



END FED 6 – 40 Meter Multiband HF Antenna

Introduction

This project produces an inexpensive, multiband, end fed HF antenna matchbox that is quick and easy to setup and use. The end fed feature adds convenience, but does present another issue. The problem with an end fed half wave antenna is that the antenna presents a high impedance, creating a significant miss match with the usual transceiver impedance of 50 ohms. This miss match is significantly greater than typical tuners can accommodate without a matching transformer.

This project creates a trifilar wound, 9:1 UNUN (unbalance to unbalance) toroid matching transformer that will match the high input impedance of an end fed antenna into the range where most antenna tuners can produce good performance. The matchbox handles 100 watts of power. *This project requires an antenna tuner to achieve satisfactory SWR.*

The matchbox project uses readily available common hardware and materials. For your convenience, Emergency Amateur Radio Club of Honolulu volunteers make fully assembled matchboxes for those who don't want to construct one. Proceeds support the club and amateur radio. Order information is included on the last page.

Matchbox Parts List

- 1 small plastic enclosure and cover
 - 1 powdered iron toroid T106-2
 - 3 20" pieces of 22 gauge solid insulated copper wire in red, green, and black
 - 2 6-32 x 3/8" machine screws
 - 2 #6 lock washer/nut combination
 - 1 10-24 x 3/4" machine screw and nut
 - 2 #10 flat washers
 - 1 #10 lock washer
 - 1 #10 wing nut
 - 2 #10 wire lugs
 - 1 #6 wire lug
 - 1 SO-239 panel mount connector
 - 1 30' #18 AWG insulated stranded wire antenna
- Few drops of clear PVC adhesive to secure cover in place
Clear silicone caulk to secure toroid in place

Preparing the MATCHBOX Plastic Enclosure

EARC sells completely fabricated ABS enclosures with all holes machined for the matchbox project. If you are making your own enclosure, start the project by drilling one 5/8" hole and two 9/64" holes for mounting the SO-239 coax connector on the lower side of the enclosure. Use the connector as a guide to mark for accurate drilling of smaller holes. Next, drill a 3/16" hole in the upper right side of the box for mounting the antenna connector.



TOROID WINDING

Next wind the three 20" pieces of insulated solid wire onto the toroid. Place the wires as shown green-black-red, and wrap the toroid 9 turns so that it looks like the photo on the upper right. Notice there are three wires extending from the left winding and three wires extending from the right winding. As the connections are completed, the steps refer to the specific wires by left or right and color.



Next, trim, crimp together and solder **the left black wire** with the **right red wire**. When the step is completed, it will look like the photo on the right:



The next three steps should appear as shown in the right photo. Crimp and solder a #10 lug to the **left red** wire about 2" from the toroid. The completed lug will later connect to the antenna connection bolt on the top side of the enclosure.

Twist the **left green** wire with the **right black** wire. Strip the ends of the two wires; twist together at about 2". Solder this wire pair to the center connection of the SO-239 connector.

Trim and strip the remaining **right green** wire at about 2". Crimp and solder a #6 lug. This lug will connect through a 6/32 machine screw to the ground of the coax connector.

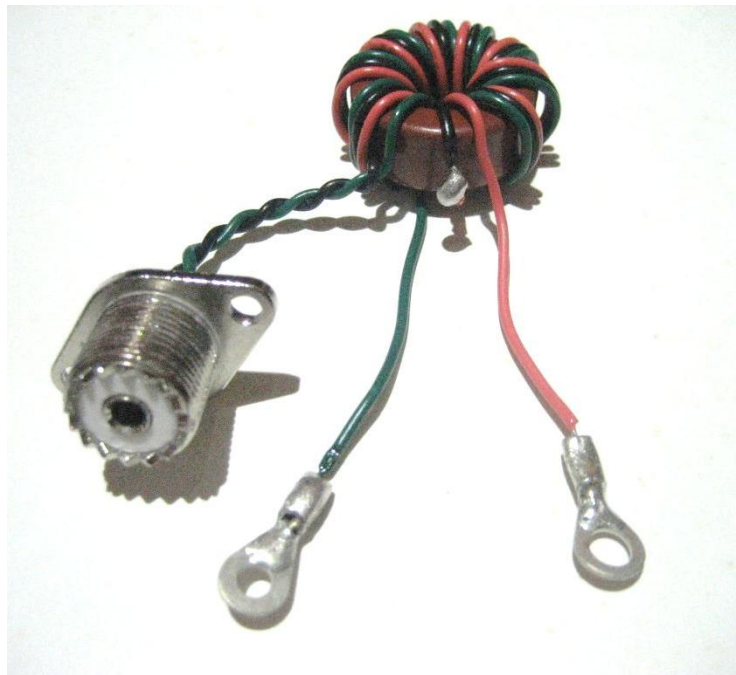
Next, place the SO-239 through the 5/8" mounting hole from inside the box and position over the two mounting holes. Place a 6/32 x 3/8" machine screw through each mounting hole and connector. Place the #6 lug connected to the green wire over one of the machine screws. Next place a #6 lock washer/nut over both machine screws. Securely tighten both machine screws.

Position the toroid inside the box to allow connection of the red antenna wire lug to the 10-24 machine screw on the upper right box side. Place the 10-24 machine screw through the #10 lug connector on the red wire, followed by a lock washer, then a flat washer, and next insert it through the 3/16" hole in the upper side. Place a flat washer on the outside of the box followed by a #10 hex nut. Tighten the nut to hold securely. Next, place the wing nut on the antenna connector and your project appears as show above.

Clear silicone caulking compound is used to insulate a connection and secure the toroid from movement in the enclosure. The only remaining assembly step is to securely glue the box cover in place with PVC cement.

Preparing the Antenna Wire

Matchbox performance will be determined by two factors: The length of the antenna wire, and the capability of the tuner. The length of the wire should generally be between 22 and 60 feet for best performance. Longer wires may have excessive impedance for some tuners to properly match. Wires shorter may not radiate as effectively. A 30 foot insulated 18 gauge stranded wire antenna and connecting lug is included with the project and should meet most requirements.



Experience has shown that most external tuners and many internal tuners will tune 80–6 meters with an antenna length of 22' to 30'. If a longer antenna is desired, the provided antenna can be lengthened.

Some tuners, in particular internal tuners, may not tune the full 80-6 meter range. You may need to try different wire lengths to optimize your antenna configuration. If you are having difficulty getting your rig to tune, start with a 26' wire. This should produce good results on at least 40-6 meters using the narrowest performance range of internal tuners. Best performance is achieved with a coax of 16' or longer.

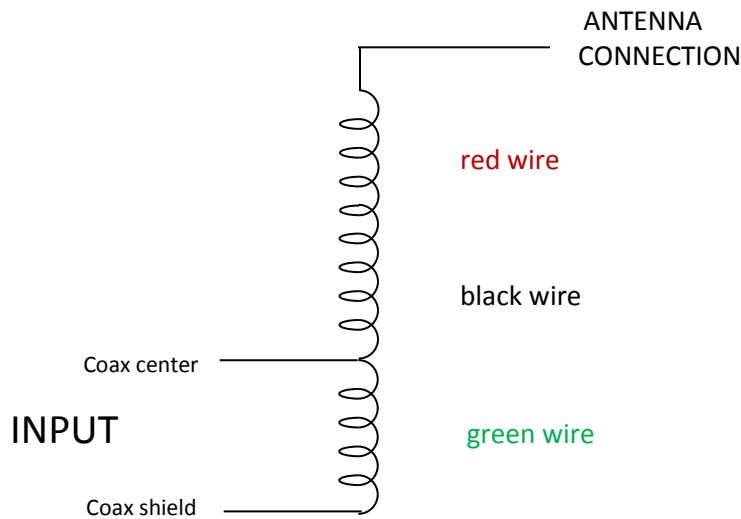


Additional counterpoise is not required in this design. The system works well in horizontal, sloper, and vertical configurations.

Observe established safety practices when working with antennas, and avoid proximity to power or utility wires. Permanent installations should be equipped with appropriate static and lighting protection.

Keep amateur radio safe and fun! If you would like to share your experiences with this project, email the club at <http://www.earchi.org>.

Toroid Wiring Schematic



Chuck Hanebuth NH7XL
Emergency Amateur Radio Club (EARC)
Fundraising Chairman

ORDERING A COMPLETED MATCHBOX FROM EARC

Volunteers at the Honolulu Emergency Amateur Radio Club (EARC) carefully assemble these HF matchboxes for those who prefer not to build one. The club will build one for \$44 including USPS priority mail shipping anywhere in the U.S. A 30 foot 18 gauge antenna wire is included. The coaxial feed cable is not included and must be provided by the user.

Proceeds go to the club to promote amateur radio activities. To order, make payment via PayPal, to our fundraising chairman chanebuth@yahoo.com for \$44 for each assembled matchbox. Be sure to include your name and mailing address in the remarks section with the PayPal remittance.

We will ship promptly and you will likely receive the order in 7 days or less. If you have any questions about the matchbox or your order, please email Mr. Hanebuth at chanebuth@yahoo.com.

Thank you for your interest in the activities of Honolulu Emergency Amateur Radio Club and amateur radio.

Email your experiences with this project to the club at <http://www.earchi.org>.

