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Instructions

Model TBR-160

Butternut Electronics Co's Instruction Manual for:
Model TBR-160 — 1979

NOTE:
The TBR-160 Top band resonator kit (160 meters) previously manufactured by Butternut Electronics Co. was discontinued in 1981. Parts are no longer available for this accessory. This instruction is made available as a reference.

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INSTRUCTIONS FOR MODEL TBR--160 METER TUNING UNIT FOR MODEL HF5V-II VERTICAL ANTENNA

General:

The model TBR 160 meter tuning unit employs a combination of fixed and variable inductance in a high-C parallel-tuned circuit to generate the inductive reactance required to resonate the model HF5V-II antenna in the 1800-1850 Khz range. At higher frequencies the TBR unit produces decreasing values of capacitive reactance which have virtually no effect on 20, 15, and 10 meter operation and which exert only a slight detuning effect on 80/75 and 40 meters. Resonance on the latter two bands may be restored by readjustment of the appropriate HF5V-II resonator circuits. It is possible, therefore, to adjust the HF5V-II and TBR combination for simultaneous resonance (automatic bandswitching) in each of the six HF amateur bands. The principal limitation on 80 through 10 meter operation because of the addition of the TBR unit to the HF5V-II is a noticeable reduction in 80/75 meter SWR bandwidth.

In a typical installation (antenna mounted at ground level over 4 to 8 radials) maximum SWR at resonance will be 1.5:1, and bandwidth for 2:1 SWR will be approximately 20 Khz.

The Model TBR is rated for 160 meter input powers of 200 watts P.E.P and 150 watts on c.w.

Installation and adjustment:

1. Remove the impedance matching coil and the center conductor of the coaxial feedline from the base of the HF5V-II. The outer braid of the feedline should remain attached to the antenna ground connection.

2. Mount the TBR unit as shown in figure 1 using the 4 U-bolts and the plate provided.

3. Attach the center conductor of the feedline to the bottom end of the TBR unit using the self-tapping screw provided (fig. 1).

4. The TBR unit is preset for antenna resonance between 1800 and 1850 Khz, so minimum SWR should occur somewhere in this range. To raise the resonant frequency (or frequency of minimum SWR) loosen the set-screw at point A (fig. 1) by turning it counter-clockwise approximately 1/3 turn and slide the black plastic assembly upward along the tubular capacitor, thus pulling the turns of the air-wound inductor slightly apart. Tighten the set-screw to hold the assembly in the new position, but do not overtighten. Similarly,

the resonant frequency may be lowered by sliding the black plastic assembly downward in order to compress the air-wound inductor a slight amount. In either case, one half-inch of movement will change the resonant frequency by approximately 20 Khz.

5. Once the proper setting for 160 meters has been determined it will be found that the HF5V-II resonates at somewhat higher frequencies on 80 and 40 meters (approximately 100 Khz higher on 80 meters). The original resonances may be restored by readjusting the appropriate resonator circuits according to the "Checkout and Adjustment" section of the HF5V-II instructions. It is unlikely that these adjustments will affect the 160 meter adjustment, but step 4 may be repeated if necessary. As noted above, the presence of the TBR unit will narrow SWR bandwidth on 80/75 meters.

Matching and other considerations:

In the average installation connection of the coaxial transmission line to the base of the TBR unit (as in fig. 1) will permit acceptably low SWR operation over approximately 20 Khz of the 1800-1850 Khz segment of 160 meters. The principal reason for seeking low SWR (2:1 or less) on this band is the requirement of most modern transmitters and transceivers that the output circuit "see" an essentially resistive load within certain limits--a situation that has greatly contributed to the popularity of transmatches or, more generally, "antenna tuners." Many older units (those manufactured c. 1960) are capable of a wider range of adjustment and are thus more tolerant of input impedances that deviate considerably from the 50-ohm non-reactive "ideal" of recent years. In any case, it should be emphasized that line losses from SWR's as high as 5:1 should be utterly unimportant on 160 M, even for very long runs of cable. From the practical standpoint, operating bandwidth need not be defined by the 2:1 SWR points if the output circuit of the transmitter is capable of delivering power to the line at some higher value of SWR.

One should keep in mind the fact that the radiation resistance of a vertical antenna that is very short in terms of the operating wavelength will be quite low. The HF5V-II plus TBR combination has a total height of 26 ft. or about 1/10 wavelength on 160 meters, so its radiation resistance will account for only a small part of its total feedpoint impedance which will include conductor and ground losses. Since efficient operation depends on making the radiation resistance as high as possible in relation to all the loss resistances, every effort should be made to reduce ground losses. On the other hand, if one is fortunate enough to have the room for an extensive low-loss ground system, it is likely that higher values of SWR will be encountered because of the decreased feedpoint impedance. In all cases the exact impedance at the input (transmitter) end of the line will depend on the feedpoint impedance and the line length. For example, a 50-ohm line having an electrical length of one quarter-wave (80 to 110 feet for velocity factors of .66 to .80) will

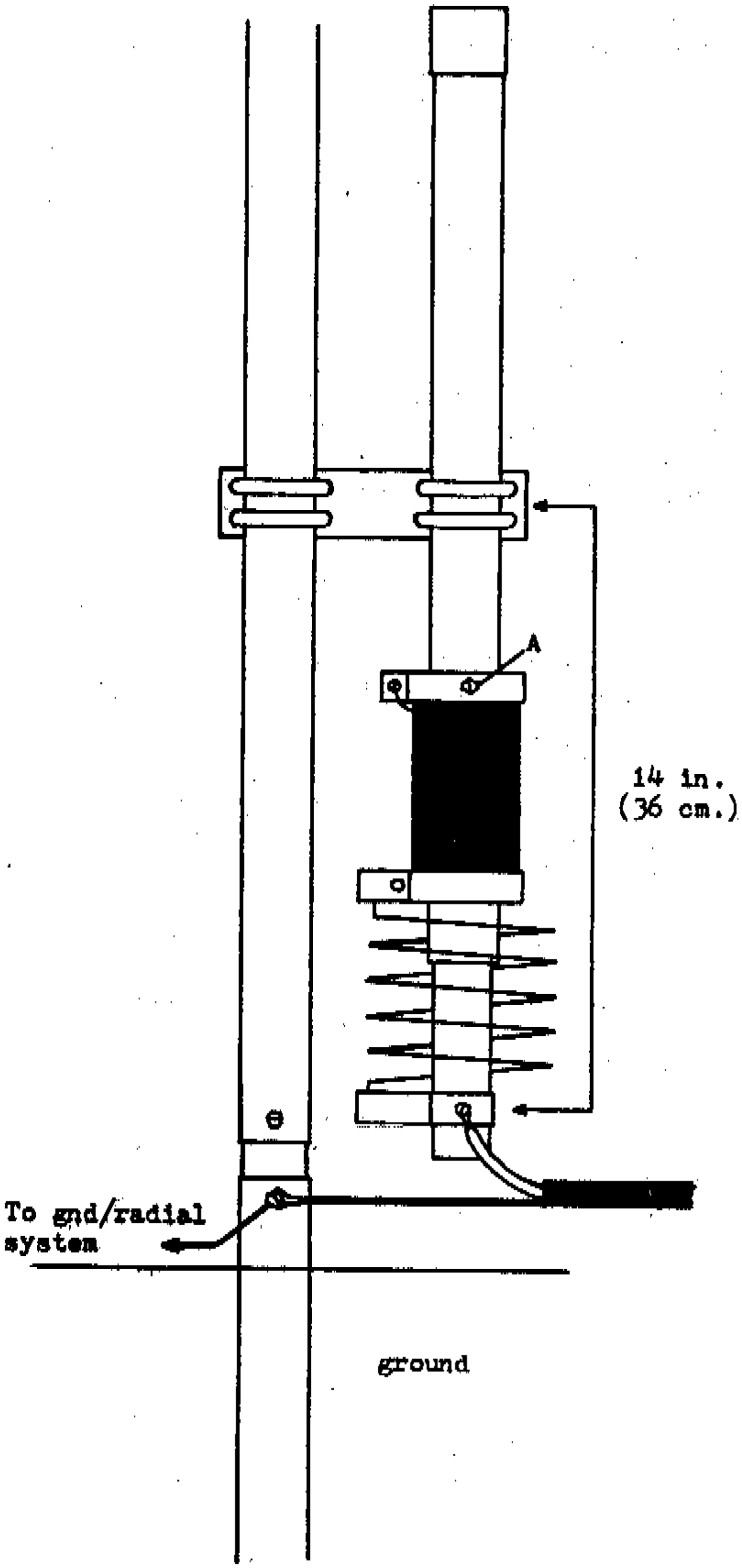

FIGURE ONE

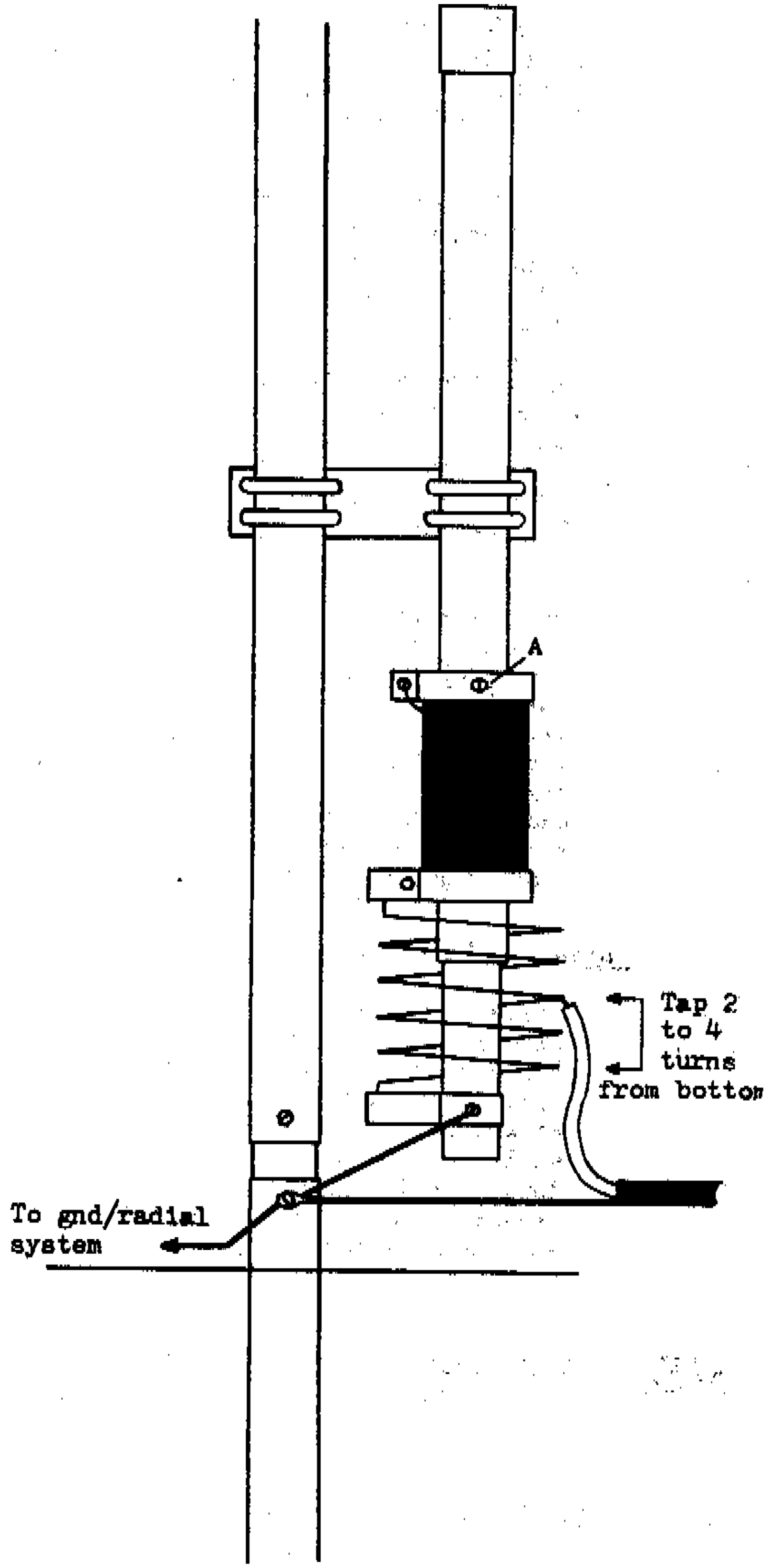

FIGURE TWO

transform an antenna base impedance of 10 to 15 ohms to a resistive load of some 160 to 250 ohms at the input end of the line--a range of values easily matched by most transmatches designed for use on 160 meters and even by the output circuits of certain transmitters.

An alternative matching scheme for direct coupling to the output circuit is shown in figure 2. In this configuration the base of the TBR is grounded, and the center conductor of the feedline is connected to the point on the adjustable inductor that produces the best match. Very low values of line SWR can be realized with this method, but its use limits operation to 160 meters. Still, if extensive operation on this band only is contemplated (as during a contest weekend) it may be an attractive alternative to a transmatch if one of the other matching techniques mentioned proves unsatisfactory. Care should be taken to insure a good low-loss connection to the tap point. A clip lead may be useful in finding the proper setting, but a more mechanically secure arrangement should be used for the final connection.

Finally, it goes without saying that such a short vertical antenna cannot be as effective a radiator as a much taller structure over a good ground system. After all, an antenna height of 26 ft. is the equivalent of only a 19-inch radiator for 10 meters. In spite of the obvious compromises that have to be made, contacts out to several thousand miles are possible with this simple system under the proper conditions. Additionally, a short vertical for 160 meters may prove to be a more effective receiving antenna than even a full-size quarter-wave vertical or a high horizontal dipole under the QRN conditions often encountered on this band, for a short vertical tends to pick up less of the atmospheric noise that so frequently masks weak signals received on larger and higher antennas.

Using the Model TBR unit with other types of vertical antennas:

There is no reason why the TBR unit cannot be adapted for 160 meter operation with any type of mono- or multi-band vertical that is already resonant on 80/75 meters, but performance with a particular type cannot be easily predicted. In general, efficiency and bandwidth will depend on overall antenna height and construction of any loading devices used. Whether a given antenna will also operate on the other bands for which it was originally designed will depend on its range of adjustment for each band. In most cases it will be necessary to use auxiliary loading devices on one or more bands, and adjustment is likely to require a good deal of cut-and-try.

N.B. MODIFICATION NOTICE: Model TBR-160
(For use with models HF3V, HF5V-II, HF5V-III and HF5V-III/Export vertical antennas)

1. The coil on the TBR-160 unit is compressed for protection during shipment. Remove the tape, loosen the set-screw (A), and extend the coil so that set-screw (A) is just below the blue mark on the capacitor tube. This is the initial setting for resonance in the 1800-1850 kHz range.

2. In place of the 4 U-bolts and metal plate shown in figures 1 and 2 of the instructions, two clamps are provided to attach the TBR-160 to the base of the antenna. One clamp may be placed at the point shown for the U-bolt + plate combination, and the other may be placed somewhat higher for greater stability.