A versatile antenna tuner covering 1.5 MHz to 7 MHz

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This unit will match a wide range of resistive and reactive impedances, commonly encountered with short or loaded antennas widely used in this frequency range, matching to 50 or 75 ohms. Locally available components are specified.

ANTENNAS for frequencies between 1.5 MHz and 7 MHz are usually limited in size by the amount of real estate available. Full sized quarter-wave verticals are difficult to achieve so one usually arrives at some sort of compromise. This often takes the form of a random length of wire, as long as possible and strung as high as possible. Loaded verticals are also used.

The feedpoint impedance of such compromise antennas is often lower than the 50 or 75 ohms at the transceiver antenna terminal, and is very often reactive – usually capacitive, particularly if the antenna is 'short' at the working frequency.

Most mobile antennas for these frequencies, particularly 'helical' wound whips, exhibit similar characteristics.

A good solution is to use a tapped auto-transformer in conjunction with a variable inductor. The circuit of this combination as shown in Figure 1. The tapped auto-transformer, T1, is wound on a large Neosid toroid (432/3/F14A). It consists of 32 turns of enamelled copper wire wound twice around the core as illustrated. The first 11 turns are wound with 14 or 16 gauge (swg) wire spread about two-thirds of the way around the core. The following 21 turns are wound with a lighter gauge wire such as 18 of 20 gauge. The taps are placed at intervals which give convenient impedance transformations.

Taps can be made in one of two ways. Where the wire for the appropriate turn passes across the outer face of the toroid, it can be lifted slightly when it is wound on. The insulation is then scraped off each tap after completing the whole winding and a wire soldered on to the tapping point, taking care not to cause shorts to adjacent turns.

Alternatively, the whole winding may be completed and the insulation scraped off portion of the wire at the appropriate turn, attaching a wire at each tap. This requires a little more care and skill, but the toroid is much easier to wind. Be careful when identifying the correct turn for each tap. For the taps at turns 7, 9 and 11 use 24/0076 hookup wire, or something heavier, to make connections to the switch contacts on SW1.

The switch, SW1, is an eleven position rotary switch with fairly heavy contacts. This is an expensive item but is sometimes found in ex-disposals equipment. Alternatively, a banana plug and eleven sockets may be used, and is quite economical.

The variable inductor may be a roller inductor which was used in a similar tuner described by Rod Champness VK3UG in the May 1976 issue of the Radio Bulletin. These devices are as scarce as hen's teeth these days but can occasionally be scrounged from ex-disposals gear – some people may have them in their junk box.

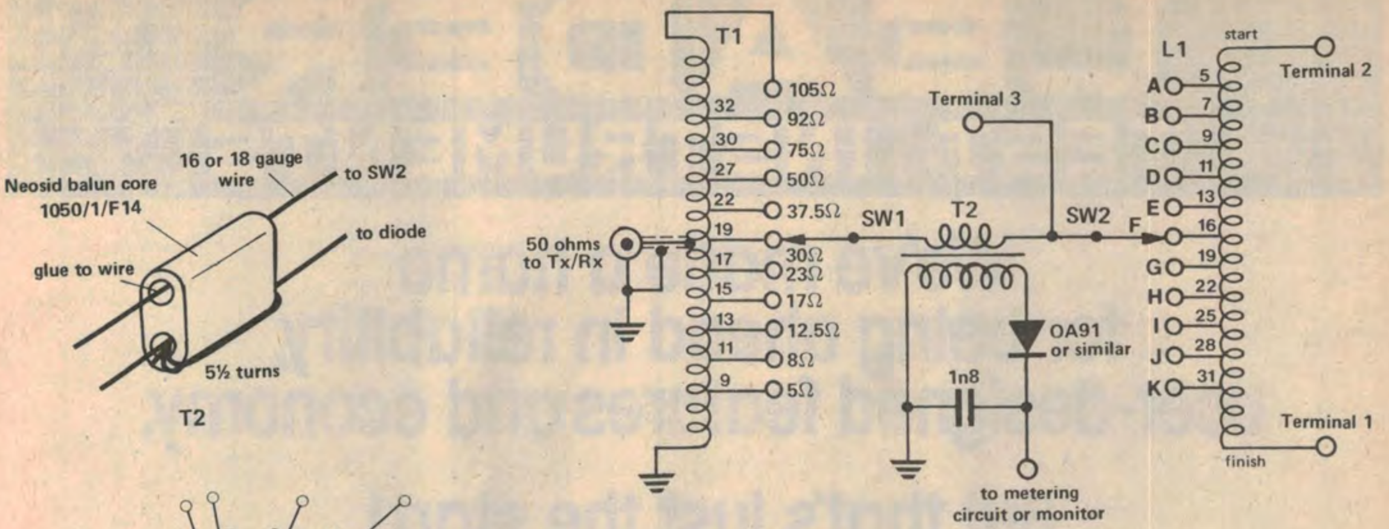
A commercially-manufactured version of this circuit uses a permeability-tuned coil. A length of ferrite rod is manually moved in or out of a coil to vary the inductance. Both of these variable inductors are elegant solutions in that they provide an infinitely-variable inductance, but both are difficult to physically realise if you are forced to construct them yourself. The next-best thing is a tapped coil.

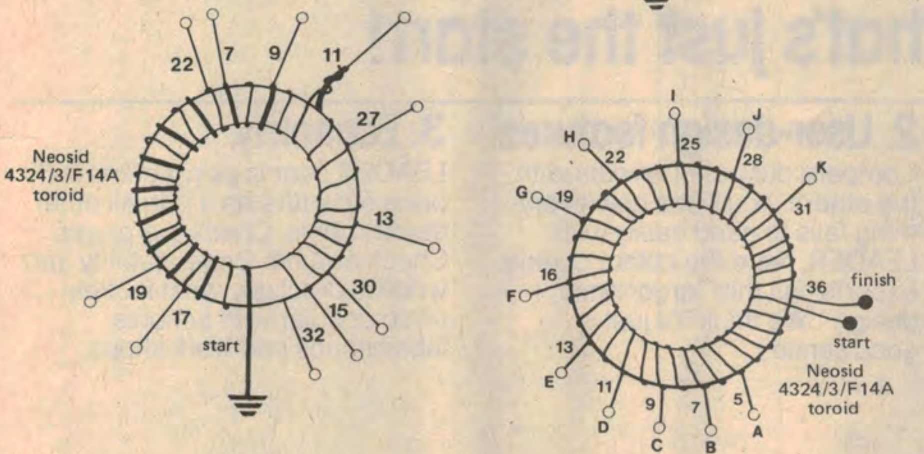
The tapped coil, L1, is illustrated in Figure 1 also. It consists of 36 turns evenly spaced around the cirumference of the large Neosid toroid of the same type used for T1. Taps are made at positions which provide convenient intervals of inductance. These are made in the same way as on T1. SW2 may be an eleven-position switch as for SW1 or a banana plug and sockets as suggested previously.

The antenna is connected between either of terminals 1, 2 or 3, and ground. If connected to terminal 1, SW2 provides relatively small increments of inductance, the percentage change increasing as tap K is approached.

If the antenna exhibits a large resistive impedance at the feedpoint, it can be connected between terminal 3 and ground.

The transformer T2 is used as a current transformer to provide a convenient signal for a metering or monitoring circuit. The wire connecting SW1 and SW2





T1
Neosid ferrite toroid, type 4324/3/F14A (38.1 mm o.d. by 25.4 mm i.d. by 12.7 mm high, F14A ferrite material)
Total of 32 turns of wire wound twice around the core. Use 14 or 16 swg enamelled wire for the first 11 turns and 18 or 20 guage for the following 21 turns; taps as indicated.

L1
Neosid ferrite toroid as for T1.
Wind 36 turns of 28 swg enamelled wire around core, leaving an 8 mm gap between start and finish; taps as indicated.

Figure 1. **Circuit diagram and winding details for the coil and transformers. Note that a variable capacitor may be connected between terminal 3 and ground to change the circuit to an L-match type rather than simple coil loading. The 11-position switches must have contacts rated to stand the RF current for the power level used.**

COMPONENTS

The 4324/3/F14A toroid (two needed) and the 1050/1/F14 balun core are available from Neosid Pty Ltd, 23-25 Percival St, Lilyfield NSW and from Watkin Wynne Pty Ltd, 32 Falcon St, Crows Nest 2065 NSW.

All other components are generally available.

is passed through one hole of a dual-hole balun, a Neosid type 1050/1/F14, which is glued in place. This forms the primary of the transformer. The secondary consists of 5½ turns of a light gauge enamelled copper wire or hookup wire wound through the other hole as illustrated in Figure 1. One end goes to ground, the other end goes to the diode rectifier circuit. The metering circuit may simply be a preset potentiometer in series with a suitable meter. Appropriate components are best determined by trial and error to suit the particular situation and power level of an installation.

In practice, SW1 and SW2 are adjusted for maximum antenna current as indicated by the metering circuit on T2. Alternatively, if an SWR meter is inserted in the transmission line between the transceiver and the tuner, adjust SW1 and for the lowest SWR or least reflected power. Do not operate SW1 and SW2 while power is applied.

The line to the transceiver from T1 is shown connected to the 50 ohm tap (22nd turn) in Figure 1. If a 75 ohm system is used, this may be connected to the 27th turn.

T1 works well between 1.5 MHz and about 7 MHz for all the impedance taps for 105 ohms down to 17 ohms. The lowest three taps only provide reasonable impedance transformations between 1.5 MHz and 3 MHz.

The tuner is suitable for use at power ratings up to 500W CW or PEP, providing sufficient care is taken with insulation, particularly with points that may carry reasonably high voltages. ●