The Un-Ugly Balun Form

Build balms for 160 - 6 meters using these 3D-printed frequency-customizable bobbins

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This article explains how to build two 3D-printed coax balun bobbins that eliminate tie wraps, mounting holes in the form, or messy adhesive to secure the coax. Information for 3D-printed mounting brackets is included as well. See Chapter 23.10 in the 100th edition of the ARRL Handbook for details on 3D-printing.

Pole-mounted 160-meter un-ugly balun.

The Design

These much improved 3D-printed bobbins (see the lead photo) are easily customized for any frequency between 160 and 6 meters. That's because the body of the bobbin is not 3D-printed but is a short length of 2 or 4-inch PVC pipe (see figure 1). The printed ends are glued to the PVC pipe. Figure 2 Shows two sizes: one for RG-8X (Mini-8) and one for RG-8 coaxial cable. The smaller bobbin also works with RG-58 coaxial cable.

A Handy Coax Balun Design Calculator

Turns and pipe lengths (see Tables 1 and 2) were developed using the coax balun calculator at https://tinyurl.com/b2sjcxv9. We added one additional turn because the calculator outputs a center-to-center winding length. The calculator needs the following data:

- ❖ Form diameter: 2 inches of PVC with 2.375-inch outer diameter or 4 inches of PVC with a 4.5-inch outer diameter.
- ❖ RG-8X Mini coaxial cable. 0.242 inch or 0.2 inch without insulation.
- ❖ RG-8 coaxial cable. 0.405 inch or 0.38 inch without insulation.

Figure 1 — End caps and body pipes. Note ramps on rings to keep turns together.

Figure 2 — Completed small 40-meter and large 80-meter un-ugly baluns.

Table 1 — 2-inch PVC with RG-8X (Mini-8)

Band	uH	Turns	PVC (inches)
160	17.7	30	7.7
80	9.1	17	4.6
40	4.5	10	2.9
20	2.3	6	2
10/6	1.1	4	1.5

Table 2 — 4-inch PVC with RG-8

Band	uH	Turns	PVC (inches)
160	17.7	17	7.7
80	9.1	10	4.9
40	4.5	6	3.2
20	2.3	4	2.4
10/6	1.1	2.6	1.9

The body pipe lengths were calculated from the number of turns multiplied by the diameter of the coax, plus an extra 0.8 inch for the pipe to reach the stops in the end caps. The nominal industry standard diameter for RG-8 coaxial cable is 0.405 inch. In practice, however, coaxial cable may vary. It's wise to measure yours with a caliper and add to or subtract from the table dimension, particularly if your coax is slightly larger.

Mounting the Balun

Figure 3 shows a heavy duty 3D-printed mounting bracket for the larger bobbin. A single bracket at the top is adequate for a 6 through 40 meter balun. Two are best for an 80 or 060 Meter balun. The smaller

Figure 3 — A 3D-printed mounting bracket for a large balun attached to an end cap with #10-24 × 1-inch stainless-steel screws.

coax balun is light enough to self-supported by the coax or zip tied to a nearby support.

Connectors may be installed at the ends of the coax, or the balun may be inserted directly into the existing antenna feed line without connectors. If so, each turn of RG-8 will require 16 inches of feed line. Mini-8 coax will need roughly 8.25 inches per turn.

Construction

Polylactic acid (PLA) plastic filament is acceptable for printing. The end caps and the mounting brackets are heavy duty and will tolerate reasonably long-term UV exposure. Polyethylene terephthalate glycol (PRTG), acrylonitrile butadiene styrene (ABS), or acrylonitrile styrene acrylate (ASA) may also be used, white or clear is preferable.

1. Cut the PVC body pipe to the length shown ib Tables 1 and 2 for the design frequency (the lowest frequency on which the balun will be used.
2. Glue on one end cap using clear RTV silicone or polyurethane Gorilla glue. Allow the glue to set.
3. Insert one end of the coaxial cable under the securing tab. Leave a sufficient amount of coaxial cable if you're adding a connector.
4. Wind on turns. You may wish to first apply RTV adhesive lengthwise along the PVC pipe under the turns.
5. Pass the final turn of coax under the securing tab, and apply glue to the second end cap. Install it and snug up the turns.
6. Allow glue to set.

Frequencies

In general, baluns, including these ub-ugly baluns, can bde used on higher frequencies than the design frequency. For example, an 80 meter balun is suitable across the entire HF spectrum and on 69 meters. The extra turns merely provide greater choking impedance.

You can obtain the 3D-printer files (stl) by emailing

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All photos by the authors

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W6OEK - Jim Bailey @ QST Magazine - February 2024; pg. 30

- MY addendum from ARRLfeedback:
  In "The Un-Ugly Balun Form" by John Portune, W6NBC, and Jim Bailey, W6OEK, in the February 2024 issue, it was incorrectly stated that an ugly balun can be used to cover several higher frequency bands than the one for which is was designed. Due to self-resonance of the balun windings, the frequency range is limited to one or two higher frequency bands at most. Additionally, 3D-printer files that will assist with the build are now accessible on *QST* in Depth (www.arrl.org/qst-in-depth).