

A low cost 600 watt ultra-linear amplifier

for 40, 20, 17, 15, 12, and 10m



This compact little amplifier is the brain-child of Pat Murdoch, ZL1AXB, in Auckland, New Zealand. It is only 11" wide, 4" high, and 9" deep. In most respects it is a typical grounded grid linear amplifier, with the exception of a rather unique tuned cathode input circuit that was developed by Pat over 10 years ago.

To best describe this unique circuit; the 813's directly heated cathode (filament) becomes an integral part of the resonant cathode tuning circuit by the use of a coaxial coil (L2). The coil is made of 3/16" copper tubing which is connected directly to one of the tube's filament terminals, and an insulated #12 wire passing through the interior of the coil's tubing is connected to the other. The filament voltage is then applied to the "cold" end of the coil, as well as its interior wire, as shown in the schematic drawing below.

The coaxial input coil is resonated in parallel by a 1000 pf variable capacitor (C3), which is mounted above ground and tuned with an insulated shaft. The LC circuit is shunted by a 2.5K ohm resistor to reduce its Q, and tunes from 7 mHz to 30 mHz, thus eliminating the need for an input band-switch. For this reason it is necessary that C3 have off-center rotor plates for ease of tuning the higher frequencies. With the input tap position on L2 set properly, a near-perfect 50 ohm input impedance will be realized on all bands.

Aside from its broad-band input tuning advantage, Pat's unique input circuit stands apart in two other significant ways: it eliminates virtually all input mismatch distortion, and it increases the efficiency and stability of the 813 dramatically.

The maximum output power of a single 813 would normally be around 300w PEP below 21 mHz. With approximately 50w input, this amplifier produces 600w PEP output nominally, and around 500w PEP output at 29 mHz. Its intermodulation and harmonic distortion products are well below 40 dB down from its maximum power output, and its tendency toward parasitic oscillations is so low that a parasitic plate choke is unnecessary.

To operate the 813 at these output power levels, a sufficient volume of air moving over the tube's glass envelope is required to dissipate the increased heat. In this

case, the tube is mounted horizontally, about ½" above the case bottom and about 1" from the rear of the case, directly in front of a 3" exhaust fan that is mounted on the rear panel which draws cooling air around the envelope, from the air holes in the top and bottom of the case (see photo of case below). The air holes in the bottom of the case are located below the rear of the plate coil (L1). A low value 10w resistor can be placed in series with the Fan's AC supply to slightly reduce the fan speed, thus reduce noise.

A 3kv @ 350ma continuous duty rated power supply is required for the 813 to achieve its maximum output power. A schematic for a suitable HV power supply is shown at the bottom of this page.

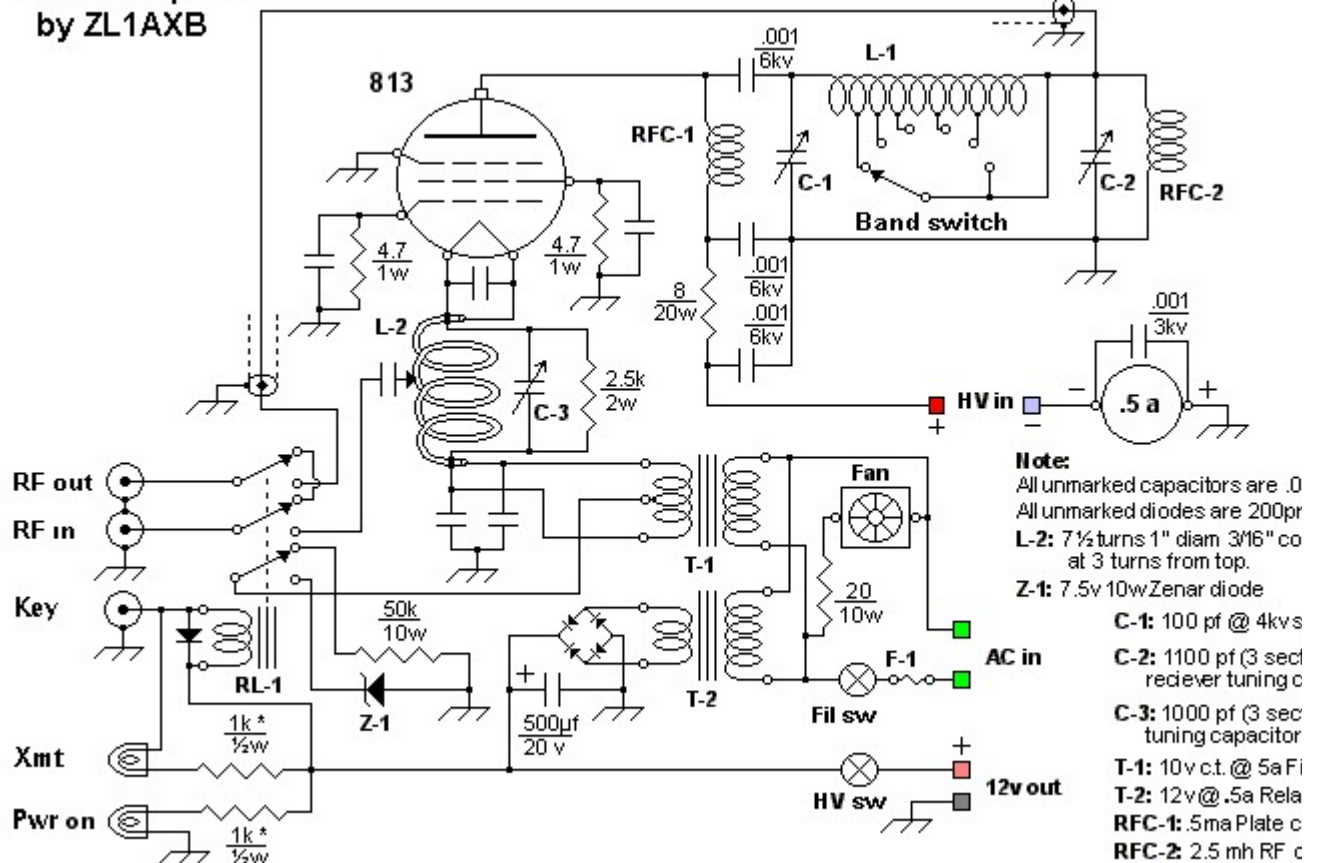
L1 consists of two 2" ID coils in series that are: 8 turns of 3/16" copper tubing with the windings spaced about 3/32", followed by 8 turns of #8 copper wire with the windings spaced similarly. Counting from the C1 end, the following taps are placed at: 2 turn for 10m, 2½ turns for 12m, 4 turns for 15m, 5 turns for 17m, 7½ turns for 20m, and the full coil for 40m. If one wants 30m, the tap is at 11 turns.

Since Pat winds his own transformers, the 12v relay winding is integrated in T1 thus a similar transformer may be unavailable. A small 12v transformer suitable for supplying the relay voltage (T2) may be placed below C3's tuning shaft extension, near the front panel.

The following schematics should provide enough details to construct a similar amplifier. 813 tubes can be found via the internet from around \$5.00 used, to up to \$30.00 new. 813's that have gone soft can usually be rejuvenated by applying 10½ volts to the filaments for an hour or two.

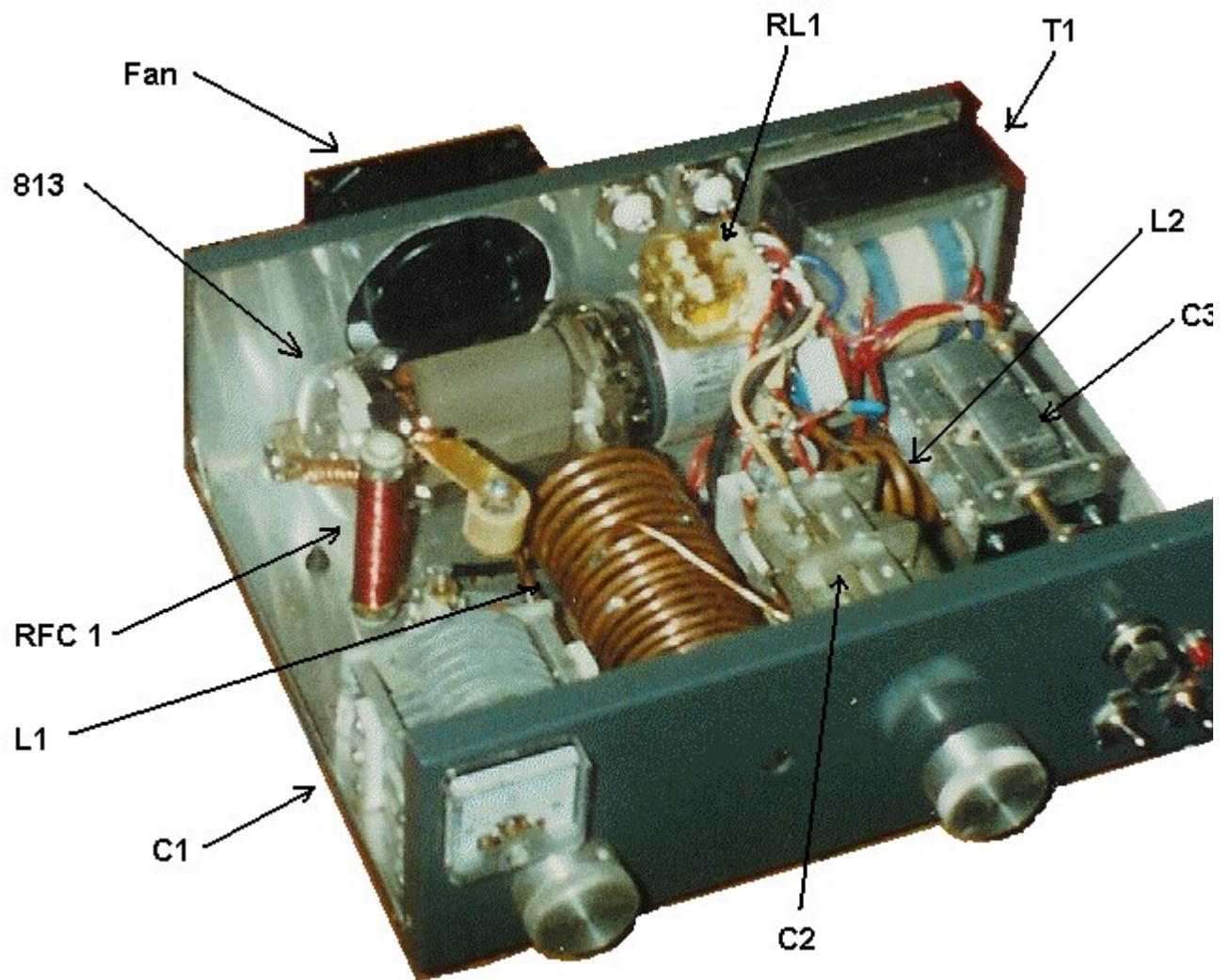
Schematic Drawing

600 W amplifier by ZL1AXB

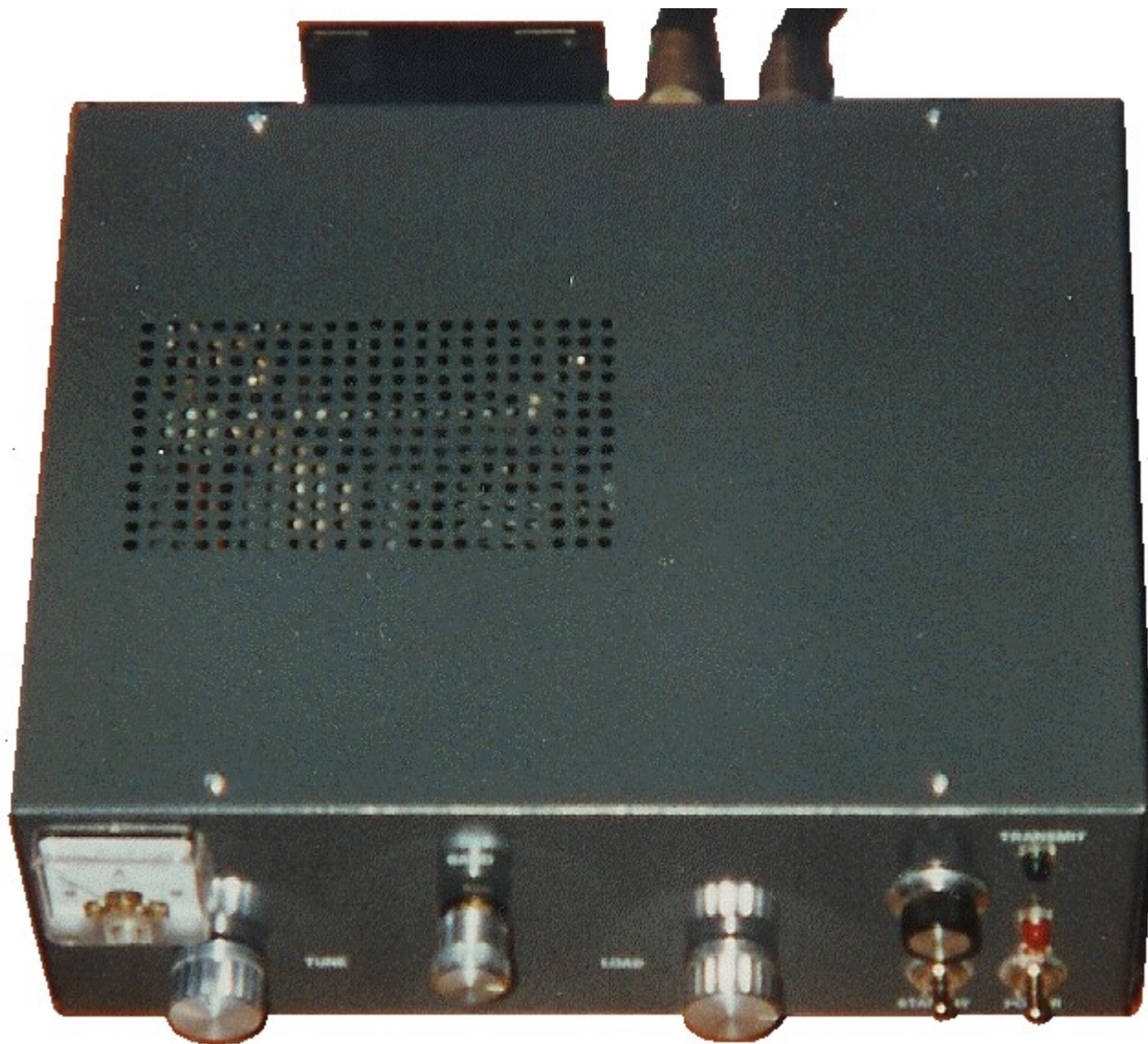


You can also see ZL1AXB's 1KW version of this amplifier [→ GO](#)

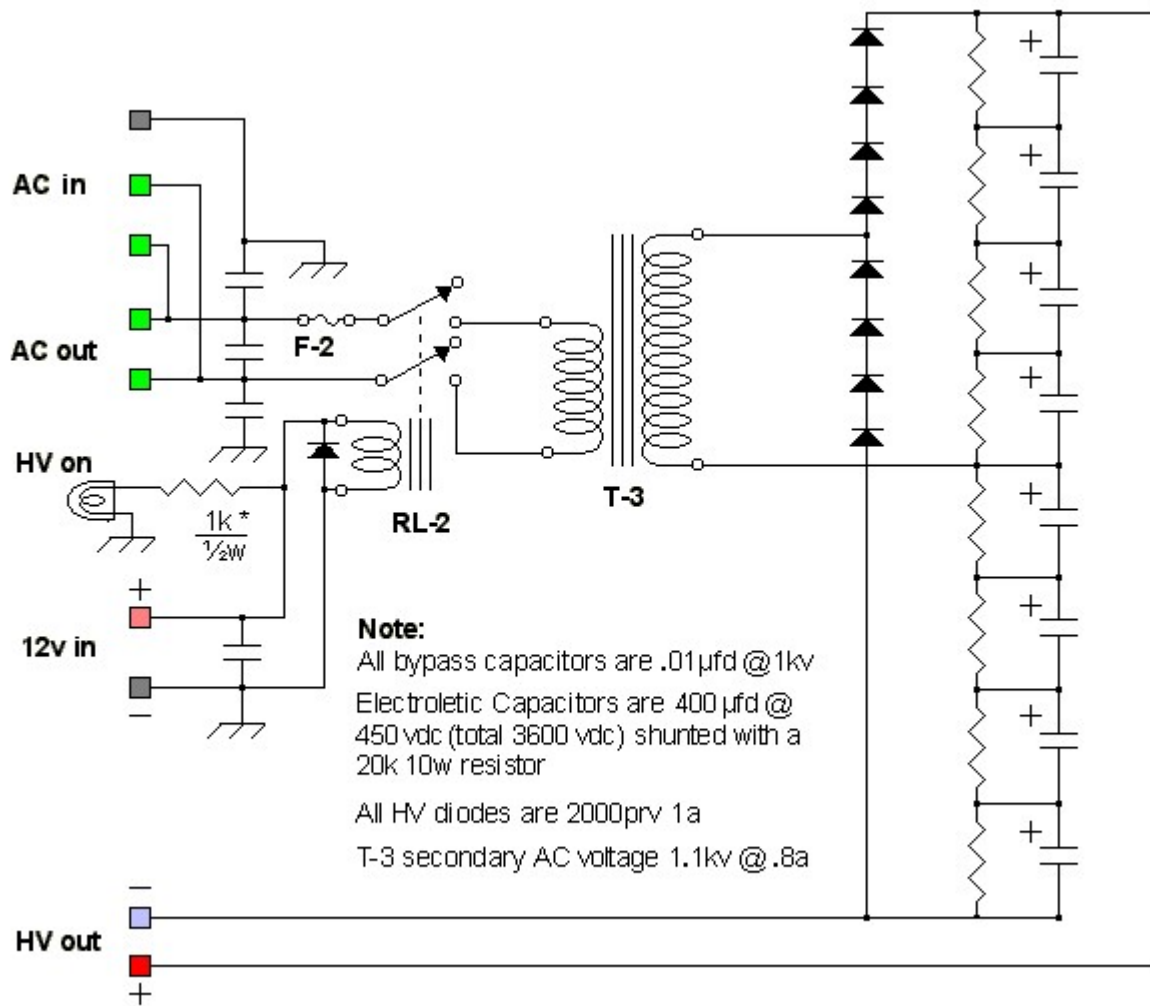
The layout



Air vents in top of case cover



A 3kv voltage-doubler power supply



It is important to note, this supply is not adequate for the 1kw version of the amplifier. For this, the current rating of T-3 must be increased to 1.5 amps.

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