



## BRING BACK THE NOSTALGIA WITH A TUBE TRANSMITTER

**IMPORTANT:** The published circuit diagrams of Station QRP are for educational purposes only. These are offered for the furtherance of the readers' knowledge regarding Radio Frequency design and principles. At all times during operation an assembled unit must be connected to a dummy load. In most countries law prohibits the unlicensed operation of transmitters when connected to an antenna or even to have such equipment present in a fully or partially installed state. All responsibilities for the ultimate use of the diagrams are borne solely by the builder and/or operator.

## Introduction

Tubes are a dying technology. All modern transmitters, even high power ones, do work with transistors and other semiconductors. But many fondly remember their first homebrew transmitter and its hard to forget warm glow of a vacuum tube.

The Station QRP website ([www.stationqrp.com](http://www.stationqrp.com)) is especially for you to come into touch with tube technology.

To shed light onto this site that many may not know about but may find interesting, please put a link on your website/blog to spread the word. Thank you.

73's

November 21<sup>st</sup> 2014

## 8 Watt Tube QRP AM Shortwave Transmitter

Are you interested in this 8 Watt tube AM shortwave transmitter? If you ever wondered how those tube AM shortwave transmitters from the early 1960's worked, then why not build it yourself? Most would tell you that hand-assembling a tube AM shortwave transmitter offers a much richer experience than simply operating it. And when you're finished, you'll have a tube AM shortwave transmitter that you can understand, repair, and even modify.

Most parts used in this transmitter are still available (e.g. Surplus Sales of Nebraska <http://www.surplussales.com>) or can be salvaged from old radio communication sets.



## QRP AM Tube Shortwave Transmitter - Technical Data

**Transmitter:** Tube (EUR = Valve)

- Oscillator 6BX6 (EUR = EF80)
- Power Amplifier 6CJ6 or 6DR6 (EUR = EL81)

**HT Power Supply:** 300 Volts at 300 mA

**Band coverage:** 6200 - 7400 kHz (Other bands are possible; for example 3800-5000 kHz)

**Modulation:** Amplitude Modulation (AM)

High Level Anode and Screen AM with 100% positive and negative peaks available

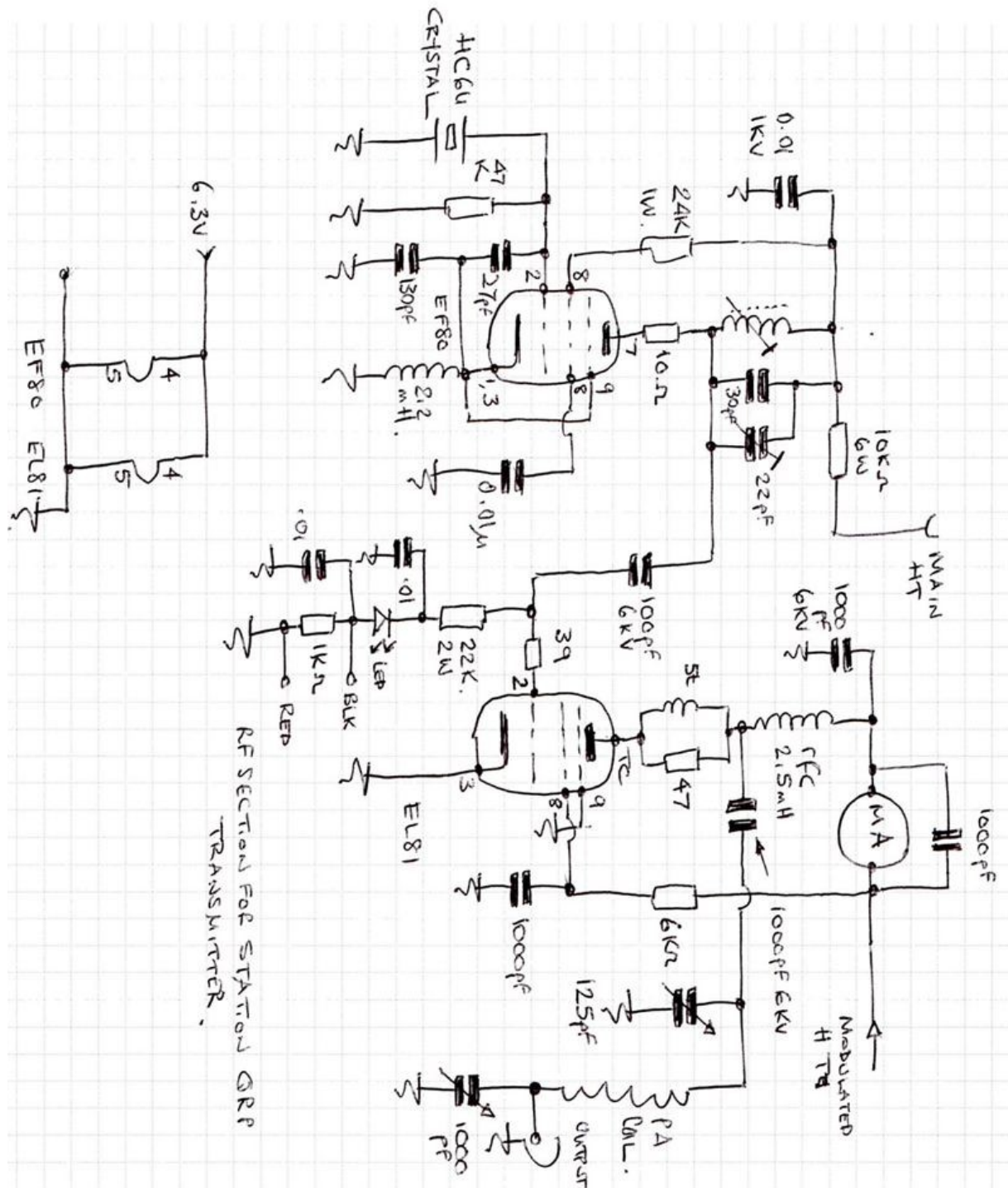
**Audio:** Tube (EUR = Valve)

- Pre-amplifier 6AQ4 (EUR = EC91)
- Phase splitter 12AT7 (EUR = ECC81)
- Amplifier 2 x 6BW6 (EUR = CV4043)

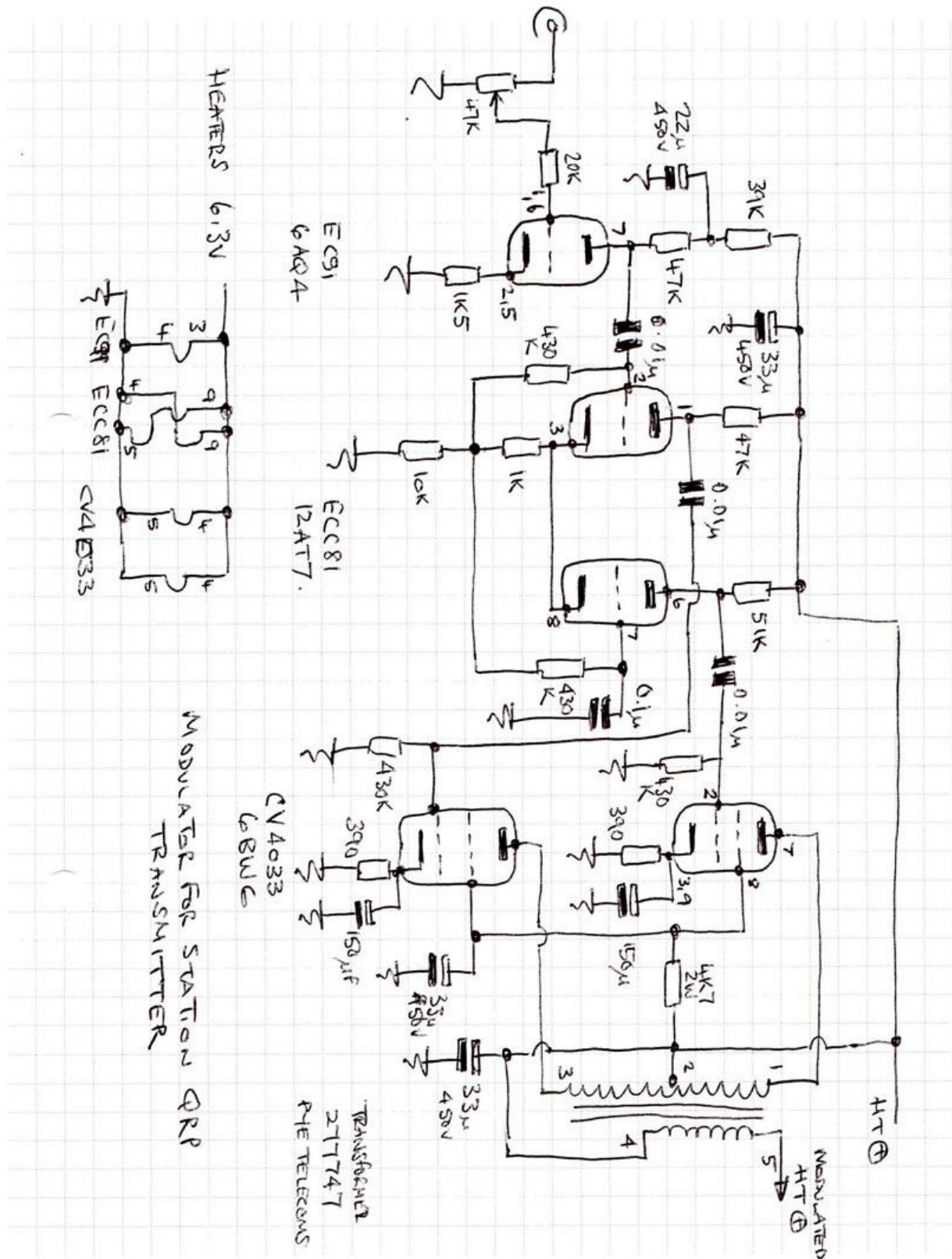
**Audio impedance:** 47K Ohm

**Power Output:** 8 Watts nominal

## QRP AM Tube Transmitter Circuit Diagram - RF section

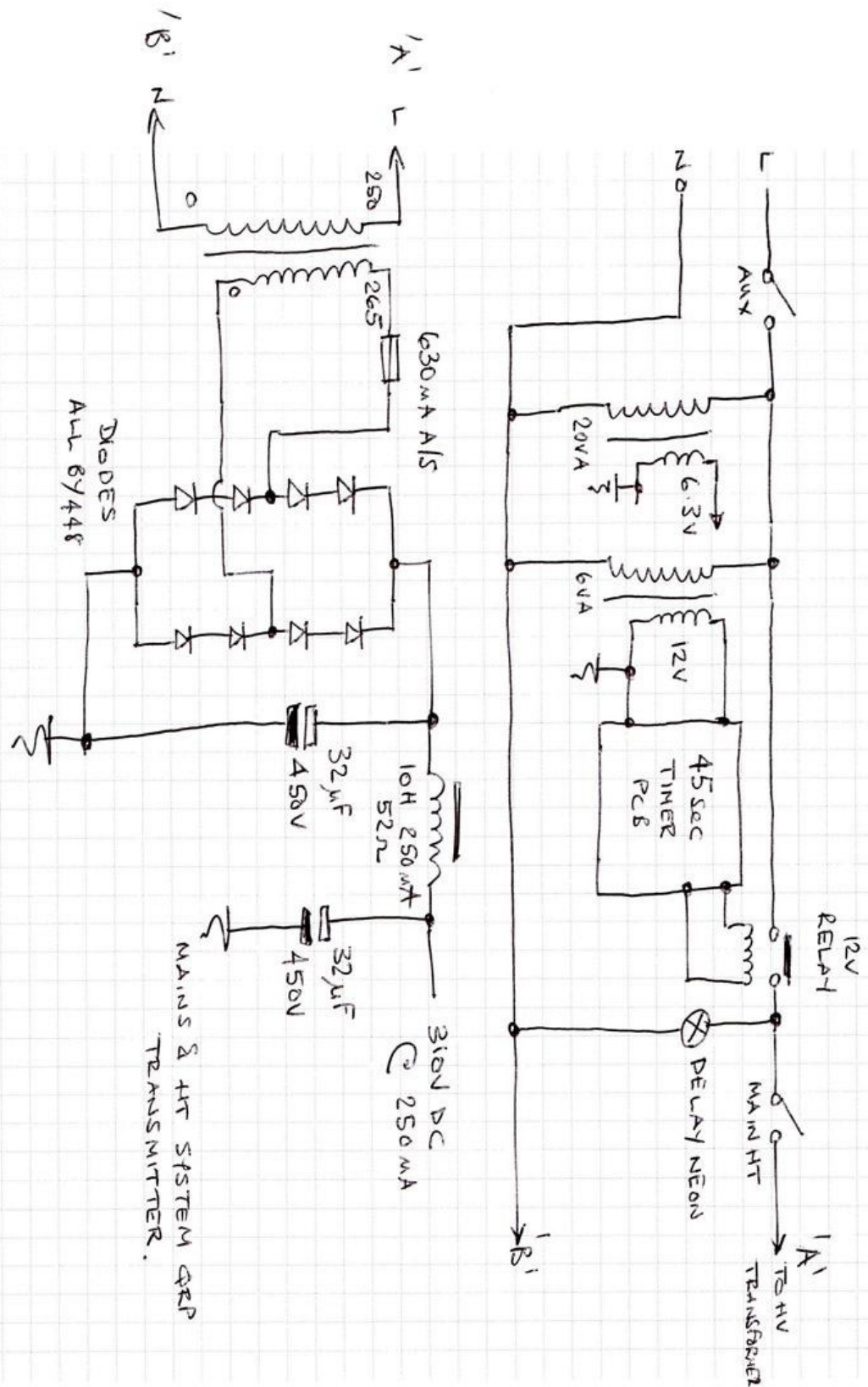


# QRP AM Tube Transmitter Circuit Diagram - MODULATOR section

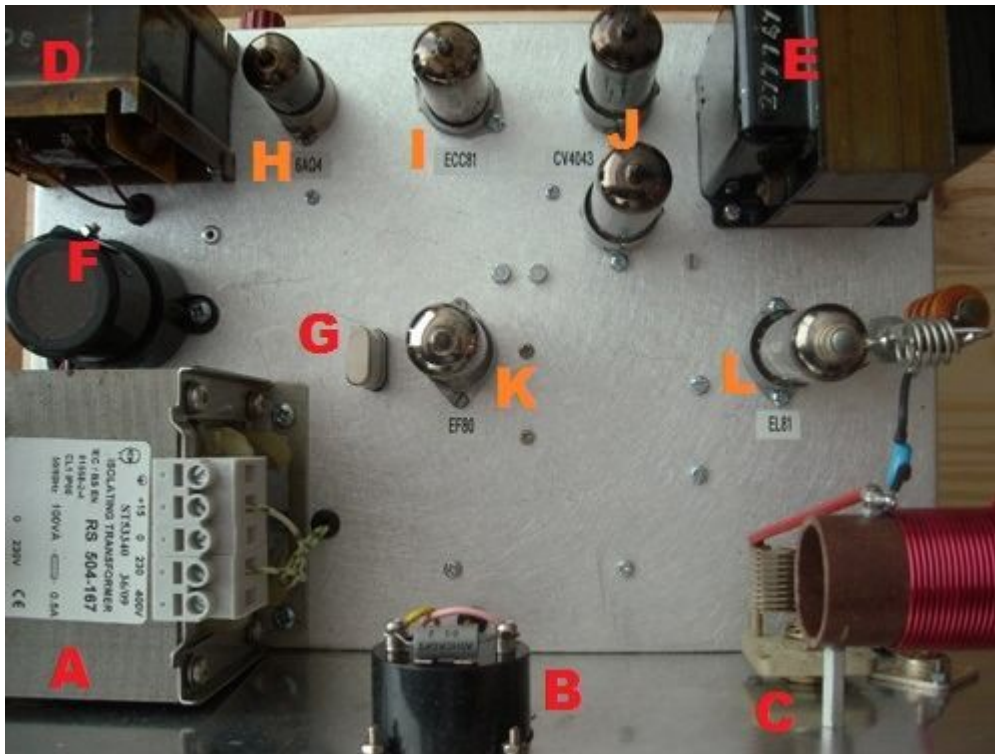




## QRP AM Tube Transmitter Circuit Diagram – POWER SUPPLY section



# QRP AM Tube Shortwave Transmitter



- A = Main HT Transformer (300 Volts at 300 mA)  
B = Anode Current meter  
C = Tank circuit  
D = HT DC Smoothing Choke (3 H at 250 mA 52 ohms resistance)  
E = Modulation Transformer (9 K anode to anode and 3.5 K ohms secondary at 75 mA DC)  
F = 32 + 32  $\mu$ F 450V DC HT Smoothing Capacitor  
G = HC-6/U Crystal in socket  
H = 6AQ4 Pre-amplifier (EUR = EC91)  
I = 12AT7 Audio pre-amplifier / phase splitter (EUR = ECC81)  
J = 6BW6 2 x Audio amplifier / modulator valves (EUR = CV2136 or CV4043)  
K = 6BX6 Crystal Oscillator (EUR = EF80)  
L = 6CJ6 or 6DR6 Power amplifier (EUR = EL81)

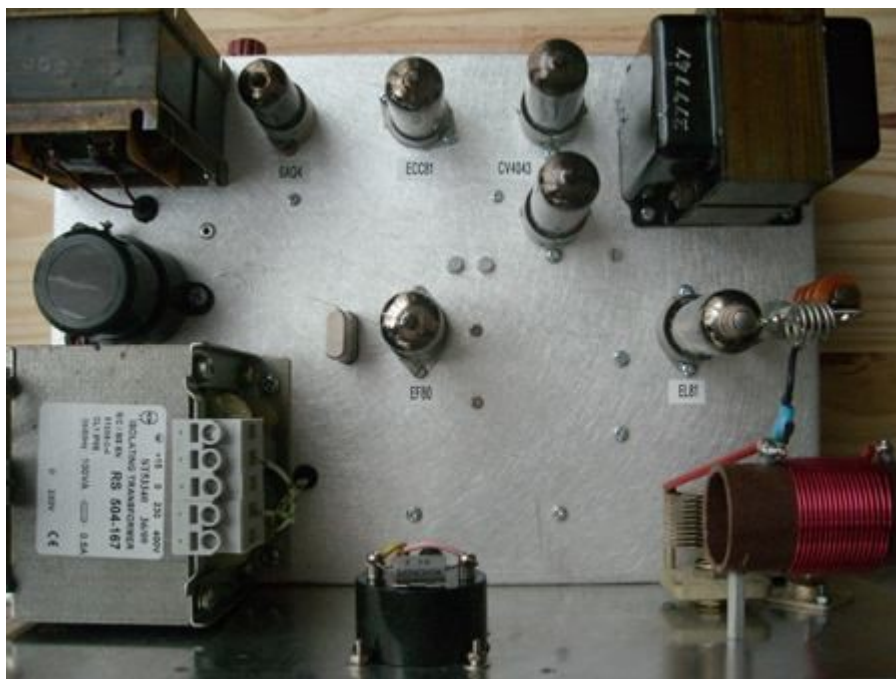




Front



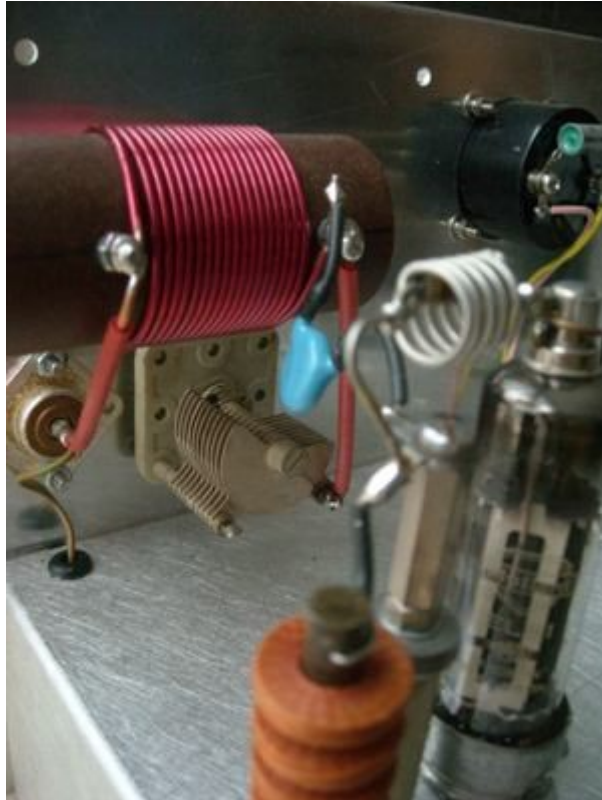
Rear



Seen from above



Seen from below



Tank circuit

# QRP AM Tube Shortwave Transmitter – Instruction Sheet

## Step 1: Grid tuning procedure

It may be necessary to check the tune from time to time of the Grid circuit. This is especially so if you move from say 6950 kHz to say 7300 kHz. Insert a crystal and tune the PA as normal. Connect up a digital voltmeter and observe the Grid. Rotate the trimmer capacitor and tune maximum reading on the high side of the frequency you need, that is the best tune point. For example, if you get 2 volts then slightly re-tune so you get 1.95 and leave it.

## Step 2: Start

Connect the xmtr to a dummy load. Set PA Tune and PA Load variable capacitors to maximum capacity. Set modulation gain to minimum audio level. Switch on the aux power and wait for 1 minute; switch on the HT power.

## Step 3: PA Tune

After switching on the control immediately observe the anode current meter and rotate the PA Tune control for a dip in the anode current.

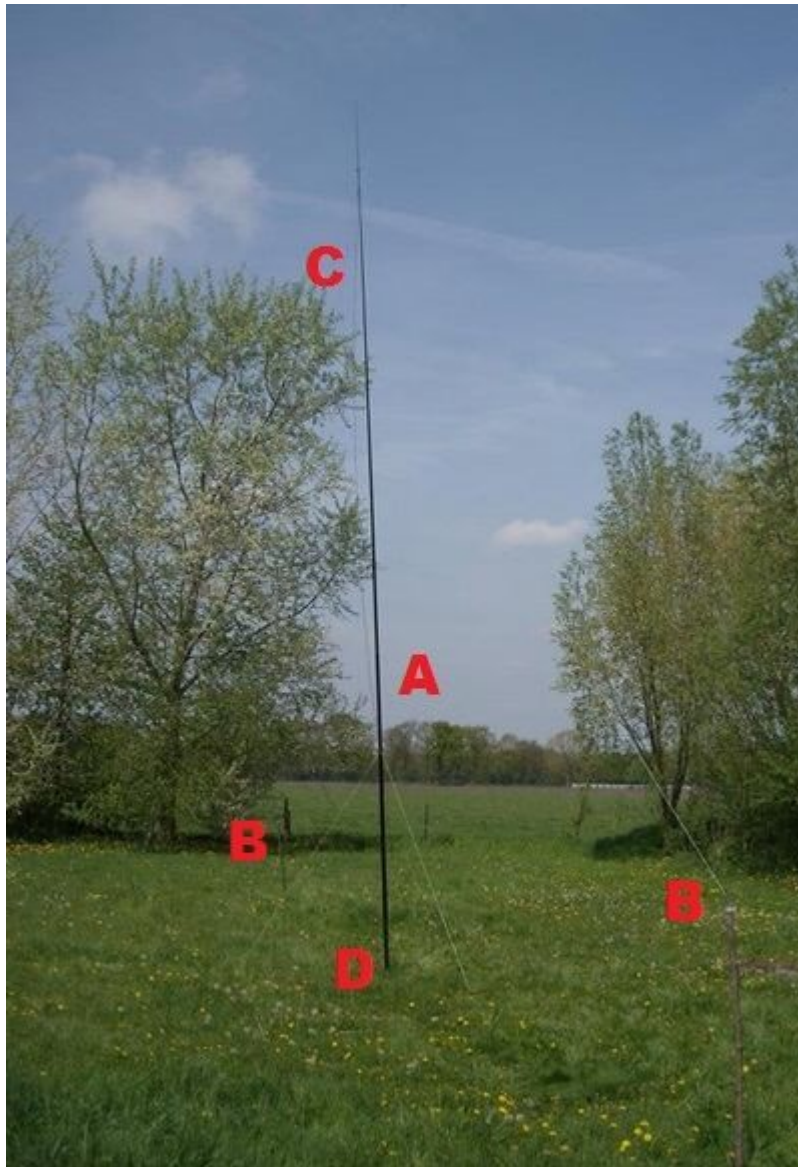
## Step 4: PA Load

Load up with the PA Load control until the anode current meter reads 70 on the scale in the dipped condition, this corresponds to about 8 Watts output.

## Step 5: Grid

To check the actual Grid current, use a digital voltmeter; If you measure say 1.9V then that corresponds to 1.9mA of the Grid current. The normal running current will be between 1.5mA and 2.0mA.

## QRP Inverted-V Shortwave Antenna



The antenna is built using a fibreglass fishing pole and speaker wire

- A = Fibreglass telescopic fishing pole
- B = Both legs of Inverted-V
- C = Top of fishing pole
- D = Balun (at bottom!)



Why might the Inverted-V be preferred to the dipole? The first reason is mechanical - only one high support is required. Another often cited reason is that the Inverted-V makes a better match to the typical 50 Ohm feed line. The Inverted-V will give up to 3 dB power gain at high take-off angles. Despite the theory the steeper the Inverted-V the worse it is, 90 degrees is about the tightest it ought to be. For best results the included angle needs to be as large as possible so in effect it looks like a roof on a chalet, nearly horizontal, so 160 degrees.



Top of fishing pole (C)

In terms of efficiency the best is say, a 65ft (20m) support pole and as large included angle as possible, ie) the antenna is nearly like a proper dipole. Less efficient is the same 65ft pole and a smaller included angle. Even less efficient is say a 32ft (10m) pole and a large included angle, and the least efficient is a 32ft pole a small included angle. Other than the gain difference at high angles, the Inverted-V has basically round patterns. At lower take-off angles however, the Inverted-V maintains a uniform azimuth pattern, whereas the dipole becomes increasingly bi-directional. Last but certainly not least, is that due to the relatively low height above ground, the Inverted-V antenna 'shoots' straight up for a perfect skip.

All that is needed are three end insulators, a length of rope, wire and in my case a fishing pole!



Balun (D)

- END -