2304 MHz Power Amplifier

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INTRODUCTION:

This amplifier was created to fill an existing void in power amplifier designs available for 2304 MHz. Previous designs by WA9HUV, OE9PMJ and OZ9OR have required extensive machine work or used exotic tubes. This design uses readily available materials in critical areas and can be built with simple tools. The design was developed using the principles presented by Buzz Miklos, WA4GPM in his paper *Coaxial Cavity Amplifiers* at the 1985 Central States VHF Conference.

OUTPUT CIRCUIT:

The amplifier will operate using any of the 2C39 or 7289 like tubes. The input and output circuits will accommodate the range of internal capacitances. The output circuit is a loaded 3/4 wavelength resonator while the input coaxial line is a 5/4 wavelength resonator. The input and output cavities use modified UG58A/U chassis mount "N" connectors as a capacitive coupling probe. The plate tuning capacitor is a large diameter 5/16" brass "toilet flange" bolt with approximately 18 threads per inch. The plate tuning will be very sharp and a bolt with finer threads is recommanded. I have used a 3/8" - 24 T.P.I. unit and found it very satisfactory. An option would be to make the anode cavity approximately 3/16" longer (overall cathode line length is unchanged but more of it will have to be inside the anode cavity) which will require less tuning capacitance. The change in capacitance for a change in length will be smaller nearer the outside wall.

INPUT CIRCUIT:

The cathode cavity is tuned with a sliding RF short. This short uses conventional finger stock in contact with the inside of the 3/4 inch copper water pipe as the sliding coaxial quarterwave stub moves along the 7/16" OD cathode line. The bottom 2 inches of the cathode line is covered with a thin plastic sheet material. I used teflon by mylar tape (transparent "Magic" tape or the brown packing tape) should work well. The 3/4 inch long piece of 1/2" OD hobby brass tubing in the RF short slides along on the tape. It should be smooth inside to prevent damage to the tape. Two short 1/16" brass rods extend out the bottom of the cavity to allow adjustment.

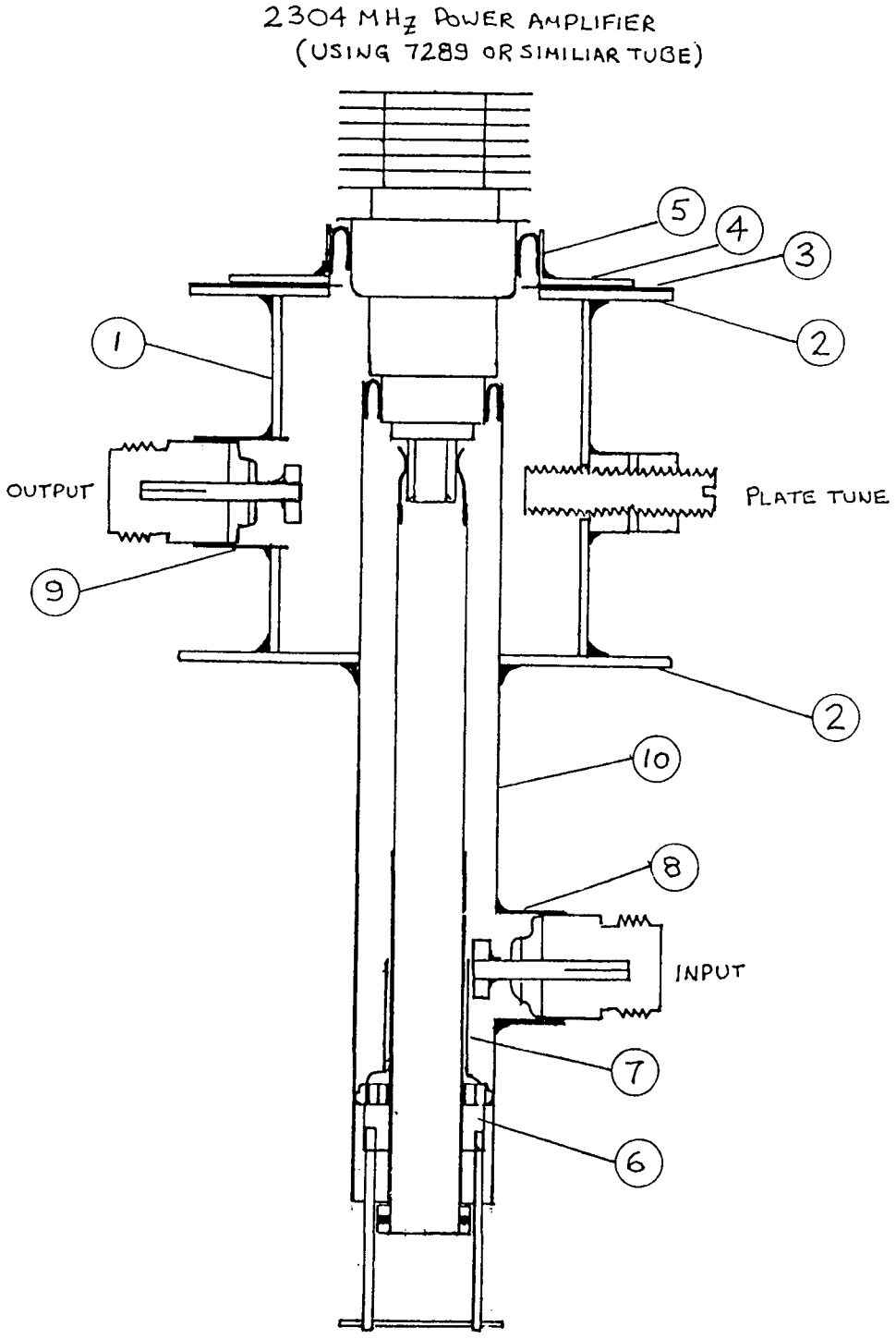
The input coupling probe, like the output probe, is a UG58A/U "N" type coaxial connector with the mounting flange removed. A #8-32 brass nut is soldered to the end of the center conductor and for the input probe, only a thin piece of teflon or mylar tape covers the end of the probe to prevent shorting out the input, when pushed all the way in. The probe will optimize within 1/16" of the center conductor. The copper input and output mounting sleeves were cut from a straight splice fitting for 1/2" copper water pipe. These were slotted and accept a small hose clamp to secure the coupling probes.

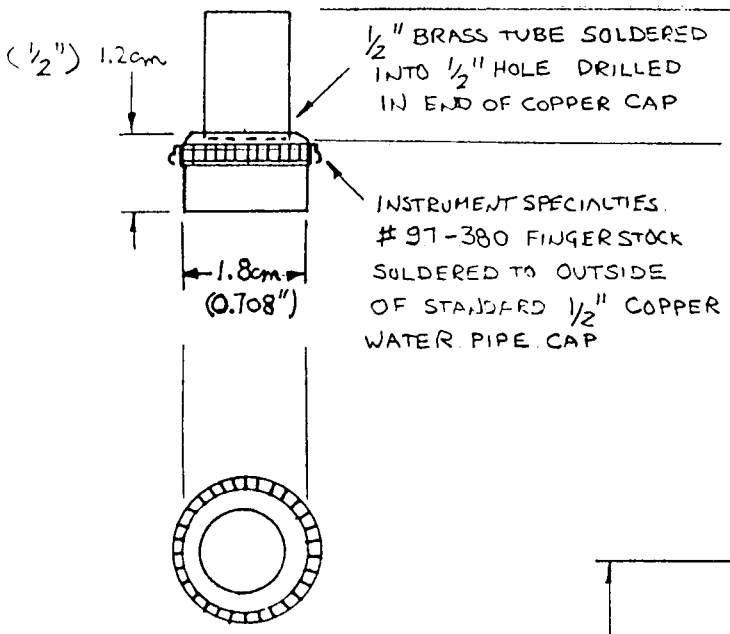
The cathode line assembly in my case was a surplus unit. The 7/16" outside dimension is important and should be adhered to, altough +-1/16" may work out alright if you adjust the dimensions of the 3/4" long piece in the RF short accordingly. The cathode line must be mechanically secured at the bottom without shorting out the cathode or filament voltage. This was achieved by securing the bottom of the cathode line to a 11/16" wide piece of epoxy board (no copper). A 7/16" hole was drilled in the center of the 2" long board to let the cathode line pass through. The short pieces of approximately 7/16" ID tubing or 2 flat washers are soldered to the cathode line on opposite sides of the board to hold it in place. The epoxy board is secured to the outside of the 3/4" cathode line with 2 right angle brackets and a hose clamp. The push rods attached to the cathode tunable short, straddle the epoxy board as they emerge.

TUNEUP AND RESULTS:

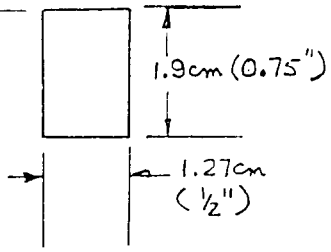
The amplifier tunes very easily and smoothly. The amplifier should tune with the probes, etc. in the positions shown in Figure 1. Adjust the idling current for 50 mA and apply a few watts of cathode drive. Adjust the cathode short and the input probe for maximum plate current. With a suitable RF indicator, adjust the plate tuning for maximum output. It will be a very sharp peak. Then alternately adjust the output probe and tuning for maximum power. With good tubes, I have seen greater than 60 W output at efficiencies near 25% and gain of 10-13 dB.

One final comment is required concerning cooling. No attempt has been made to use air cooling. My experiences on 23cm with these types of tubes is that water cooling is the only way to eliminate thermal drift of the output power. The 2 versions of this amplifier I have built, have no significant drift with the 7289 type tubes. A slight amount appeared with 7211 tube but this was not enough to be concern.

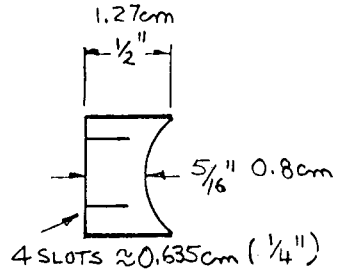




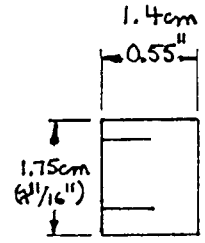
6 TUNABLE CATHODE SHORT



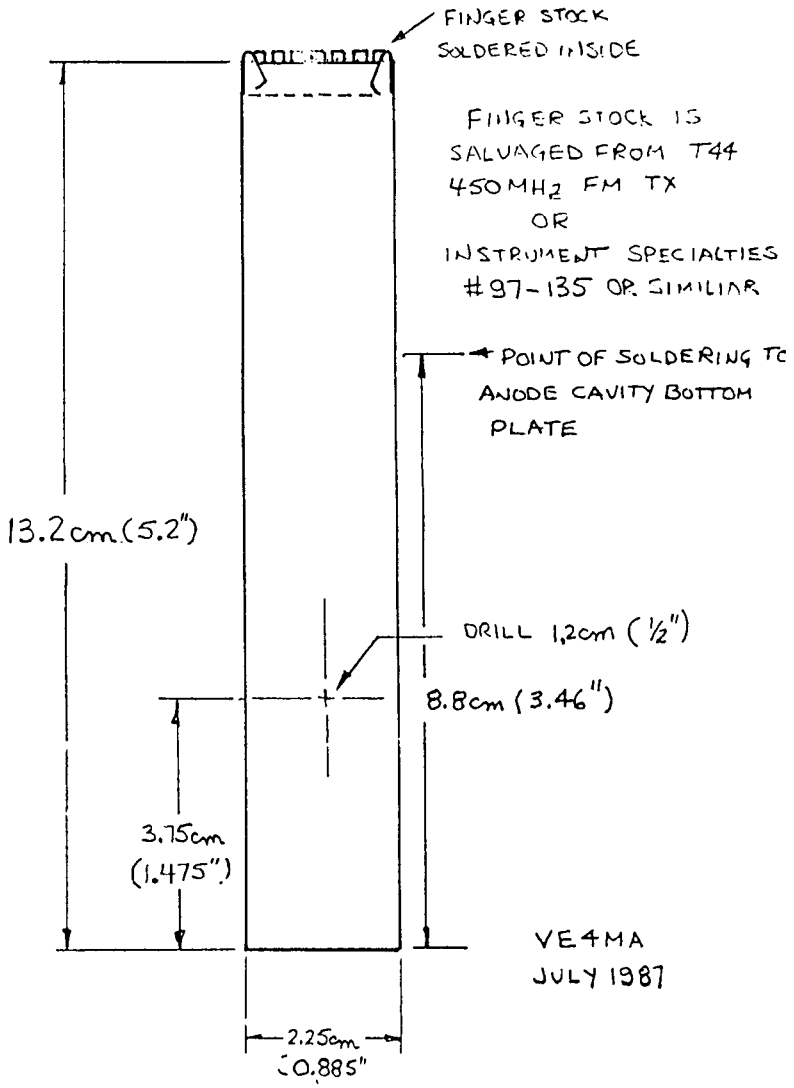
7 SLIDING QUARTER WAVE STUB



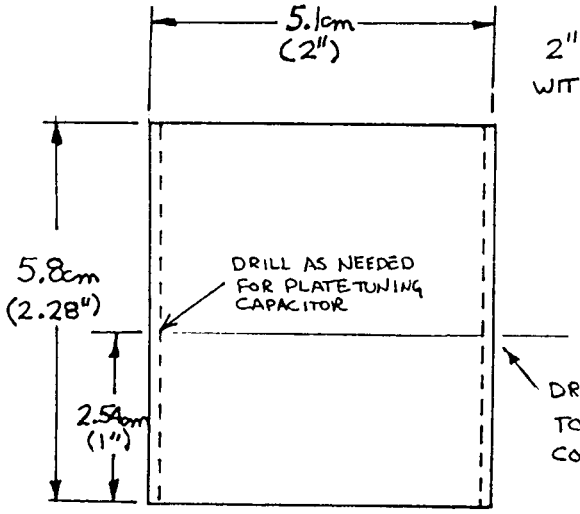
8 INPUT PROBE MOUNTING SLEEVE



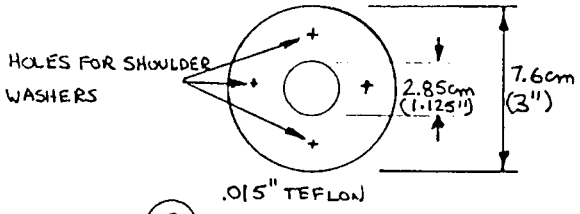
9 OUTPUT PROBE MOUNTING SLEEVE



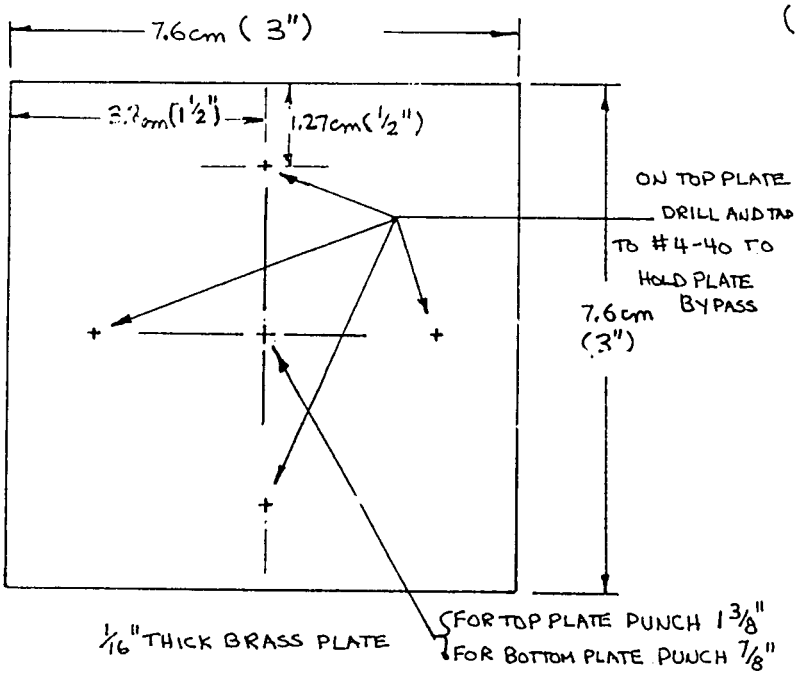
10 CATHODE CAVITY OUTER CONDUCTOR



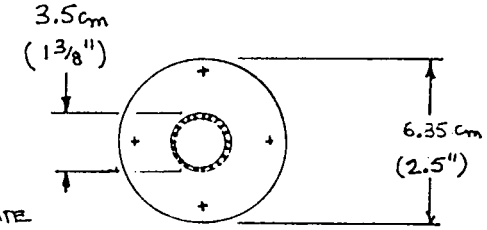
(1) ANODE CAVITY OUTER CONDUCTOR



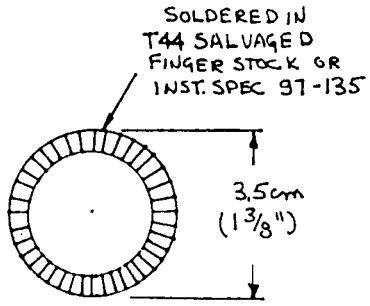
(3) PLATE BYPASS INSULATOR (NOT TO SCALE)



(2) ANODE CAVITY TOP AND BOTTOM PLATES



(4) ANODE BYPASS PLATE 1/16" THICK BRASS (NOT TO SCALE)



(5) ANODE FINGER STOCK SUPPORT RING

APPROX 1cm HIGH (5/16")

(NOT TO SCALE)

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