

# **ANTENNA TUNER**

Model PT2500A

## **OPERATOR'S MANUAL**

**Palomar Engineers**

Box 455, Escondido, CA. 92025 • Phone: [714] 747-3343



# CHAPTER I

## INTRODUCTION

### 1-1. DESCRIPTION

The PT-2500A is a wide range impedance matching network that is designed to match a 50 ohm transmitter to a variety of antennas over the frequency range 1.8 to 30 MHz. The antennas may be coaxial cable fed, single wire against ground, or balanced two wire feed.

The circuit is a "T" network with two series capacitors and a tapped shunt inductor.

### 1-2. MAJOR FEATURES

The PT-2500A has three significant new design features:

- 1) Quarter inch diameter copper coils to allow continuous operation at high power.
- 2) A built-in R-X noise bridge to allow tune-up without transmitting.
- 3) A 1:1 balun at the input instead of a 4:1 balun at the output to improve efficiency with balanced lines.

### 1-3. SPECIFICATIONS

Frequency Coverage:	1.8 to 30 MHz.
Power Rating:	2000 watts continuous.
Input Impedance:	50 ohms.
Outputs:	BYPASS (for dummy load) COAX (for coax-fed antenna) SINGLE WIRE BALANCED FEEDER
Power Requirement:	9-v @ 50-ma in TUNE. (No DC power required in OPERATE mode). Battery clip provided.
Dimensions:	16" wide x 14" deep x 6" high.
Weight:	18-lb.
Mechanical:	Chassis and panels aluminum. Hardware plated brass or stainless steel. Knobs double set screw. Balun core RF ferrite.

## CHAPTER II

# INSTALLATION

### 2-1. UNPACKING.

Carefully remove the tuner from its shipping carton. Make sure it isn't damaged. If it is, don't throw anything away. Save the box and packing material to show to the transportation company that delivered the tuner.

If everything looks all right go ahead and set up the tuner. But before applying rf to it read this manual.

### 2-2. LOCATION.

Place the tuner where it will be easy to see and adjust the knobs. You'll be turning its knobs more than any others except your VFO and receiver tuning. So make it convenient.

### 2-3. CONNECTING THE TUNER.

Connect the output of your transmitter or your linear amplifier to the XMTR jack on the rear of the tuner. This line can be of any length that is convenient. RG58/U cable is all right here because the SWR will always be low on this section of cable.

If you have an SWR or SWR/Power meter, connect it between the transmitter or linear and the tuner. We recommend the use of an SWR meter - it can be very helpful.

There are two ground terminals on the tuner rear panel. The bottom one should be connected to the station ground with a heavy braid. This puts the chassis of the tuner at ground potential. This is a safety precaution and is particularly important at high power.

A 9-volt transistor battery should be installed in the holder on the rear panel and connected to the clip provided. An alkaline battery is recommended.

The fuse holder is fitted with a 1/200 ampere fuse. A spare fuse is enclosed with the instruction manual. The fuse is for protection of the noise bridge if you accidentally transmit into it.

#### 2-4. THE BYPASS JACK.

If you have a coax fed antenna that doesn't need a tuner you can connect it to this jack. When the front panel switch is in the BYPASS position this antenna will be connected directly to the transmitter.

Or you can connect a dummy load to the BYPASS jack. Then you can tune your transmitter into the dummy load without transmitting on the air. We strongly recommend using this method of transmitter tuning. Of course, if you have a broadband final and broadband linear you won't need to do this. Even so, it is a good way to check transmitter performance into a known load.

#### 2-5. COAX FED ANTENNAS.

Connect the coaxial line from your antenna to the COAX terminal on the rear panel. When the panel switch is in COAX DIRECT position, this antenna will be connected directly to the transmitter. When the switch is in COAX TUNE position, the tuner is connected to the antenna.

This antenna might be a beam that has low SWR in the 'phone band but you want to use it in the cw band where its SWR is too high for your transmitter. In the 'phone band you can use COAX DIRECT position. In the cw band you can use the COAX TUNE position and use the tuner to lower the SWR as seen by the transmitter.

Or you might have a dipole that is cut for and has low SWR on one band, but you want to use it on another band where its SWR is very high. Use COAX DIRECT on the band where the SWR is low. On the other band use COAX TUNE and the tuner may be able to lower the SWR on the transmitter cable to an acceptable level.

NOTE. There is a jumper between the upper GROUND terminal and the upper BALANCED LINE terminal. This jumper must be in place when using the COAX jack.

#### 2-6. SINGLE WIRE FED ANTENNAS.

Connect your single wire antenna to the SINGLE WIRE terminal on the rear of the tuner. Turn the panel switch to SINGLE WIRE.

NOTE. There is a jumper between the upper GROUND terminal and the upper BALANCED LINE terminal. This must be in place when using single wire antennas.

2-7. BALANCED LINE FED ANTENNAS.

Connect your balanced line feeder to the two BALANCED LINE terminals on the rear panel of the tuner.

NOTE. There is a jumper between the upper GROUND terminal and the upper BALANCED LINE terminal. Remove this jumper when using balanced lines. Leave the jumper connected to the GROUND terminal so you don't lose it.

## CHAPTER III

### OPERATION

#### 3-1. TUNE UP PROCEDURE.

First connect the tuner for the antenna you are using. See Chapter II.

If you need to tune your transmitter and you have a dummy load connected to the BYPASS jack, set the panel switch to BYPASS and tune up your transmitter. Be sure the OPERATE - TUNE switch is in OPERATE position before you do this.

Next put the top switch in the position you need. That is, COAX TUNE if you have a coax fed antenna you want to use, SINGLE WIRE if you want to tune a single wire fed antenna, BALANCED LINE if you have a balanced line fed antenna.

NOTE: Be sure the ground strap is in place (Between the upper GROUND terminal and the upper BALANCED LINE terminal) if you are using coax or single wire feed and that it is not in place if you are using balanced feeders.

#### 3-2. HOW TO SET THE TUNER WITH THE NOISE BRIDGE.

First, set your receiver on the frequency you want to tune up on. Then turn the OPERATE-TUNE switch to TUNE. The red light will come on and you'll hear a loud noise in your receiver. DO NOT TRANSMIT WHEN THE RED LIGHT IS ON.

If this is the first time you've used the tuner with this antenna on this band you'll have to search for the magic combination of knob settings that will put the tuner in tune.

It's best to do this in an orderly manner. Set the INDUCTANCE knob on A. Set the TRANSMITTER knob on 2 and swing the ANTENNA knob from 1 to 10. Watch your "S" meter; look for a drop in the noise. If it doesn't drop much move the INDUCTANCE knob to B and repeat the procedure. Then try C and D, etc.

If you are lucky you will find an INDUCTANCE knob setting where you get a noticeable drop in the noise when you adjust the other knobs as described above. If you do you'll usually find that going to the next INDUCTANCE knob setting increases the noise a lot.

If so, go back to the INDUCTANCE knob setting that gave the lowest noise and start working with both the TRANSMITTER and ANTENNA knobs. Tune one for lowest noise. Then tune the other for lowest noise. Then adjust the first knob again. Keep this up as you "walk" the adjustments to a null in the noise. Don't give up too soon on this process; the adjustments interact and by carefully working at the adjustment you may get a complete null - the noise will disappear completely. If you get this condition turn the switch to OPERATE (the red light will go out). Turn on your transmitter and check SWR. It will be 0 (or 1) on your meter.

### 3-3. CAN'T GET A NULL?

If you follow the procedure described above and you go all the way on the INDUCTANCE knob from A to R without finding a null you are unlucky but not defeated. Relax! Remember that during all the time you have been searching you have not been melting down your final (as you would have if you were using your SWR meter). You've just been giving the noise bridge some exercise.

There are two possible reasons why you have not found a null:

- 1) The tuner won't match your antenna on this frequency. Yes, this can happen. You've got a wide range tuner but its range is only so wide - it won't match everything. If you think this is the problem try another frequency in the band, say 100-KHz away, or try another band. At least until you get the feel of the tuner. Later you may be able to get it to tune on this frequency.

- 2) The tuning is too sharp on this frequency for the procedure described above to work. The reason for this is that with some antennas and with some settings of the tuner the null is broad. That is, the circuit "Q" is low and it is easy to find the null.

But with other antennas, or the same antenna on a different band, the "Q" may be very high and the tuning extremely sharp. In this case there is only one way to find the null and that is to go through the procedure again but, this time, start with the TRANSMITTER knob at 0 while tuning

the ANTENNA knob from 0 to 10 while looking for a drop in the noise. Repeat the procedure at TRANSMITTER knob settings of 1, 2, 3 etc. and after trying setting 10 switch the INDUCTANCE knob to the next position and do it all again.

This procedure takes forever and once you find the null, if you are wise, you'll write the settings down in your logbook so you don't have to go through this again. Once you know the INDUCTANCE knob position to use it is easy to find the null.

Sometimes you may find it easier to locate the null using your SWR bridge. But once you have found the null and recorded the INDUCTANCE knob position you can tune up next time with just the noise bridge.

#### 3-4. IS THERE AN EASIER WAY TO FIND THE NULL?

No. An antenna tuner when set on the correct INDUCTANCE setting still has two knobs to be tuned to find the null. And they interact, that is, when you've found the lowest noise with one knob, moving the other knob means you have to readjust the first one. This problem is basic to the operation of all wide range antenna tuners.

To make the problem easier to live with we repeat these two suggestions:

- 1) Be patient. Remember that with your PT2500A the noise bridge does the work, not those expensive final tubes or transistors, so you have plenty of time to find the null. And you are not causing interference on the frequency while you tune.

- 2) Once you've found the magic settings, write down the frequency and INDUCTANCE knob setting in your log book. Next time it will be easy to find the null.

#### 3-5. OPERATING PRECAUTIONS.

##### A. Noise Bridge

The built-in noise bridge lets you tune up without transmitting. The red warning light reminds you that the noise bridge is connected. If you transmit when the bridge is connected you can burn it out. There is a fuse but it may not

work fast enough to save the noise bridge.

CAUTION #1: DON'T TRANSMIT WHEN THE RED  
LIGHT IS ON.

B. Rf voltage.

The tuner is built with heavy coils to take high rf current. This is what is needed in normal operation. But if no load is connected to the tuner or if high power is applied when the tuner is not in tune high voltages may be applied that can damage the tuner.

CAUTION #2: DON'T OPERATE THE TUNER WITHOUT AN ANTENNA CONNECTED. BE SURE THE PANEL SWITCH IS IN THE RIGHT POSITION TO CONNECT YOUR ANTENNA.

CAUTION #3: DON'T APPLY HIGH POWER UNTIL THE TUNER IS IN TUNE.

CAUTION #4: DON'T CHANGE SWITCH POSITIONS WITH RF POWER APPLIED.

## CHAPTER IV MAINTENANCE

### 4-1. SERVICE DATA.

The power handling section of the PT-2500A is practically maintenance free as it is a passive network.

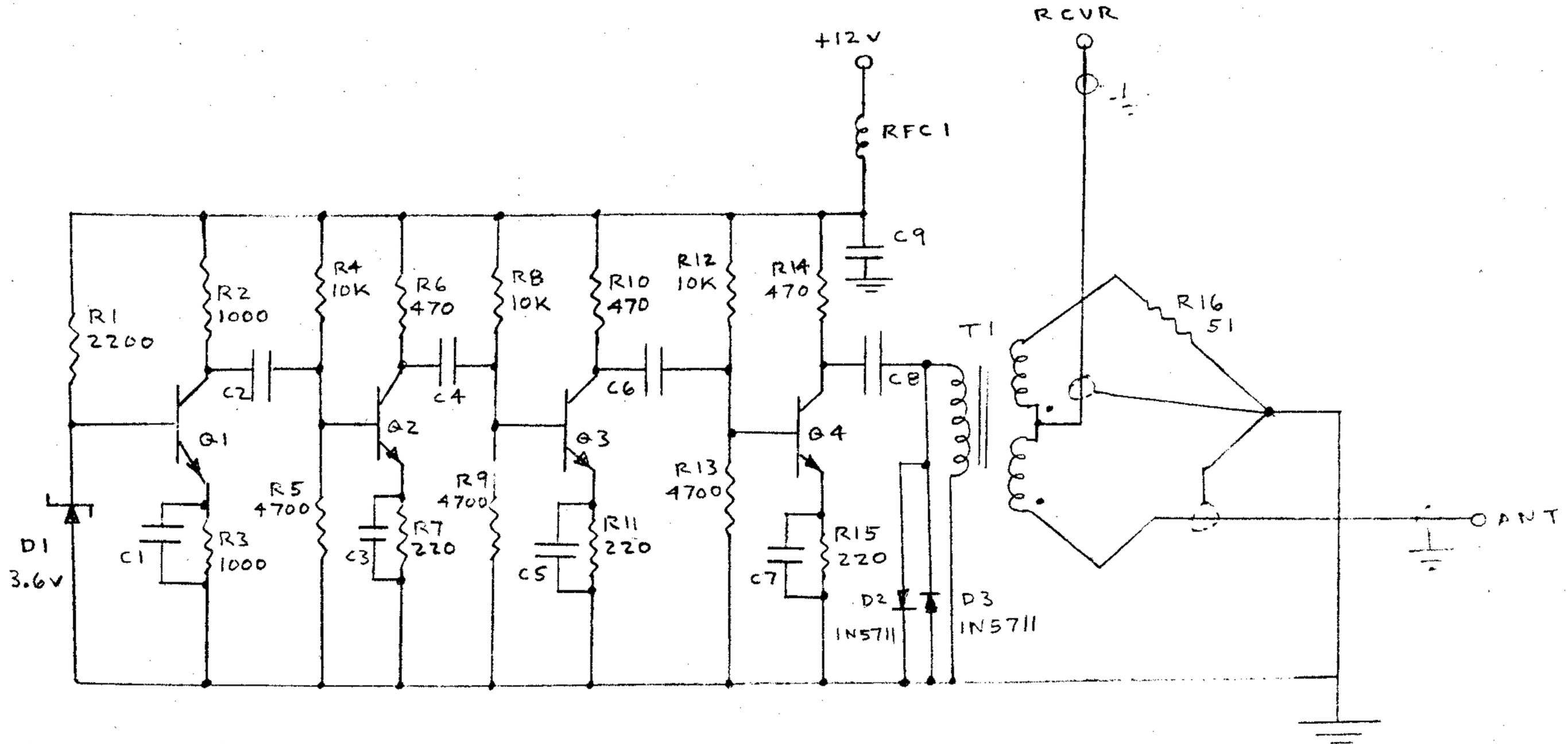
The noise bridge and warning light operate from a 9 volt battery on the rear panel. This will have to be replaced periodically depending on the amount of use.

If the noise level from the bridge becomes low or the panel lamp becomes dim the battery should be replaced. Don't use the tuner with a dead battery; the warning light can't come on to warn you if the battery is dead.

The fuse on the rear panel is to protect the noise bridge. Replace it only with a 1/200 ampere fuse. One spare is furnished with the tuner. Additional fuses can be obtained from your dealer or Palomar Engineers.

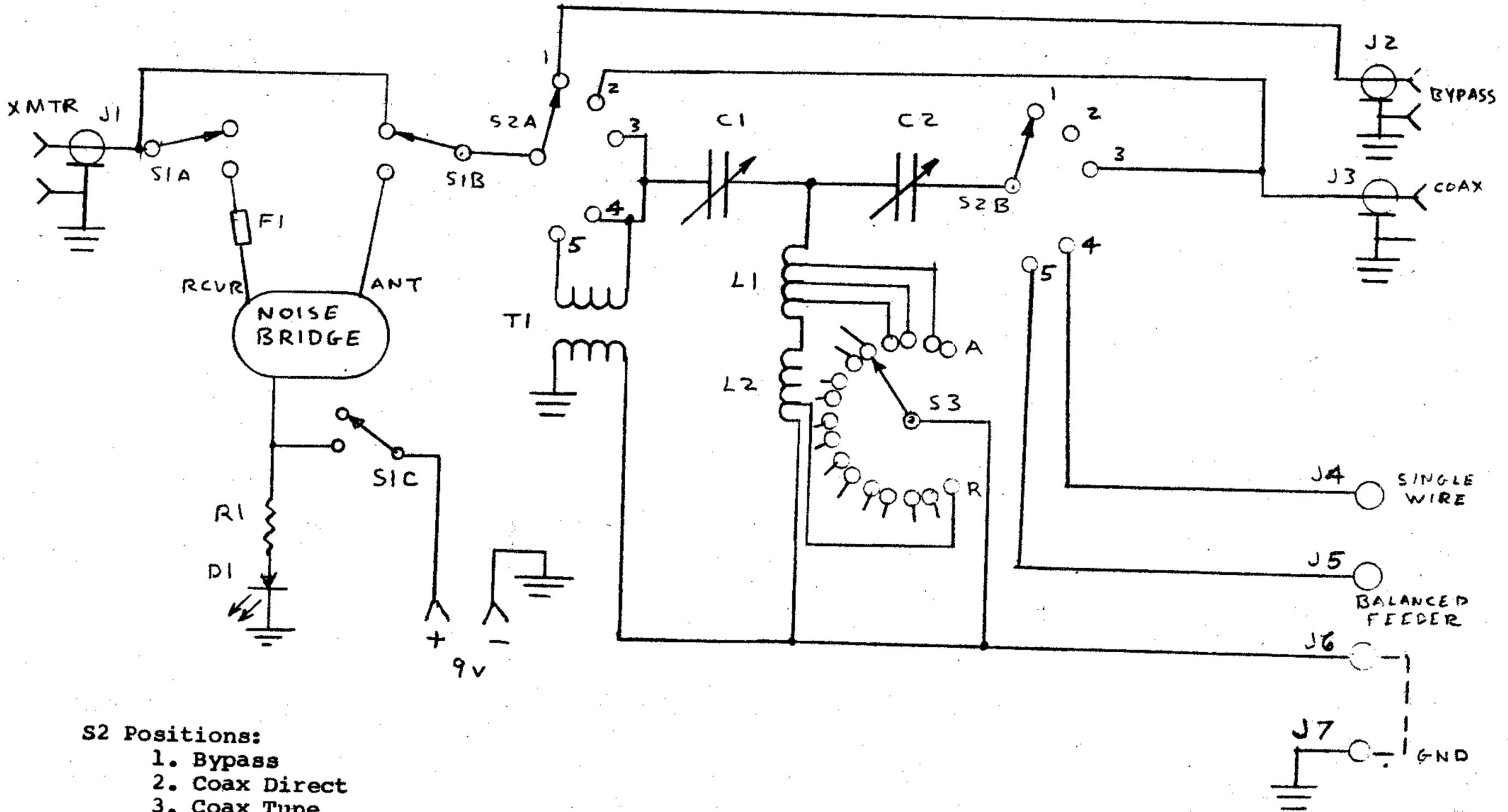
Application advice, spare parts and service are available from the factory. If problems arise write with a detailed description of the difficulty. Do not return your tuner to the factory without authorization.

Our address is: Palomar Engineers  
P.O. Box 455  
1520-G Industrial Avenue  
Escondido CA 92025  
Telephone: (714) 747-3343



All transistors 2N5770  
 All capacitors .1 mfd

PT-2500A Noise Bridge Schematic



- S2 Positions:**
1. Bypass
  2. Coax Direct
  3. Coax Tune
  4. Single Wire
  5. Balanced Feeder

PT-2500A Antenna Tuner Schematic