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AT5K 3500 Watt Antenna Tuner

Specifications Summary

- 3500 W single tone, low loss, wide Z range
- 160m to 15m, limited Z range on 10m
- Custom variable capacitors and inductor
- Dual movement cross needle meter
- 8" H x 16" W x 18" D

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AT5K 3500 Watt Antenna Tuner Technical Manual



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AT5K SPECIFICATIONS

- **METERING:** Dual movement cross-needle power and frequency compensated coupler
- **INPUT & ANTENNA TUNING:** 2 x Variable capacitors 600 pF, 6 kV Peak, 6:1 Vernier Drives for both capacitors
- **INDUCTANCE:** 28 μ H roller inductor, 10 amps, 5 kV, 10 ga. wire wound on steatite ceramic core, silver plated bar and wheel
- **ANTENNA SELECTOR SWITCH:** 6 position:
 - Coax 1 - tuned and tuner bypass
 - Coax 2 - tuned and tuner bypass
 - Bypass coax connector;
 - Balanced antenna
 - Switch wafers are 7 kV/10A rated
- **POWER RANGE SWITCH:** 2 position 300 W / 3000 W
- **REAR PANEL CONNECTORS:**
 - SO-239: RF Input, Coax 1 & 2, Bypass
 - END FED WIRE: High Voltage Nylon66™ terminal/ground posts for Balanced Line
 - 12 VDC INPUT: 14mm connector, 2.1mm ID, 5.5mm OD, center positive, 200 ma
- **FREQUENCY COVERAGE:** 1.8 - 29.5 MHz
- **POWER MAXIMUM:** 5000 W PEP SSB, 3500 W single tone
- **IMPEDANCE RANGE:** 10 to 2000 Ω , 160m to 10m (assuming resistive load)
Reduce power for lower Z-range
- **BALANCED OUPUT:** 1:1 current type balun at input-Ferrite
- **DIMINSIONS:** 8" H x 16" W x 18" D (incl. terminals)
- **WEIGHT:** 25 LBS, 12 Kg
- **CHASSIS & COVER:** 11 ga., 0.090" Aluminum

AT5K GENERAL DESCRIPTION



The Palstar AT5K Antenna Tuner is an American-made impedance matching network that can provide unbalanced and balanced output with a power rating of 3500 watts (single tone continuous) and 5000 watts PEP at certain Z ranges.

The AT5K T-matching network utilizes a 1:1 unbalanced to balanced transformer in the input of the network. When the network is properly tuned, a 50 Ohm impedance will be presented to both the input and output of the balun for maximum efficiency.

The AT5K optimizes the performance of your antenna and transmitter by providing adjustable impedance matching using a T-type circuit configuration. The AT5K also measures the power and Voltage Standing Wave Ratio (VSWR), which allows you to tune the SWR to the lowest ratio for the selected transmission frequency.

Integrated into the AT5K is a frequency-compensated lighted-dial dual-movement SWR meter. The meter features the ability to read True Active Peak and Peak Hold.

Designed to handle both Balanced line feeds and Coax feeds the AT5K features a front panel mounted switch to select between feeds.

Tuning is achieved with the front panel mounted controls. The Vernier capacitor dials allow for tuning with precision and accuracy, while the inductor crank handle facilitates coarse adjustments.



INSTALLATION

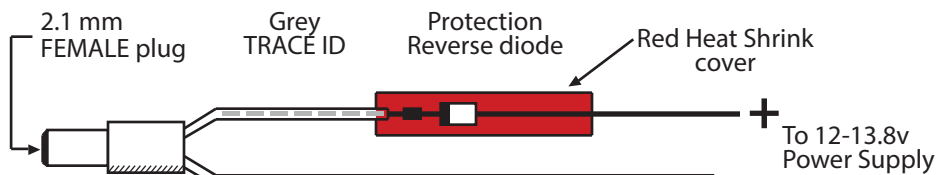
UNPACKING

Carefully remove the AT5K from the shipping carton and inspect it for signs of damage. If any damage is apparent, notify the transportation carrier or dealer immediately.

KEEP THE PACKING CARTON for moving, storing, or reshipping the tuner to us for repair if required.

LOCATION

Select a location for the AT5K that allows the connectors to be free from any possible contact with people, pets, or objects during operation and with unrestricted air flow for cooling.



AT5K DC POWER CORD

INSTALLATION PROCEDURE

Connect a coax cable from your transmitter to the RF INPUT connector on the rear panel. Keep the cable as short as possible. If you use a linear amplifier, connect your transmitter to the linear amplifier input and the linear amplifier output to the AT5K.

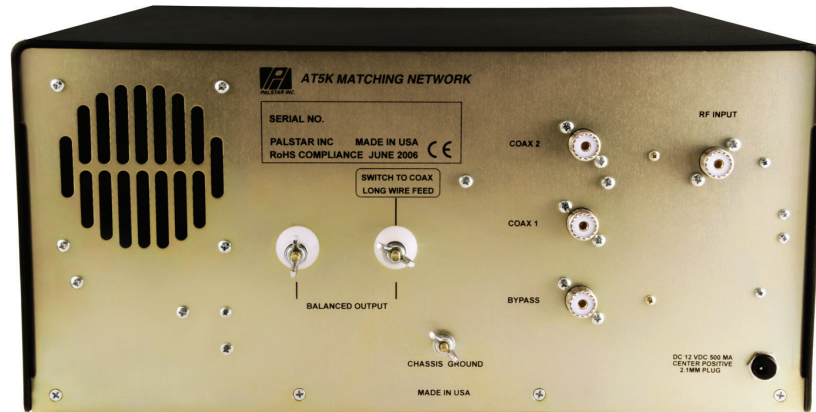
DO NOT USE MORE THAN 3500 WATTS (single tone continuous) through the tuner.

REAR PANEL

RF INPUT coaxial connector for input from transmitter or amplifier

COAX 1 coaxial connector for output to Antenna 1

COAX 2 coaxial connector for output to Antenna 2



BALANCED OUTPUT
Two nylon High Voltage post connectors for output to RF balanced twin-lead antennas. Relay switch from front panel.

GROUND post/wing nut ground connector

BYPASS coaxial connector for output to dummy load or resonant antenna. Bypasses tuner, but meter circuits are on if 12VDC adapter is connected to rear panel

12 VDC INPUT
(2.1 mm plug, center pin +)
12 VDC adapter 500 mA to power the metering, lamp, relay, and fan.

FRONT PANEL DESCRIPTION



1. **POWER/SWR METER** Dual needle meter displays FORWARD and REFLECTED power in watts. SWR is measured where the two needles intersect on the red scale. SWR is printed on meter face.
2. **PEAK HOLD and PEAK** Select to read **PEAK HOLD** on the SWR meter. **PEAK** switch must be in **PEAK** position. **PEAK** Selects between **PEAK** and **AVERAGE** power metering display.
3. **RANGE** The power range is 300 watts on low and 3000 watts on high (push button in for high).
4. **FAN** The IN position turns on the fan, which cools the internal components of the tuner when using a service that requires constant carrier operation (for e.g. AM or RTTY).
5. **BALANCED/COAX** Selects either coax feed or balanced feed.
6. **POWER ON** The IN position provides power for the **PEAK** and **PEAK HOLD** metering circuit, relay and meter illumination.

7. **INPUT** Continuously adjustable input capacitor. Min. capacitance = 0. Max. = 100.

8. **DIRECT-TUNED MODE SWITCH** Six-position rotary switch selects an output coaxial connector.

a. **DIRECT BYPASS** selects **BYPASS COAX CONNECTOR** bypassing the impedance matching circuit, but providing SWR, FORWARD, and REFLECTED power meter readings.

b. **DIRECT COAX 1** selects **COAX 1 CONNECTOR** bypassing the tuner matching circuit, but providing SWR, FORWARD, and REFLECTED meter readings.

c. **DIRECT COAX 2** selects **COAX 2 CONNECTOR** bypassing the tuner matching circuit, but providing SWR, FORWARD, and REFLECTED meter readings.

d. **TUNED COAX 1** selects **COAX 1 CONNECTOR** through the impedance matching T circuit.

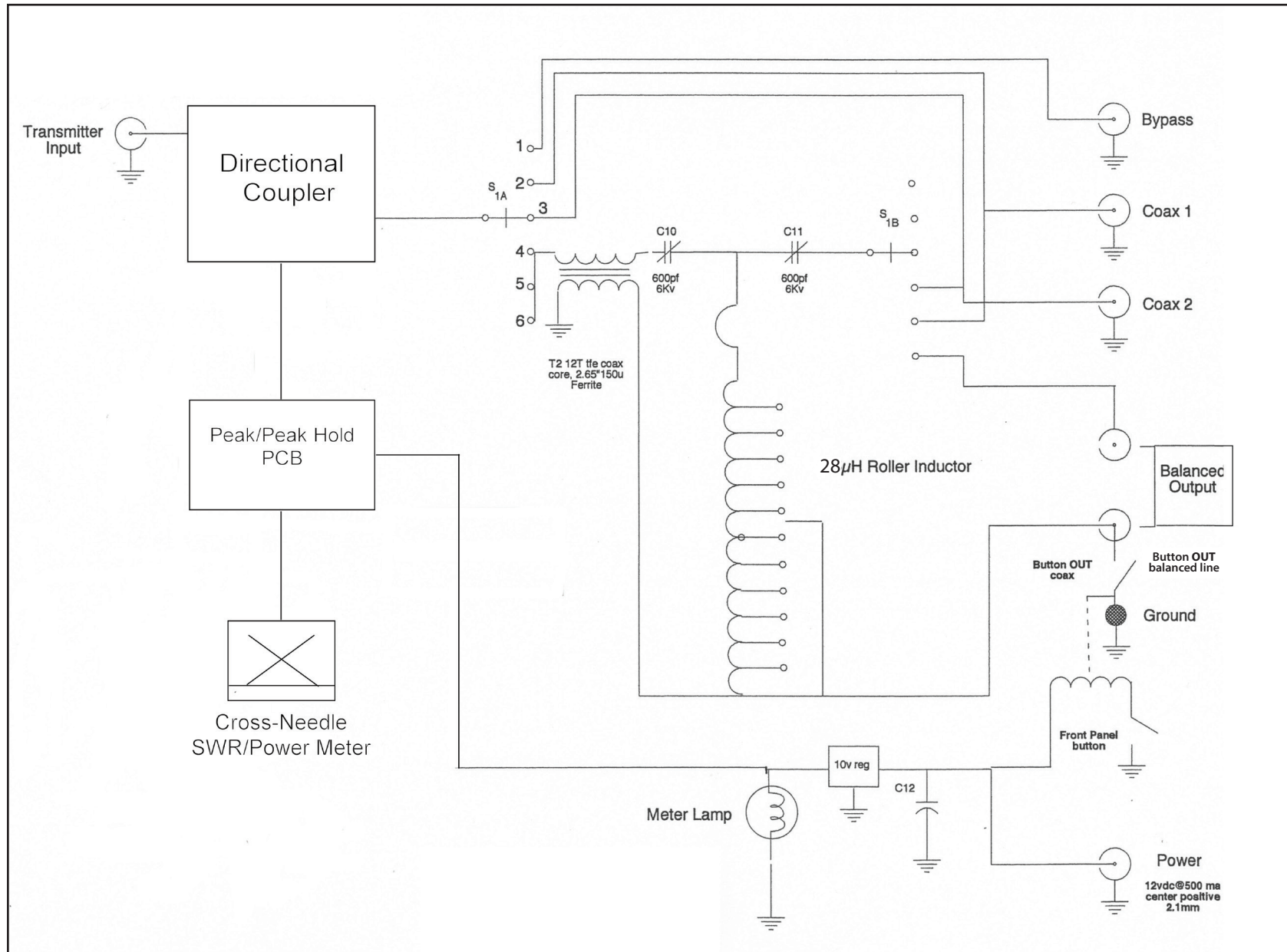
e. **TUNED COAX 2** selects **COAX 2 CONNECTOR** through the impedance matching T circuit.

f. **TUNED BAL** selects the **END FED WIRE** connector through the impedance matching circuit. For balanced antennas, the balanced coax switch (5) must be OUT.

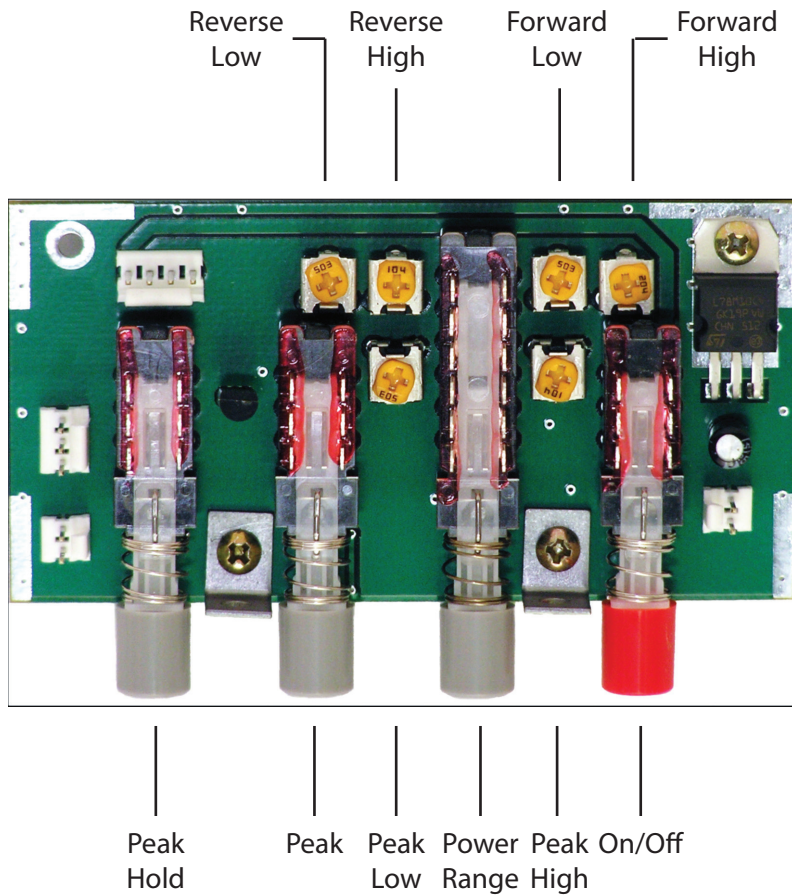
9. **OUTPUT** Continuously adjustable output capacitor. Min.=0; Max.=100.

10. **INDUCTOR** 28 μ H continuously variable ceramic roller inductor driven by a crank handle. Coupled to the crank handle is a gear-driven precision mechanical counter; Max. = 0; Min. = 289.

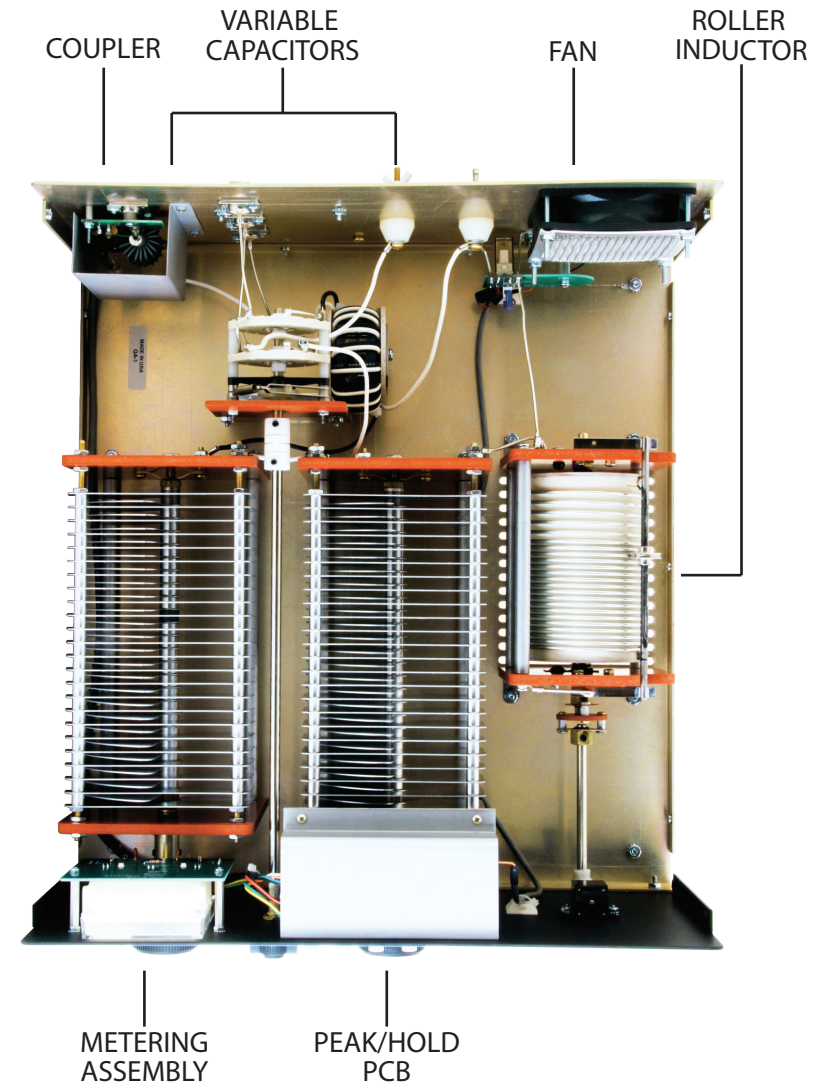
AT5K SCHEMATIC



METER BOARD ADJUSTMENTS



INSIDE VIEW



OPERATING YOUR AT5K

BEFORE OPERATING

1. To avoid possible damage to the AT5K set INPUT, OUTPUT, INDUCTOR, and POWER RANGE switches as outlined in the chart below before applying transmitter power.
2. Begin tuning with your transmitter/amp feeding the tuner set at a low output power setting (50-100 Watts max).

WARNING: DO NOT OPERATE THE AT5K WITH THE COVER OFF.

TUNING

1. Select the band and frequency of desired operation.
2. Set TUNE and INDUCTOR controls to the suggested setting before applying transmitter power (see chart). Actual settings will vary from antenna to antenna.
3. Set your transmitter/amplifier to 100-150 watts LOW output. If your transmitter has a TUNE position, select that position.
4. Preset the INPUT, OUTPUT, and INDUCTOR values shown in the chart. Select type of antenna feed, (**Button Out**) or COAX (**Button In**).

BAND	INPUT CAP SETTING		OUTPUT CAP SETTING		INDUCTOR	
	SUGGESTED	ACTUAL	SUGGESTED	ACTUAL	SUGGESTED	ACTUAL
160 M	55		55		112	
80 M	48		55		229	
40 M	43		68		264	
20 M	40		30		258	
15 M	28		15		277	
10 M	25		8		272	

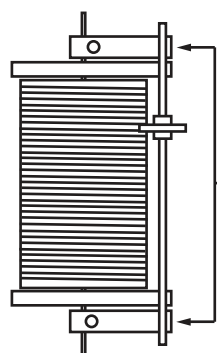
NOTE: MINIMUM INDUCTANCE is **289** (max turns clockwise).
MAXIMUM INDUCTANCE is **0 (ZERO)** on the turns counter.

5. Set **POWER RANGE** switch to 300 W (button out).
6. Set the **OUTPUT SELECTOR** switch to the position matching your antenna connection. To tune your antenna, the switch selection must be set to: COAX 1 TUNED, COAX 2 TUNED, or WIRE (BALANCED ANTENNA). Selecting COAX 1 DIRECT, COAX 2 DIRECT, or BYPASS bypasses the tuning circuitry and tuning is not possible.
7. Key your transmitter and adjust the power level for a reading of 100-150 watts on the FORWARD scale. Adjust the INPUT, OUPUT, and INDUCTOR controls for a minimum REFLECTED reading while maintaining a FORWARD reading of 100-150 watts using your transmitter power control. Use the supplied chart of approximate tuning control locations for the different bands located at the back of the manual.
8. Read the **SWR** on the red scale at the point where the two needles intersect. Repeat TUNING the input and antenna controls until the lowest SWR reading is obtained.
9. When you have tuned your antenna to the best SWR, record the settings of the INPUT, ANTENNA, and INDUCTANCE controls on the chart above for future reference. When you retune, use these settings as your starting point.

This procedure takes patience the first time. The input and antenna controls vary the capacitors and provide fine adjustments, while the roller inductor crank provides coarse adjustment.

RESTORING THE INDUCTOR WHEEL

When approaching the end stops of the roller inductor (readings of Zero or 289) **SLOW DOWN**. Slamming the roller wheel into the mechanical end stops on either end of the roller inductor *will decrease the pressure of the wheel against the wire wound on the ceramic form.*



To RESTORE wheel pressure on the inductor push down on the flat springs soldered to the wheel shaft located on each end of the shaft.

Notes:

1. A SWR of 1:1 is best, but an SWR as high as 2:1 may be acceptable. Check your transmitter/amplifier manual for details.
2. If you cannot get an acceptable SWR, lengthen or shorten your antenna and/or feedlines and retune.\
3. If you get low SWR readings at more than one setting, use the setting that gives:
 - highest FORWARD power reading
 - lowest REFLECTED power reading
 - uses the largest capacitance (highest number) on the INPUT and ANTENNA controls
 - Adjust the largest capacitance (highest number) on the output control to keep the losses low, and the voltage that would appear on the antenna capacitor to within 5 kV.
4. Any time a new or different antenna is connected, it is necessary to repeat the turning procedure for each antenna.
5. Once every 4-6 months clean the roller coil with Deoxit D5 contact cleaner and a clean cotton cloth. Do not remove the conducting grease on the rod that guides the roller wheel. Do not transfer any of the conducting grease from the rod to the roller coil body, as this will contaminate the windings.

TROUBLESHOOTING

You hear a spitting sound while tuning your AT5K at high power.

You are probably tuning into an impedance that is on the low side (20Ω - 40Ω). In this event, either reduce transmitter/amplifier power to a lower setting or change to a higher antenna impedance by using a different antenna or modifying the existing antenna.

Also, try to find the highest capacitance setting (i.e. closer to 100 on the dial) on the output knob. This will probably require readjustment of the inductance setting.

An antenna capacitance setting that is too low under these conditions will result in excessively high voltages, high losses, and poor efficiency.

Output Cap	Inductor	Voltage	Loss
100pF	11.7 μ H	4550	16%
200pF	6 μ H	2400	8%
300pF	4 μ H	1600	6%

For example, at 1500 Watts into a 25 Ω load @ 3.5Mhz will produce the following: In the first instance, the tuner will arc and suffer almost 16% loss of which 80% will be dissipated in the roller inductor.

Power Specifications (assuming single tone key down)	
Antenna Impedance	Max Power Rating
8 Ω - 15 Ω	1000 watts (all bands)
15 Ω - 25 Ω	1500 watts (all bands)
25 Ω - 50 Ω	3500 watts (all bands)
50 Ω - 2000 Ω	160m - 3500 watts 80m - 15m - 3500 watts 10m - 1500 watts (29.5 MHz max.)