The Wonderful World of Microcontroller!

Arduino / ATtiny Experiments

Ham Radio End Fed Antenna with a 1:64 Matching Network

The Experiment: In this experiment were going to explore the use of a 1:64 Matching Auto Transformer on the End Fed Long Wire Antenna. I have read a lot of post on the internet regarding the great performance off a End Fed Long Wire Antenna of with a 1:50 / 1:64 matching network. So in this experiment will build a 80-40-20-15-10 meter End Fed Long Wire Antenna with a 1:64 Matching Auto Transformer from the documentation available on the internet (See Reference Links: *PA3HHO End-Fed Antenna)*.

Photo: End-Fed Long-wire antenna up 5-6 feet (*See the 1:64 Matching Auto Transformer hooked to the fence*)

Table of Contents

Part List:

1. AWG 14 Gauge Wire (100 feet)
2. # 18 – 20 enameled wire (4 feet)
3. FT240-43 core (1)
4. SO-239 Female (1)
5. Plastic box (1)
6. Eye bolts (2) with (4) nuts
7. Misc screws/washers/nuts

80m loading coil (110uh light weight core)

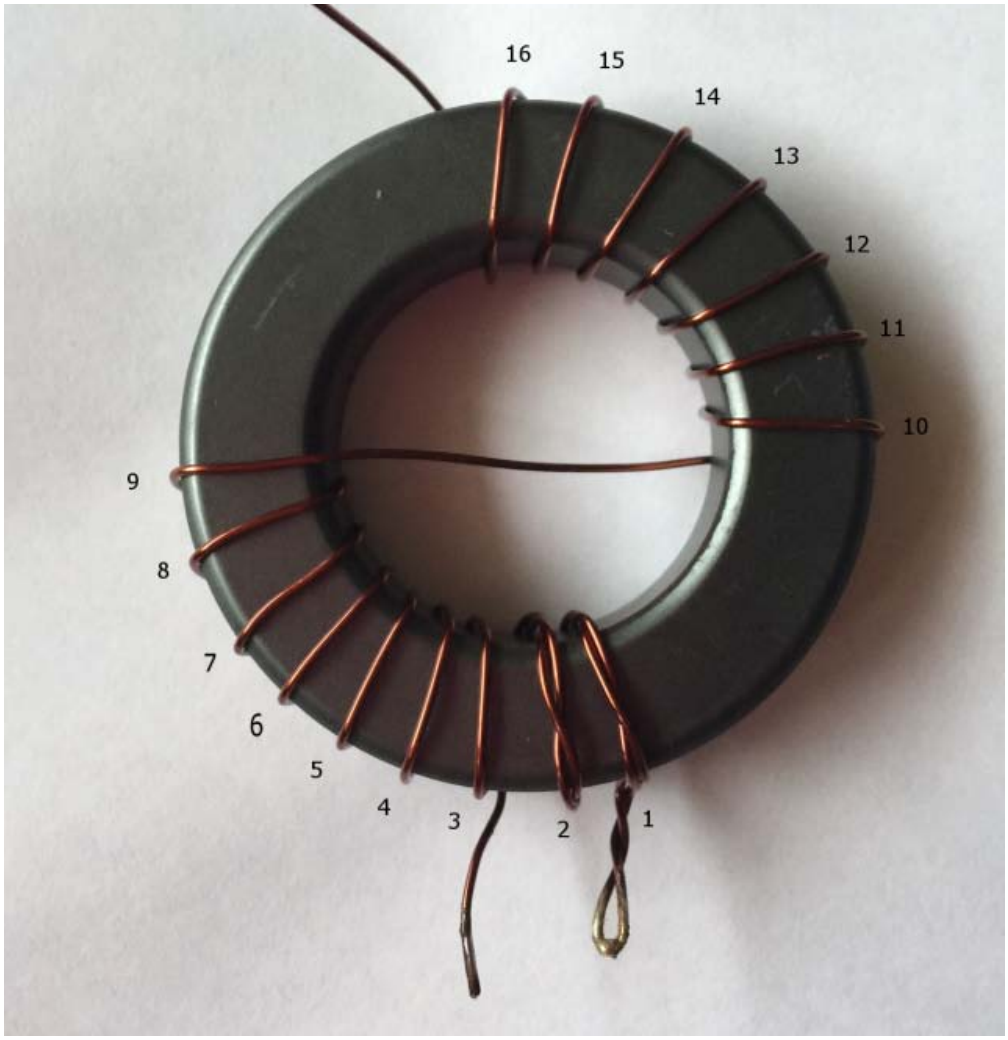
1. # 22 enameled wire
2. Thin wall white sink drain pipe 1.48 – 1.50in diameter
3. Two small screws
4. Two #8-32 brass screws
5. Two #8-32 brass nuts
6. Two #8-32 brass washers

^Top

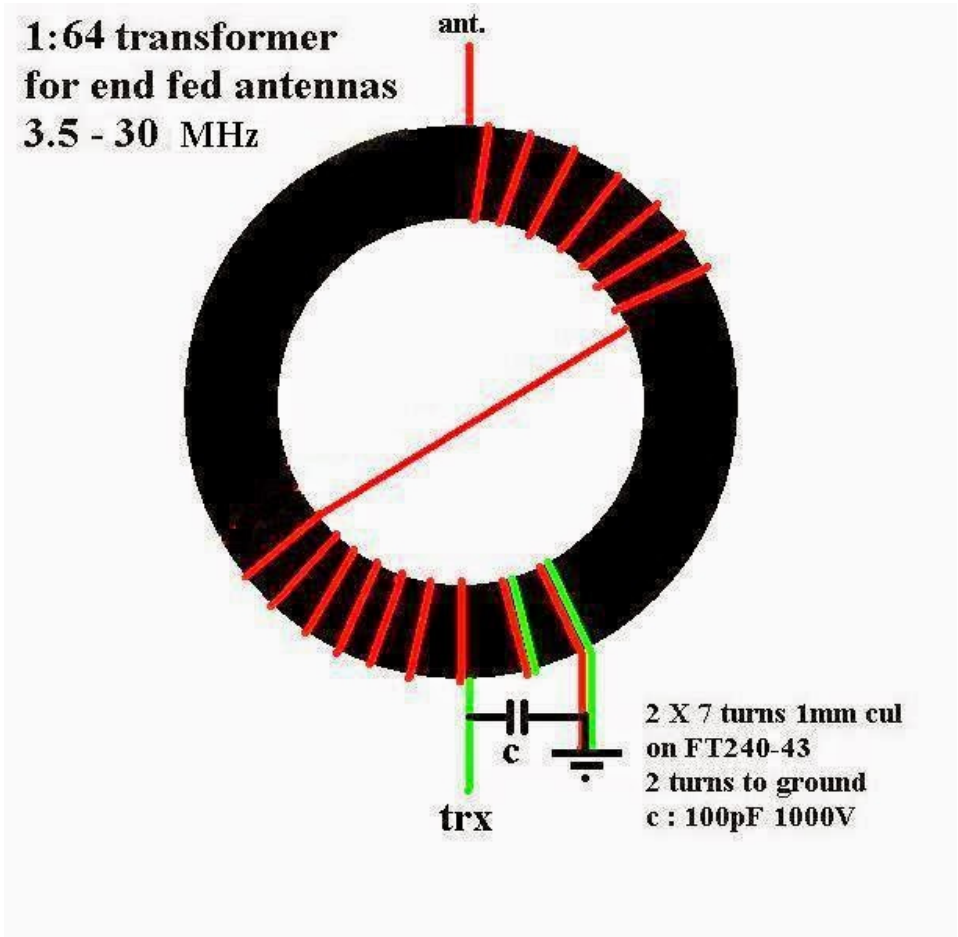
Prototype:

1. The Matching Auto Transformer with 16 primary turns and 2 secondary turns (the 2-turn secondary winding is bifilar-twisted with the first 2 primary turns).

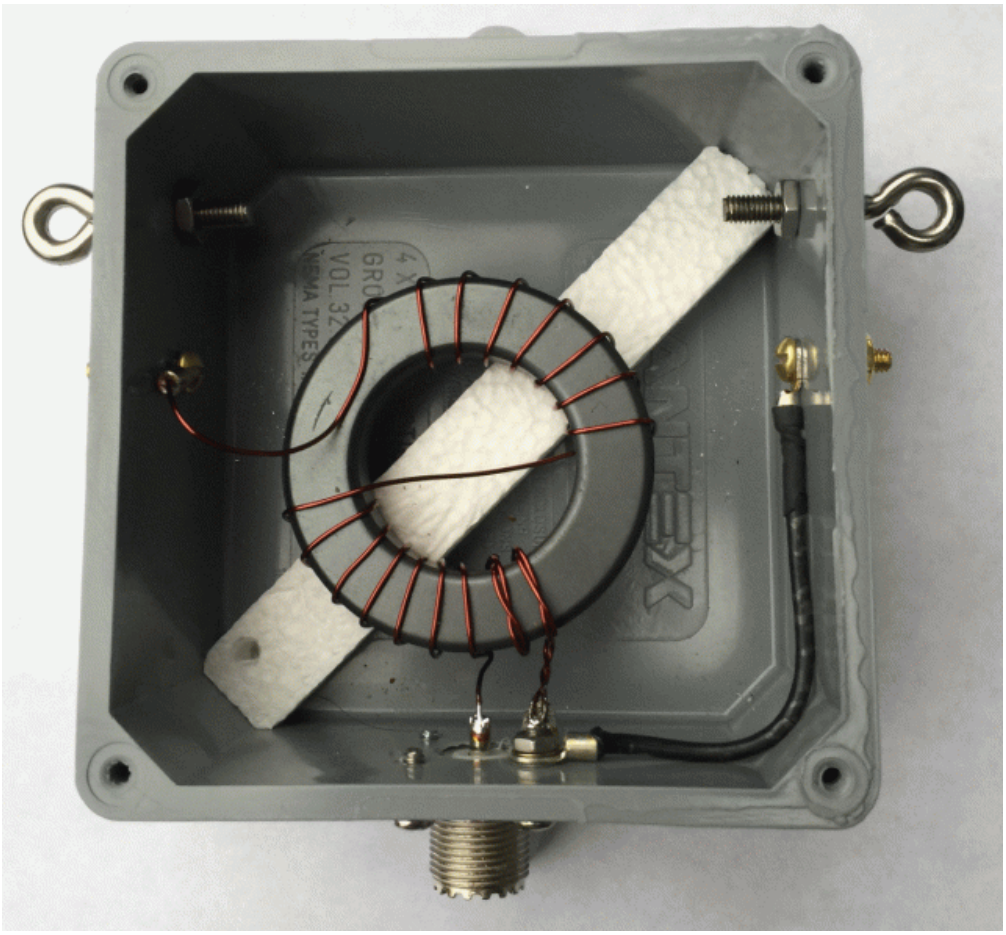
My Prototype: *1:64 Matching Auto Transformer*. hopefully this works look like the drawing...



(See Reference Links: *PD7MAA End-Fed Antenna)*



1:64 Matching Auto Transformer installed the box.



Testing the 1:64 balun: Not sure if this work on this matching network but I've tested other balun like this in the past.

1. Connected a 3000 ohm resistor across the ground an the input.
2. Connected the MFJ-269 antenna analyzer to the SO-239
3. (80) 3.500-4.000 SWR=1.6 Rs=41 Xs=21
4. (40) 7.000-7.300 SWR=1.4 Rs=45 Xs=17
5. (20) 14.000-14.350 SWR=1.4 Rs=45 Xs=17
6. (15) 21.000-21.450 SWR=3.3 Rs=68 Xs=0
7. (10) 28.000-29.7000 SWR=5.6 Rs=173 Xs=0

15-10 meter way off but, might improve when a capacitor is installed between the SO-239 ground / inner connector.

80-40-20 looked pretty good.

Will see where the antenna resonates on the mini VNA antenna analyzer.

Note: A 3200 ohm resistor between the ANT input / ground should indicated Rs=50.
Note: A 3000 ohm resistor between the ANT input / ground should indicated Rs=46-47
Note: 80-40-20 were close to an Rs=41-45.

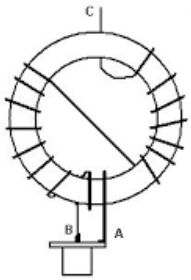
^Top

Notes:

Winding 1:64 Matching Auto Transformer on the FT240-43 core.
1. Cut a 4 foot length of AWG #18 enameled wire.
2. (A t0 B) Fold over 6 to 8 inches and twist it together.

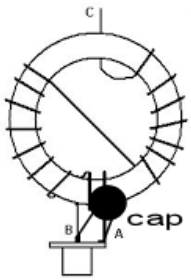
Note: My (A to B) length was 6 inches.

3. Start winding the Matching Auto Transformer, each pass through the center of the core equals one turn. First 2 turns twisted section, Then 7 turns, Then cross over to the opposite side another 7 turns. Started winding the core at the ground side of the coil (A) .



Note: After installing the Matching Auto Transformer in the box only had 51/2 inches of wire left.

Note: For 15-10m (*A ceramic capacitor of 100-150 pF is placed across the secondary side of the Matching Auto Transformer. Its purpose is to counteract the relatively high inductance of the transformer on the 15-10 mtr bands. The capacitor should have a rating of 500-1000 volt.)*



4. **Now the antenna wire:** Will build a 40 meter version 20.4 meters (66′ 11-1/8″) of wire, full bandwidth on 40m and some gain on 20 and 10. A Full Size dipole for 7.1 MHz would require 67′ 10-15/16″ (20.699m).

Note: Cute a 70′ (21.336m) piece of 14 gauge stranded wire, stung the end-fed up about 5-6 feet, checked SWR low on 40m around 6.3 MHz . I new that would be the case because the wire was longer than required for 7.1 MHz.

Note: After some trimming (don't cut the wire just fold it over the twist it together) the wire length on 40m 65′ 4″.

On the MFJ268

1. (40m) SWR=1.1 Rs=50 Xs=8 @ 7.131 MHz (Very good)
2. (20m) SWR=1.3 Rs=46 Xs=14 @ 14.160 (Not bad)
3. (15-10m) way out but, that was expected without a capacitor across the SO-239 ground / inner connector.

Note: All above measurement were made without a counterpoises. Then inserted 6 ferrite beads 6″ below the 1:64 Matching Auto Transformer, all measurement were the same. Ferrite beads were not effective choke.

Note: Raise the end-fed antenna up to 20′ hear the results:

1. (40m) SWR=1.7 RS=50 XS=21 @ 7.0613 MHz
2. (20m) SWR=1.7 RS=50 XS=20 @ 14.058

Reading were the same with with or without ferrite beads. Started to rain so did not get a chance to add counterpoise. From what I noticed on next note will try 16′ counterpoise. Have a feeling that the ferrite beads did not have any chocking effect.

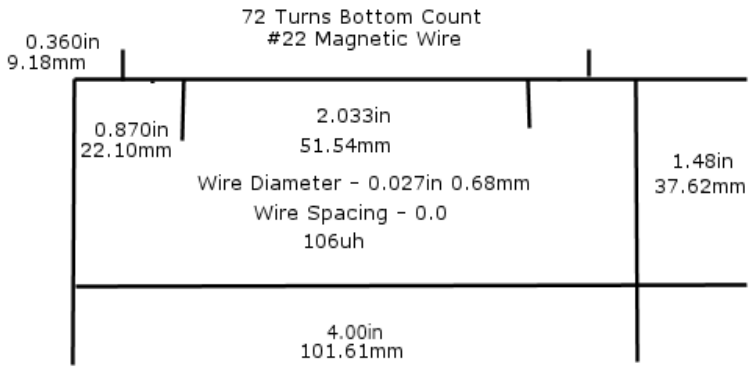
Note: Brought the end-fed antenna back down to 5-6 feet up, discovered to get a 1:1 SWR at Rs=50 I had to move the coax choke out 16-17 feet. Will experiment more when weather clears-up.

Note: Well Installed a 16′ 53/4″ counterpoise, 1/8 wave on 40m, moved the coax choke right under the 1:64 Matching Auto Transformer, checked SWR with antenna analyzer SWR=1.1 @ 7.100 MHz and @ 7.300 SWR=2.0 at 100W.

Note: Will add 110uH coil for 80m when, I install the antenna at the cabin, thinking that it might take an additional 8′ of #14 wire for 80m. Will see...

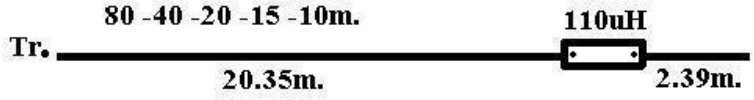
Note: After trimming the 80m section it only took 5′ 7″ after the 80m coil.

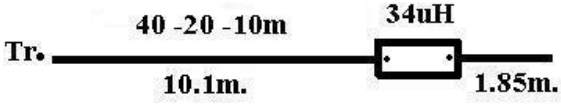
3/28/2017 – Installed the 80m loading coil.



Note: The thin wall PVC core (very light weight coil). The calculated coil ***108uh*** the measured ***101uh***. Used a 7 feet piece of AWG #14 wire for the 80m section, then tuned to final length.

(See Reference Links: *PD7MAA End-Fed Antenna)* for 80-40-20-15-10 meter long wire





110uH coil : 260 turns 1mm. cul. 34uH coil : 90 turns 1mm. cul close wound on a 19mm pvc tube start tuning the long wire on the high bands.

Note: It is recommend installing a choke not right at the transformer, but at 2-3 mtr (6-10 ft ≈ 0.05 λ) and 11 mtrs (≈36 ft) from the transformer. Making the coax radiate will work, but is often undesirable. A simple and better solution is to use a piece of wire at the opposite end of the transformer winding to which the radiator is connected. A short wire is all that is needed: about 0.05 λ ≈ 2.2 m or 7 ft for the 80m end-fed. (See Reference

Links: *Multi-band End-Fed Antenna*)

5/18/2020: Replaced the **40m 20.35m** wire with a **80m 40.7m** wire had wider band width on 80m, but notice no better performance than **40m 20.35m** wire. So now back to **40m 20.35m** with **80m** coil.

High power end-fed for 80-40
Stack 2 FT240-43 cores and add 3 primary and 21 secondary winding's with 1.5mm enameled wire to form a 500 Watt key down transformer.

Here is the well build Matching Auto Transformer optimized for 80-40m. by Gus, VK6WB . You can clearly see the 2 cores for high power use.

Another high power matching network: Two FT240-43, wind 2 turns twisted, Then 5 turns, Then cross over opposite side 7 turns.

Reminder:
FullWave
FW = 984 / frequency = feet
FW = frequency feet * 12 = Inches
FW = frequency feet * 0.3048 = Meter

Dipole FullWave
FW = 468 / frequency = feet
FW = frequency feet * 12 = Inches
FW = frequency feet * 0.3048 = Meter

1/4 (.25) = FW * .25
1/2 (.60) = FW * .50
5/8 (.625) = FW * .625
(.64) = FW * .64

As the antenna goes up in height (*The center Frequency will go down*).
Example: Antenna Center freq at **6′ 7.131 MHz** Raised Antenna to **20′ 7.0613 MHz**

^Top

Conclusion:

The End-fed antenna with a 1:64 Matching Auto Transformer is well worth building. Although about 5S units down from my 20-40-80 fan dipole center up at 30′, with one pre-amp on the end-fed 5-6 feet up matched the fan dipole. Very nice quiet receive antenna with pre-amp off.

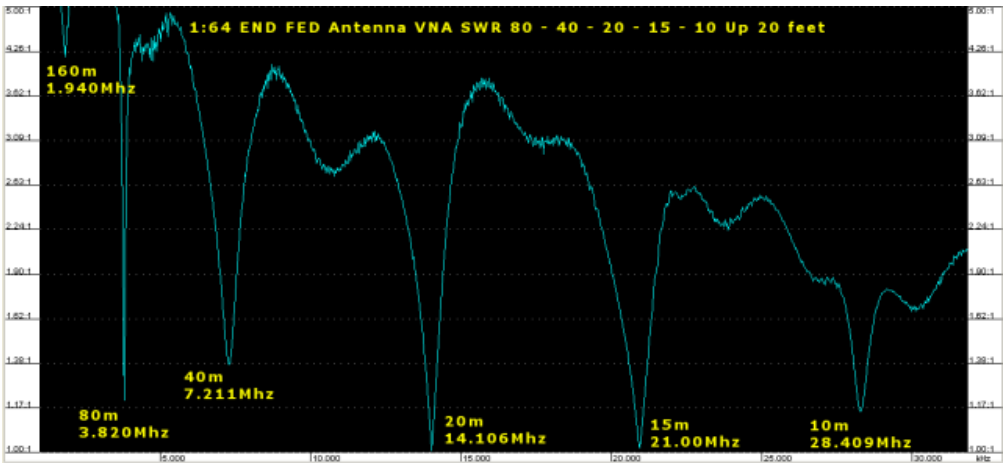
Some Transceiver SWR measurements up 12′ with 10w power:
Note: With a 16’7″ AWG #14 counter-pose.
7.100 – 1.5
7.150 – 1.25
7.200 to 7.300 – 1.1

14.100 to 14.200 – 1.1
14.250 to 14.300 – 1.2
14.350 – 1.5

3.700 – 1.8
3.720 – 1.5
3.750 to 38.00 1.1
3.900 – 2.0

The 80m section after the coil 5′ 7″.

Antenna Scanned With Mini VNA NO counter-pose:



^Top

Reference Links:

1. PA3HHO End-Fed Antenna
2. PD7MAA End-Fed Antenna
3. Multi-band End-Fed Antenna
4. Thoughts about end fed antennas and counterpoises
5. K7MEM Short Dipole Calculator
6. The .64 Wavelength Secret