Z-Rock ATU

Antenna Tuning Unit Operation, By: W5USJ, 6 July, 2019

The ATU is a single-coil Z-Match tuner designed by Chuck Carpenter, W5USJ, based on the Z-Match publications of Charlie Lofgren, W6JJZ.** Most notably, the article "*An Improved Single-Coil Z-Match*" published in the *ARRL Antenna Compendium Volume 5.*

Z-Rock ATU operation

Z-Rock ATU is designed to "tune" or match your transmitter to properly designed antenna systems for the 80 through 10 meter amateur bands.

Connections for various types of antennas include:

- Coax Feed
- Balanced Line Feed
- Long Wire with Counterpoise/Radial

Matched Impedance Range: 25 to 2500 Ohms

Tuner Loss: Less than 1 dB at resistive match

Note: Losses are generally low when you're matching resistive loads with reasonable impedances. Losses increase when you feed very low and very high impedances, or highly reactive loads, especially with both in combination. Something to watch for is sharp, critical tuning – this indicates a bad combination of resistance and reactance, or a less-than-ideal configuration of the settings on the tuner.

Antenna Connections

Connect your transmitter output to the transmitter in BNC jack. Depending on the type of antenna you will be using select the connections and settings as follows:

Note: The grounding switch connects the black binding post to the chassis ground. A physical ground (earthed) connection to the black binding post may also be used when conditions require one; sometimes called a counterpoise or radial, length TBD by user.

o Connect balanced feed lines to the red and black binding posts. Leave the grounding switch in the down, ungrounded, position.

o Connect end fed long wires to the red binding post terminal. Connect a counterpoise wire to the black binding post. Place the grounding switch in the up position.

o Connect coax to the coax out jack. Place the grounding switch in the up position.

Adjusting for a Match

With your transmitter and antenna connected to the tuner, set the tune/operate switch to the tune position. Set the load and tune adjustment knobs to the center position.

Note: Tune mode, maximum power Input – 5 Watts
Tune mode power is limited by the power rating of the bridge 51 Ohm resistors.
Operate mode, maximum tuned power input –10 Watts

Note: From the compendium article: "Whenever possible, use the high-impedance link. This loads the tank circuit more heavily, and may produce significantly better efficiency. In cases where you can tune 30 meters and sometimes 20 meters at both the low and high end of the tune capacitor use the low capacity, most clockwise, setting."

It may be useful to practice tuning into a dummy load before connecting to an antenna feed line.

- Place the Hi/Low impedance switch in the Hi position. The Hi impedance setting provides the most efficient coupling and operation.

- Briefly key your transmitter and adjust the load and tune knobs alternately to dim the LED.

- Continue adjusting back and forth until the LED is out or is as dim as possible.

- If the adjustments do not produce adequate dimming of the LED switch to the Low impedance position and repeat the adjustment process.

Note: Under some conditions of match adjustment the LED will not go completely out. Your antenna will be tuned for proper operation even if the LED is not completely dim.

- Switch the tune/operate switch to the operate position. Operating with the switch in the tune position will cut output power by half (~3dB).

Operating Notes

It's easier to build a whole Z-ROCK ATU for a different frequency range than to make all the mods needed to extend the range of one unit. Consider building at least one Z-ROCK ATU for the middle bands, another for the low bands, and maybe a third one for the upper HF bands.

If you try to force the unit to operate far outside its design range, losses will increase, and performance may suffer. It's easier and better to make a new Z-ROCK ATU for 160 meters or 6 meters than to modify the stock unit to go down or up that far by trimming capacitors and inductors. Remember that adding too many variables will make it harder to find a good match.

Don't expect to make a Z-ROCK ATU that covers 160 through 10 meters, with great efficiency and balance over the whole range, while matching everything from 1 ohm to 10K, resistive and reactive. It isn't going to happen. Remember that this gadget is a converter of complex numbers, and while it covers a big range of frequencies and impedances, the math limits what can be done with any set of components. **The tuner will not completely compensate for a bad antenna design.**

The tuning bridge in the Z-ROCK ATU is good over a very wide frequency range.
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**Charlie Lofgren, W6JJZ, is widely recognized for his expertise with Z-Match design. Charlie built all the tuners used by the Zuni Loop QRP Expeditionary Force for years. They would not be without them. He also designed the popular BLT tuner. More information about W6JJZ designs can be found in the notes at the following URL:

http://www.seboldt.net/k0jd/z-match.html