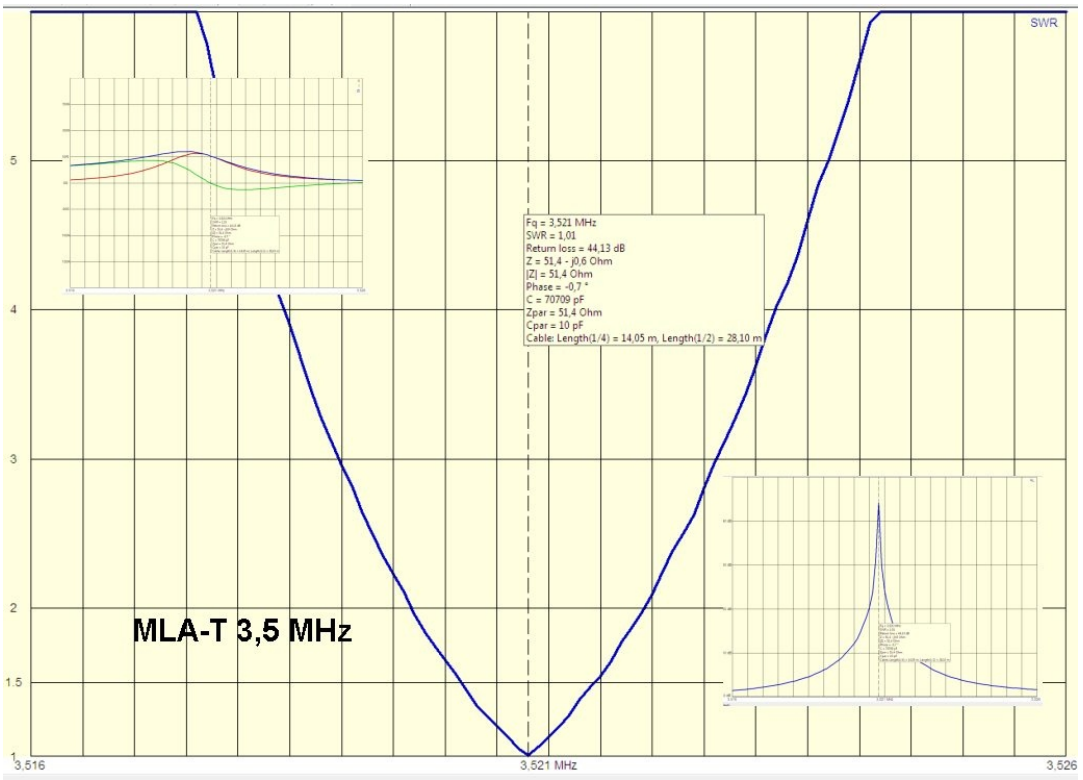


fig. 8



Measurement protocols

fig. 9