

36:1 End-Fed Half-Wave Kit Instructions

Bill of Materials:

Part	Qty	Assembly
FT-240-43	2	36:1 Transformer
14AWG Enamel Wire	4ft	
14 AWG THHN	1ft	
56pF Cap	1	
150pF Cap	1	Load Capacitor & Strain Relief
2.7M Res	1	
#8-32 - 5/8"	2	
#8-32 locknut	2	
HDPE Insulator	1	
#10-32 - 1"	2	Antenna Wire Connections
#10-32 nut	4	
#10 washer	6	
#10 split washer	4	
SO-239	1	SO-239 Mounting
#4-40 - 1/2"	2	
#4 locknut	2	
#4 washer	2	

Recommended Enclosures:

- 4" x 4" x 2" NEMA 4X PVC Junction Box – Lowes, Home Depot, etc. - \$12
- Pinfox 6.2" x 2.55" x 2.3" IP65 ABS Project Box – Amazon - \$10:
https://www.amazon.com/gp/product/B08MCWN2ZG/ref=ppx_od_dt_b_asin_title_s00?ie=UTF8&th=1

Step #1 – Wind the transformer secondary

- The two FT240-43 toroids should be glued together with superglue.
- Leave 3-4” of wire for the antenna/counterpoise bolt connections.
- Wind **12 turns** of the #14 AWG enamel wire on the toroids. The winding should only take up one half of the toroids and form a half-moon shape. Remember that each pass through the center of the toroids counts as one turn.

Step #2 – Wind the transformer primary

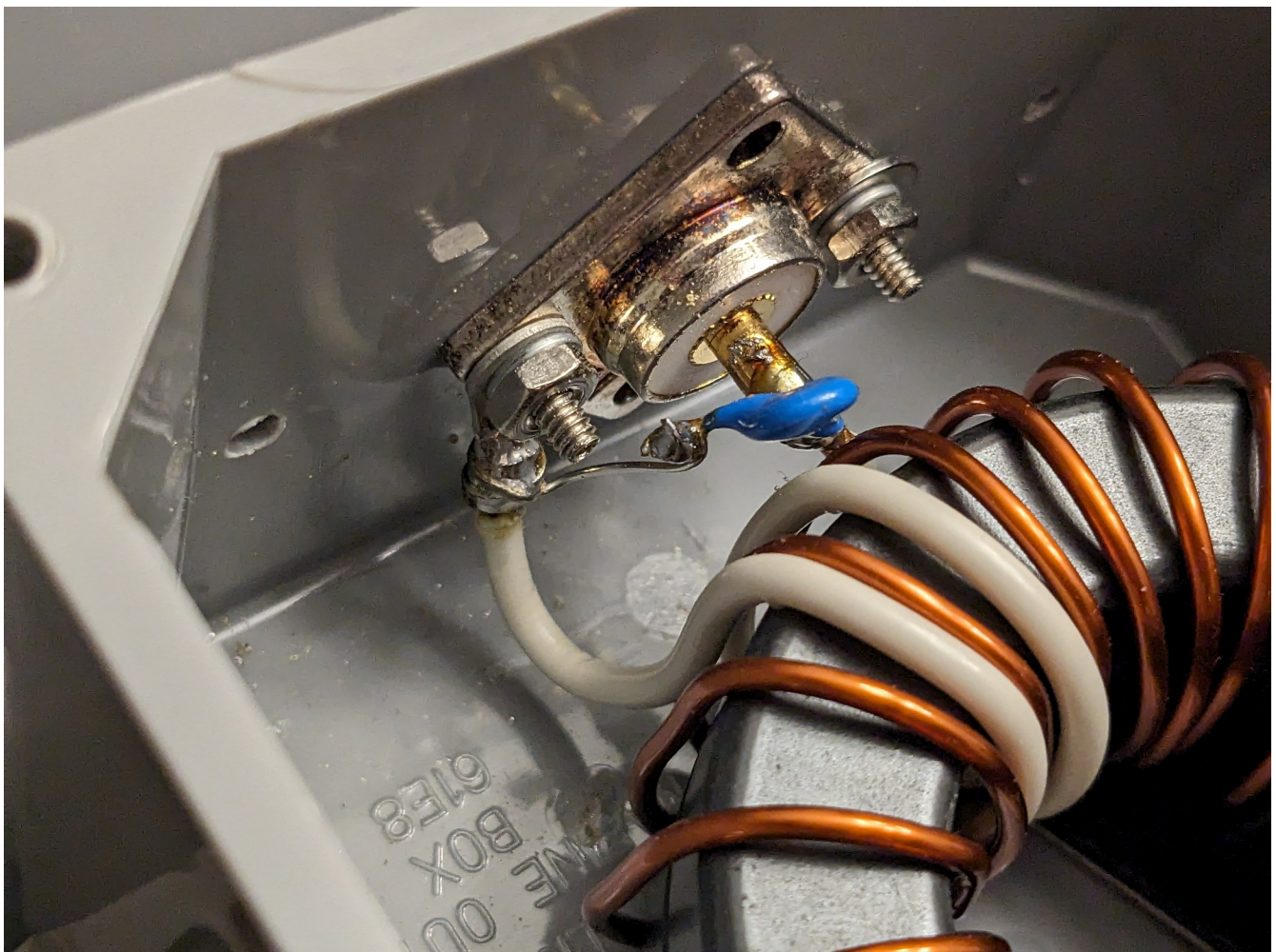
- Leave 2-3” of wire for connections to the SO-239.
- Start the transformer primary more or less in the center of the secondary winding.
- Wind 2 turns of the #14 AWG THHN wire.
 - Wind in the same direction you wound the transformer secondary.
 - The primary windings should fall between the existing windings of enamel wire.

Step #3 – Enclosure Prep

- Drill two 3/16” holes on each side of the enclosure for the two #10-32 antenna connection bolts.
- Drill a 5/8” hole centered on the bottom face of the enclosure for the SO-239 connector.
- Insert the SO-239 into the 5/8” hole and mark 2 mounting points. Drill a 1/8” hole at each mounting point.
- Mount the SO-239 using the following sequence (leave bolt with ring terminal loose for connection to the transformer primary):
 - #4-40 Bolt
 - Washer
 - Enclosure
 - SO-239
 - Ring Terminal
 - Locknut

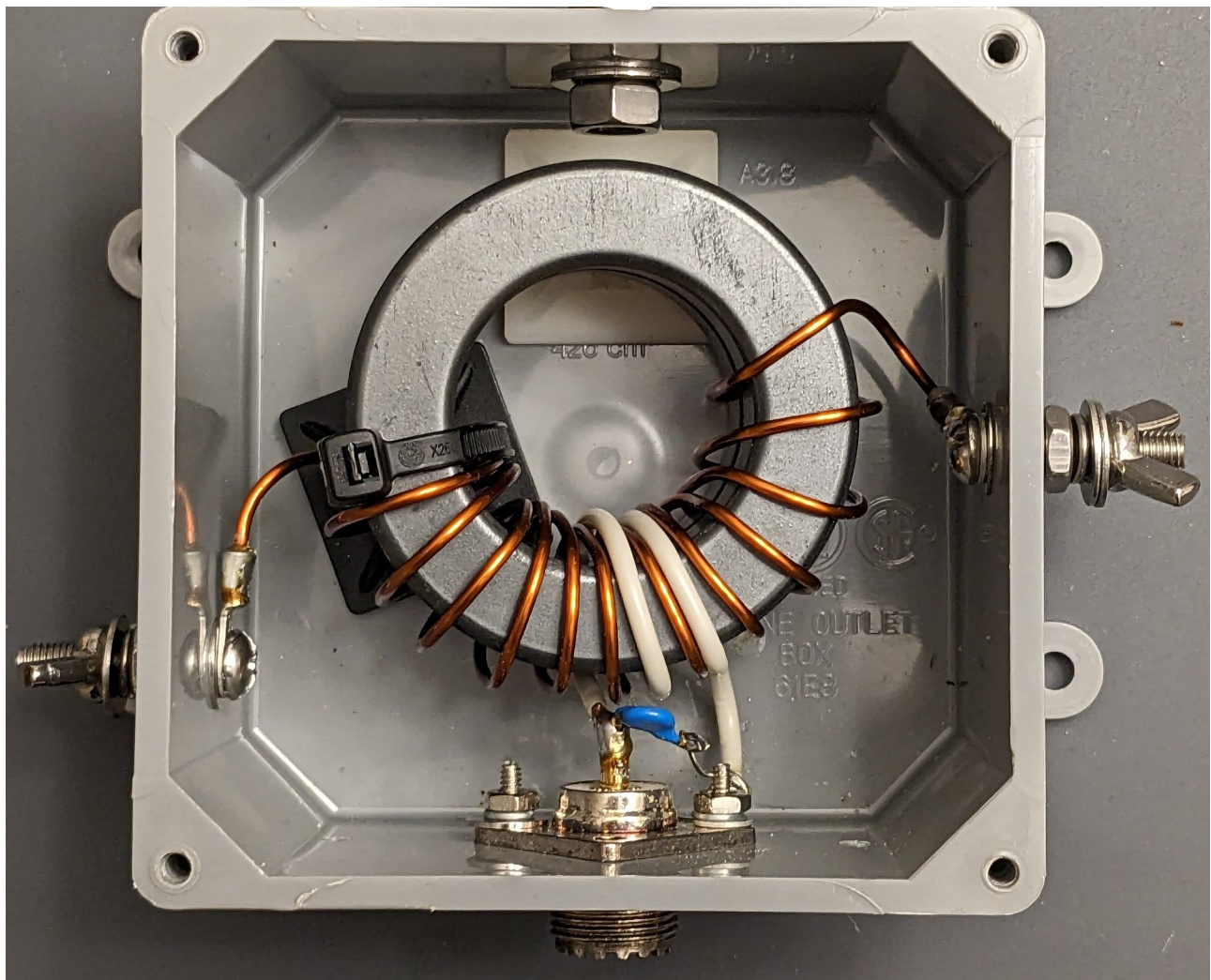
Step #4 – 36:1 Transformer Prep

- Test fit the transformer in the enclosure and estimate the final transformer wire connection lengths to the antenna/counterpoise bolts and SO-239. One side of the primary will be short for connection to the SO-239 center pin while the other will be longer and connect to the SO-239 ring terminal.
- Trim wires.
- Test fit the transformer again and adjust wire if necessary.
- When satisfied with the transformer's fit in the enclosure, scrape $\frac{1}{4}$ " of the enamel from the ends of enamel wire and strip $\frac{1}{4}$ " of insulation from the ends of the THHN wire.
- Crimp and solder the #10 ring terminals to the transformer secondary (enamel) wires.
- Crimp and solder the #6 ring terminal to the long side of the primary and one side of the 56pF capacitor. You may need to extend the lead of the capacitor with a piece of wire.



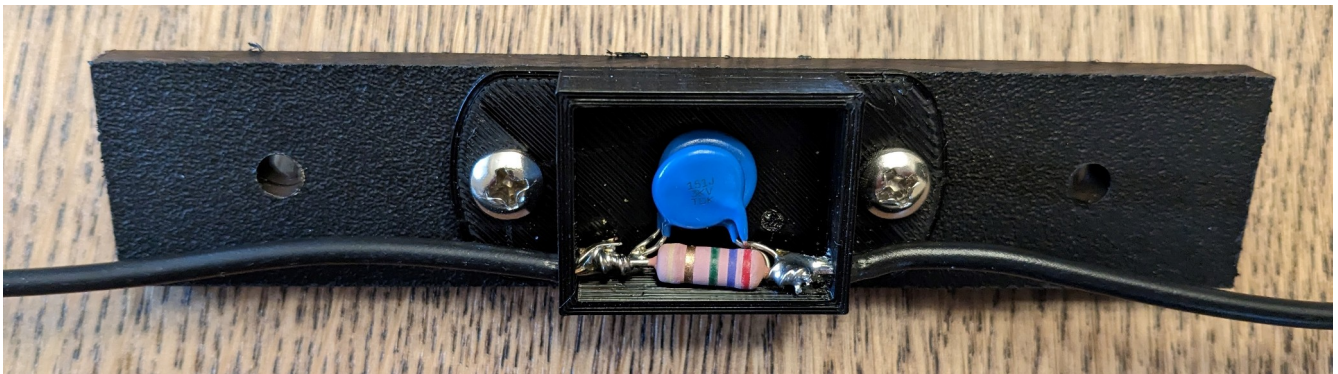
Step #5 – Final Assembly

- Install the antenna/counterpoise connection bolts using the following sequence:
 - #10-32 Bolt
 - Ring Terminal
 - Washer
 - Enclosure
 - Washer
 - Split Washer
 - Nut
- Bolt the shield side of the primary to the SO-239.
- Solder the remaining primary wire and 56pF capacitor lead to the SO-239 center pin. You may need to extend the lead of the capacitor with a piece of wire.
- The wires should be stiff enough to hold the completed transformer in place, but a cable tie mount can be added for additional support.



Step #6 – Loading Capacitor Strain Relief (Required for 80M Antennas)

- Wrap the leads of the 150pF capacitor around the leads of the 2.7Mohm resistor.
- Trim each wrapped lead such that the loading capacitor assembly fits in the load capacitor enclosure.
- Strip one end of each 6" connection wire (1/4") and insert it through the hole on each side of the load capacitor enclosure.
- Solder one side of the load capacitor assembly to each 6" connection wire.
- Drill four 3/16" holes in the HDPE insulator where marked.
- Mount the load capacitor assembly to the HDPE insulator using #8-32 hardware.
- When assembling the antenna, make sure that the insulator bears all of the wire load and no strain is placed on the connection wires to the load capacitor.
- After assembling and testing the antenna for proper operation, pot the load capacitor enclosure using non-corrosive "sensor safe" RTV silicone or equivalent potting compound. Opaque silicone is recommended to protect the components from UV light.

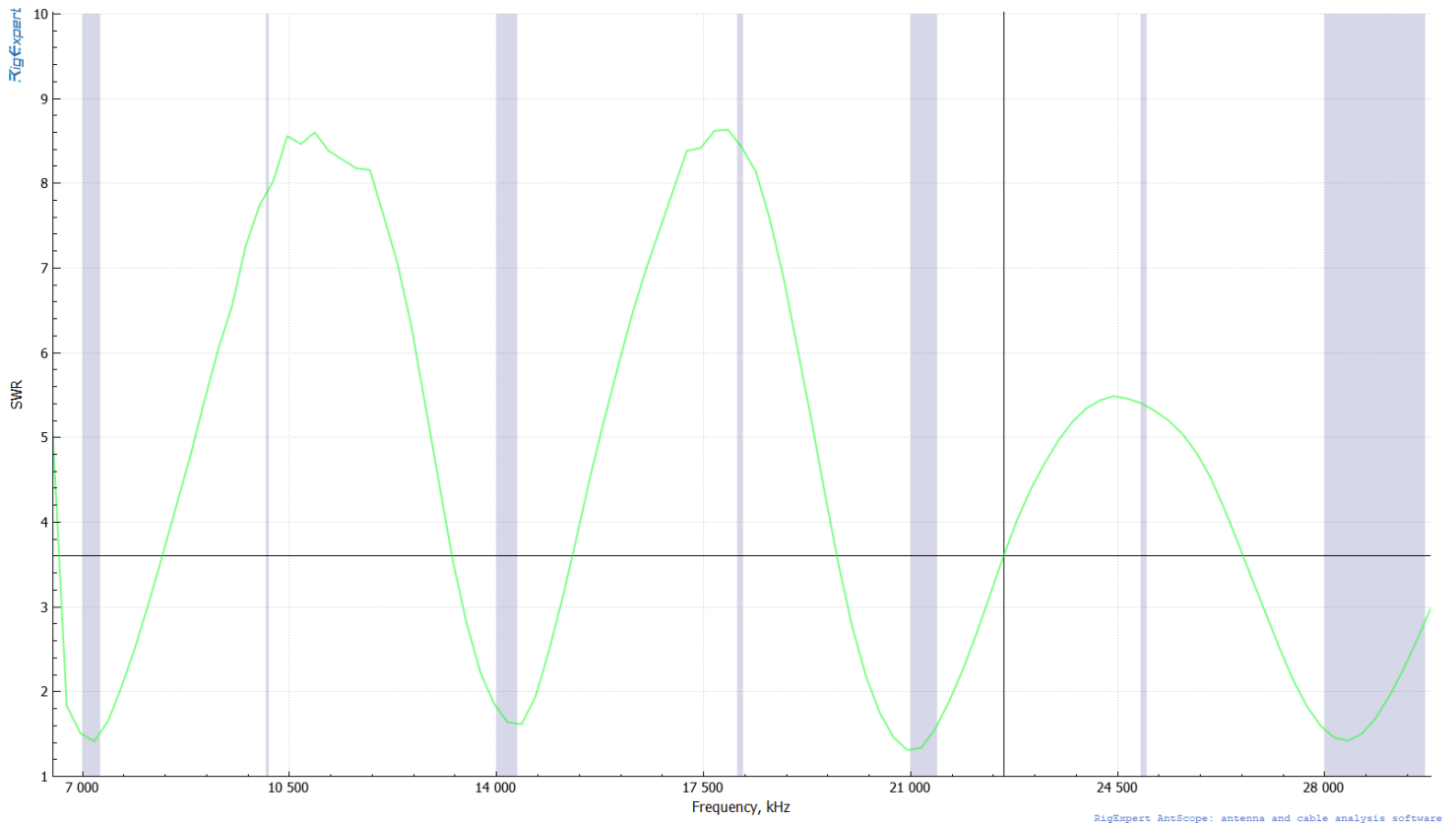


Testing the Completed Transformer (Optional)

- Connect an 1800 ohm resistive load ($\frac{1}{4}$ W resistors work fine) between the antenna and counterpoise connections. Measure the SWR and impedance with an antenna analyzer or NanoVNA. A properly constructed 36:1 transformer will have an SWR under 1.5:1 and an impedance of approximately 50 ohms from 3 – 30 MHz.

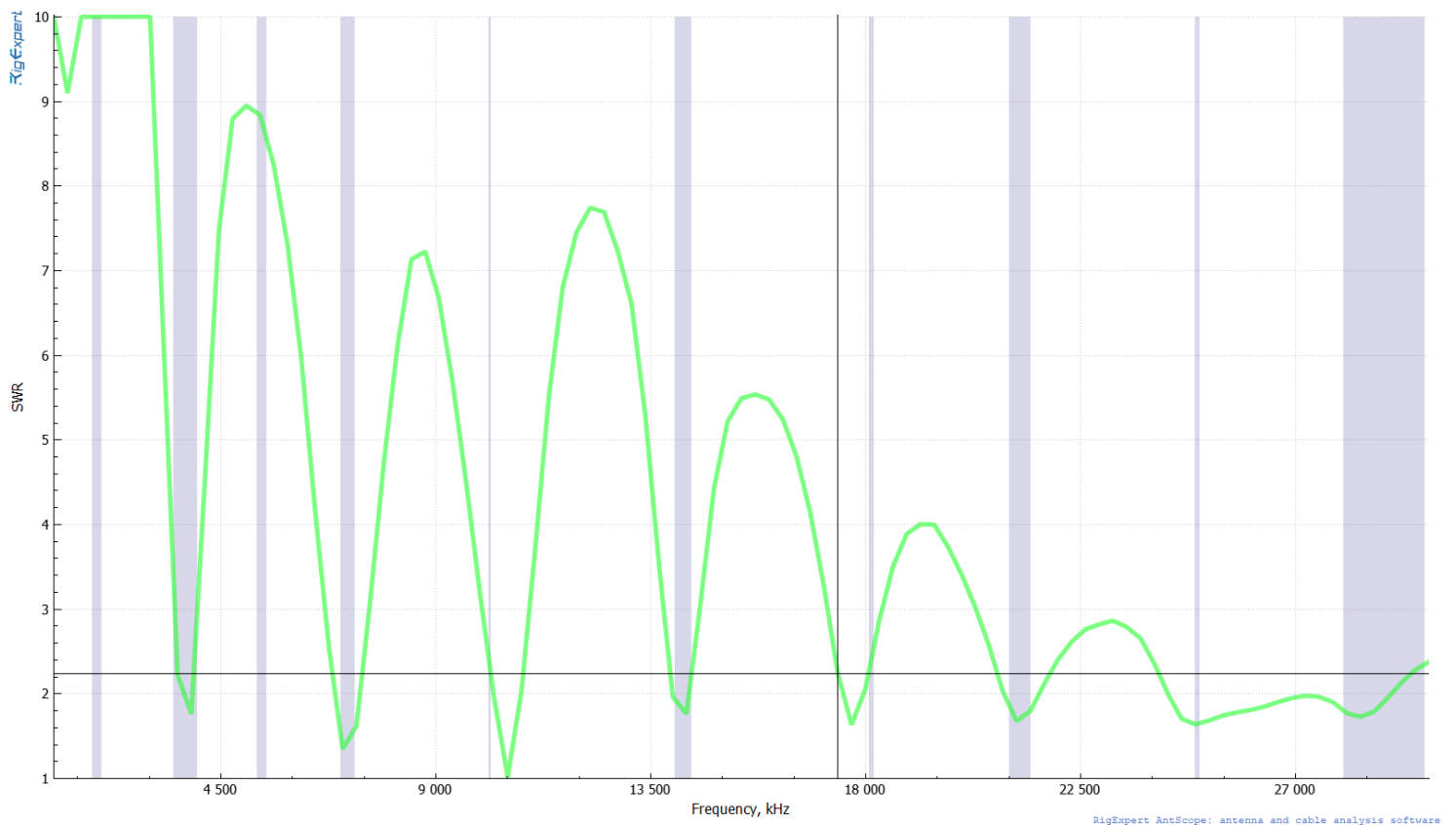
40 Meter End-Fed Half-Wave Dimensions & Tuning

- Start with 67ft of wire and trim for best SWR on the 40, 20, 15 & 10 meter bands.
- 6ft 7in Wire Counterpoise
- The example antenna below did NOT require the antenna loading capacitor to achieve a good match on all four bands.
- Example: inverted V (peak height of 30 ft), 65ft 3in long, SWRs below 2:1 on all four bands.



80 Meter End-Fed Half-Wave Dimensions & Tuning

- 36:1 Transformer – 44ft Wire – 150pF Load Capacitor Assembly – 93ft Wire = 137ft overall length.
- 13ft 2in Counterpoise
- To tune, adjust the far end of the antenna so the lowest SWR on 20 meters is above the middle of the band and the SWR on 15 is less than 2:1 across the band.
- If the SWR on 10 meters is not below 2.5:1 between 28 and 28.5 MHz, adjust the length of the counterpoise.
- Example: inverted L (peak height of 40 ft), SWRs below 2:1 on 40, 20, 15, 12, & 10 meter bands. SWRs below 2.5:1 on 30 and 17 meter bands. SWR below 3.5:1 across 80 Meter band (minimum of 1.3:1 at 3.76MHz).



Using the Coax Feedline as the Counterpoise

- The coaxial feedline can be used as the antenna's counterpoise in place of the separate counterpoise wire, however, one side of the transformer secondary will need to be connected to the shield of the SO-239. The remaining side of the secondary is connected to the antenna.
- Cut a piece of coax to the length required for the size of end fed you are using (40M = 6ft 7in, 80M = 13ft 2in).
- Place a high quality (4000+ Ohms of suppression) 1:1 choke inline after the counterpoise to isolate that section of coax and prevent feedline radiation.

Power Ratings

- Power ratings as noted in the reference article:
 - 3 – FT236-52 (2.36" x 1.5") – 1200W SSB, 800W CW, 400W Digital
 - **2 – FT240-43 (2.4" x 1") – 750W SSB, 500W CW, 250W Digital**
 - FT140-43 (1.4" x 0.5") – 150W SSB, 100W CW, 50W Digital

Alternate Designs

- 36:1 transformers can be constructed for reduced power or QRP operation using various sizes of ferrite toroid, however, not all sizes exhibit the best SWR & impedance characteristics when swept with a NanoVNA.
- FT114A-43 (1.14" x 0.55")
 - Further testing required to determine power rating
 - Best guess: 75W SSB, 50W CW, 25W Digital
- FT82A-43 (0.83" x 0.47") – QRP+
 - Zero heating with 5W digital
 - Best guess: 30W SSB, 20W CW, 10W Digital
- Cores that do not make the best 36:1 transformers:
 - FT82-43 (0.83" x 0.25")
 - FT50-43 (0.5" x 0.19")

References

- A Deep Dive into End-Fed Half-Wave Antennas:
<https://batteryeliminatorstore.com/blogs/ocf-masters-articles/a-deep-dive-into-end-fed-half-wave-antennas-original>