Project 714

VHF LOG-PERIODIC ANTENNA Part 2

By Roger Harrison, VK2ZTB, who still swears (SWR's?) the prototype hasn't fallen down yet!

Balun Construction

THE BALUN TRANSFORMER consists of a trifilar winding on a ferrite balun core, Neosid type 1050/2/F14. Alternatively, a similar core could be stripped from a standard 4 - 1 TV balun and rewound. Construction is relatively non-critical, and details are illustrated in Fig. Fig. 7.

The winding wire is any convenient small-gauge hookup wire, preferably in three different colours to identify the different strands and assist construction. Alternatively, ordinary enamelled copper wire, about 22 gauge to 28 gauge B & S, would be satisfactory, although the three separate wires would have to be identified in some way, for example, by knotting wire 'b' once at each end, and wire 'c' twice at each end.

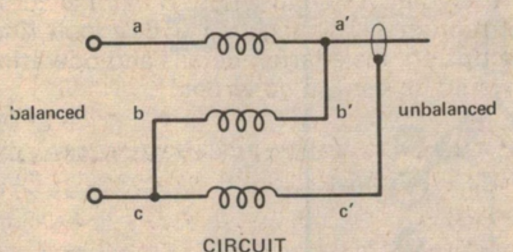
The three wires need to be about 150 mm long and should be lightly twisted together before commencing the winding. Wind 6½ turns through the two holes, around the outside of the balun core as illustrated in Figure 7.

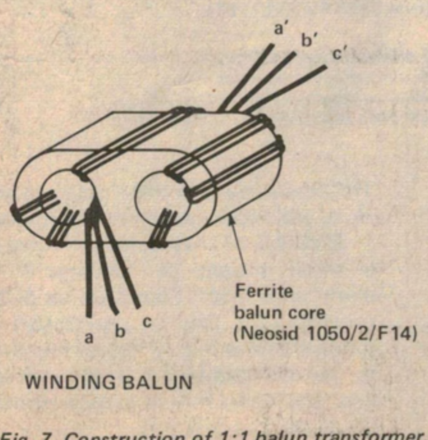
The wound core is then glued to a small square of matrix board, about 25 mm long per side, using a small amount of five-minute epoxy or one of the 'super' glues. The windings are terminated to two pins on either side of the board, as illustrated in Figure 7. Two lengths of hookup wire should be soldered to the 'balanced' terminals, sufficient to reach from the mounting point of the balun to the feedpoint of dipole 10. A short length of coax, terminated in a Belling-Lee line socket, is then attached to the 'unbalanced' terminals as indicated.

The balun assembly can be conveniently 'potted', using five-minute epoxy, to weatherproof it.

Mount the balun on the antenna boom, near or underneath, dipole 10, and connect the two 'balanced' connection leads to the feedpoint of dipole 10. Tape the assembly to the boom using weatherproof tape or plastic ties. Even string could be used, or the assembly glued in position using some more five-minute epoxy.

An alternative balun system would be to use standard 4 - 1 TV baluns. These perform a 300 ohm to 75 ohm transformation. With the type of construction employed, they can be used for a balanced-to-balanced or a balanced-to-unbalanced transformation.





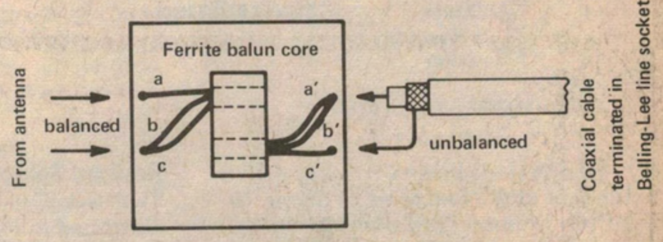


Fig. 7. Construction of 1:1 balun transformer.

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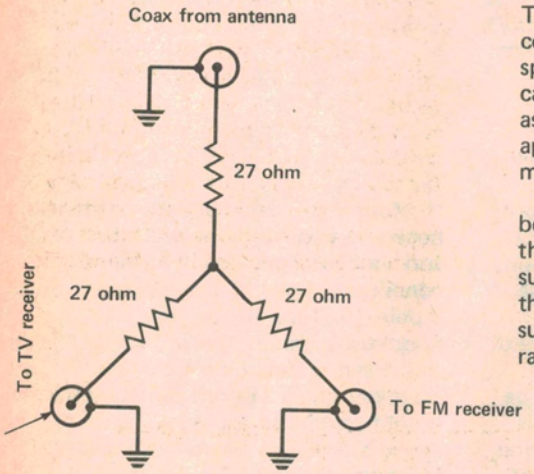
VHF LOG-PERIODIC ANTENNA

Splitters

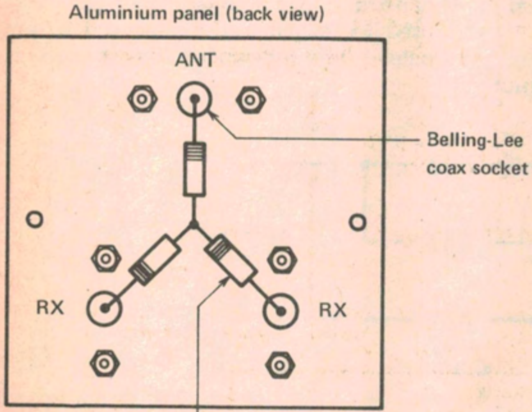
To run two different receivers from a common antenna a device called a splitter is necessary. The two receivers cannot simply be connected in parallel as they will interact with each other, apart from causing an impedance mismatch with the antenna feedline.

Two different kinds of splitters can be constructed – the resistive type and the transformer type. Alternatively, a suitable splitter may be purchased. As they are wideband devices they are suited for operation over the entire range from 40 MHz to 250 MHz.



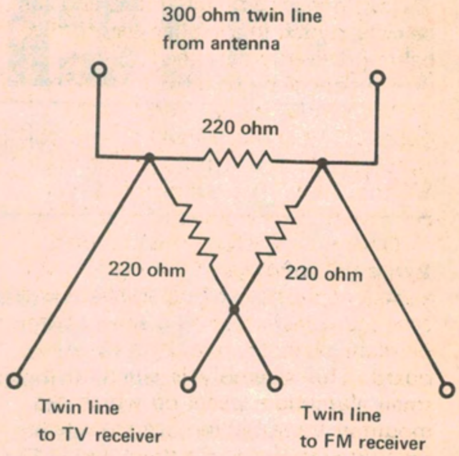
CIRCUIT

Aluminium panel (back view)



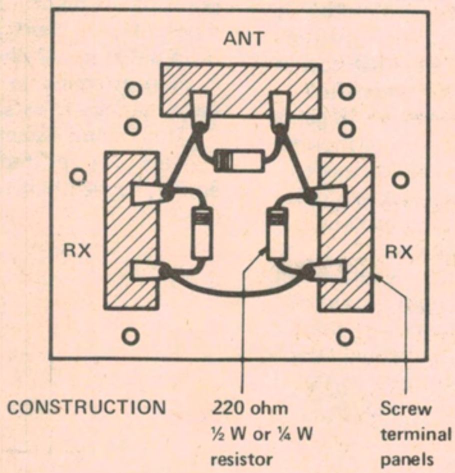
CONSTRUCTION

75 OHM SYSTEM SPLITTER



CIRCUIT

Aluminium panel (back view)



CONSTRUCTION

300 OHM SYSTEM SPLITTER

Fig. 8. a) Circuit of 75 ohm resistive splitter.
b) Layout of 75 ohm resistive splitter.
c) Circuit of 300 ohm resistive splitter.
d) Layout of 300 ohm resistive splitter.

If using these baluns, connect the 75 ohm side to the feedpoint of dipole 10 and run ordinary 300 ohm ribbon to your receiver installations from the 300 ohm balun connections. Be sure to take all the required precautions necessary with this sort of feedline installation as for TV feeder, to prevent signal 'suckout' by nearby metal structures and by line imbalance.

Resistive Splitters

Two resistive-type splitters are illustrated in Fig. 8. That on the left is for unbalanced, 75 ohm coaxial cable feedline systems; the one on the right is for 300 ohm systems. Both of these splitters are compromise solutions and are only recommended for TV & FM receiver installations in strong signal areas. If you are after DX, then the loss these splitters introduce will reduce receiver sensitivity.

Either type may be constructed on a small square or rectangular aluminium plate. Size is unimportant providing the feedline connectors are mounted reasonably close together so that the lead-length of the resistors and interconnections is kept short. Solder all connections.

Note that any terminal may be used as an input and the other two terminals may be used as the outputs.

When the splitter construction is completed, it can be mounted in a convenient place such as a cutout in a wall, shelf, or equipment cabinet.

Transformer Splitter

The best splitter is a transformer-type as it introduces a minimal loss, and can be constructed in a similar way to the balun previously described.

Commence by winding three wires on a Neosid balun core type 1050/2/F14 as illustrated in Fig. 7 and wind on 6½ turns, trifilar as described for the balun. The connections and construction are as illustrated in Fig. 9.

Once the transformer is completed, secure the windings, if necessary, with a small application of super glue. Then glue the transformer to a small scrap of plain phenolic board or matrix board. This assembly is glued to a small aluminium panel on which are mounted three Belling-Lee sockets as illustrated in Fig. 9. Carefully separate and identify the three leads at each end of the transformer windings and connect them as shown. Carefully solder all joints.

When the construction of the splitter is complete it can be mounted as described for the resistive splitters.

Feedline Systems

There are two alternatives for your feedline system: a 75 ohm coaxial cable system, or a 300 ohm twin-line system.

The coaxial cable system is recommended for a number of reasons: the coax may be run anywhere convenient as it is unaffected by wall material, metal objects and power cords. Most VHF receivers, TV sets and FM tuners these days have a coax connector antenna fitting to suit, and no interference can be picked up on the coax feedline as it is effectively shielded.

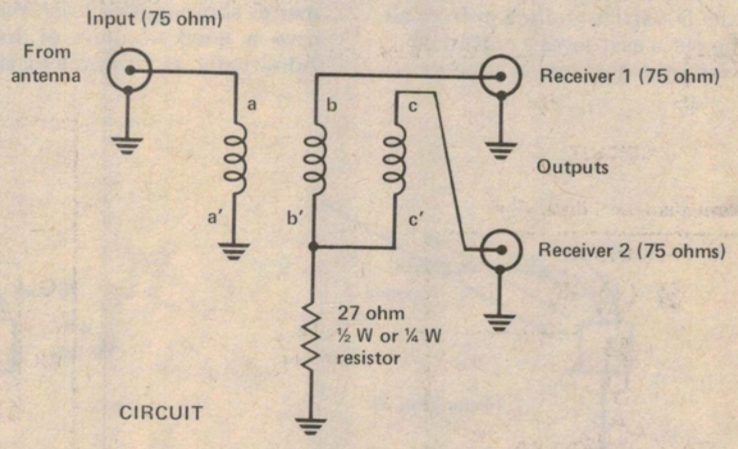
A 300 ohm twin-line feeder has the advantage of being inexpensive, but it must be correctly installed with stand-off supports and twists in the line to aid in maintaining 'balance'. It cannot be run as conveniently as coax, and noise and multi-path signals may be picked up on the feeder.

The required use of baluns and splitters in the system is illustrated in Fig. 10 for both systems. The 75 ohm coaxial cable system is illustrated on the left and the 300 ohm twin-line system on the right.

The coax required depends on the exact details of your installation. If a short run of coax is possible then a 6.5 mm diameter cable such as RG59 (variously designated as RG59/U or RG59/CU etc.), which is a 75 ohm characteristic cable, is suitable. If this cannot be obtained, then 50 ohm cable such as RG58 may be substituted, although a slight mismatch will result. The effect will be unnoticeable on a VHF or FM receiver but slight 'ringing' may be apparent on high contrast areas on a TV picture. This may not be visible at normal viewing distances.

For maximum sensitivity on reception or if you have to run the feedline more than 15-20 metres, then a low loss 75 ohm cable is recommended, such as type ET13M or PT13M with black, weatherproof outer jacket. It is made by Cablemakers Australia and is about 10mm diameter. There is a version of this type of cable with a grey plastic outer sheath. This is meant for community antenna installations, such as in flats and units, and the sheath deteriorates rapidly when exposed to the weather.

If you wish to use a 300 ohm feeder system, any of the commonly available TV ribbon feeders should suffice, depending on your requirements. Solid dielectric type is adequate in strong signal areas and is the least expensive. If you want the maximum in sensitivity a low-loss type should be installed. There are various versions of low-loss 300 ohm feeder. Some types are similar to the solid dielectric type and simply have cutouts in the dielectric. 'Open wire' types have small spacers supporting the two wires at intervals. Another type has a continuous dielectric of foam material encased in a thin plastic 'shell'.



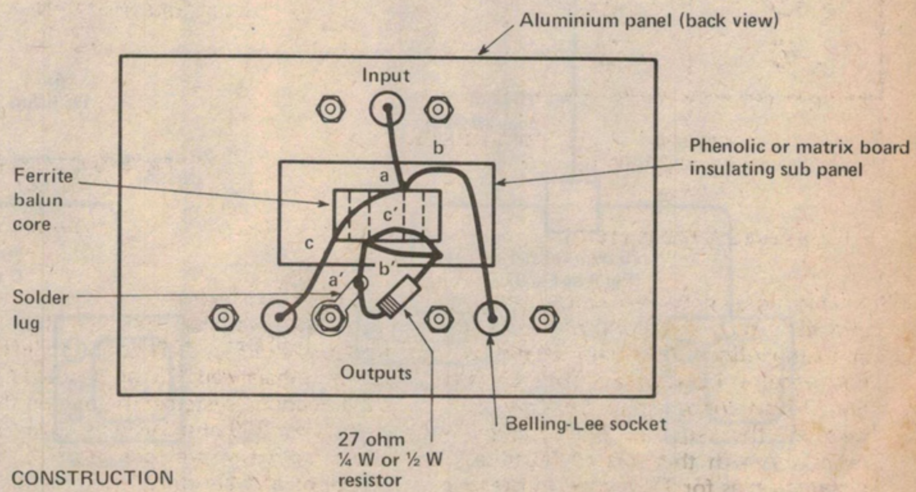


Fig. 9. a) Circuit of transformer-type splitter.
b) Construction of transformer-type splitter.

VHF LOG-PERIODIC ANTENNA

Antenna Performance

The beamwidth of the antenna is about 50° (between the -3dB points). There were no discernable sidelobes in the forward direction which reduces problems with multi-path signals on FM and TV reception which are the cause of distortion on FM stereo and ghosting on TV signals.

The gain of the antenna is around eight to nine dB and the front to back ratio (rejection of signals behind the antenna) around 30 dB.

The broad beamwidth allows reception over a wide range of angles in the forward direction, very handy when the DX starts pouring in from all over the place as it saves a great deal of rotating the antenna. If you are using it for TV/FM reception the beamwidth should prove adequate for most capital city locations. However, if you live in the Balmain-Leichhardt-Annandale-Glebe area of Sydney as I do, you may think that you will have problems with a fixed antenna. The TV transmitters are to the north (Gore Hill area) and 2MBS-FM is to move to the AMP building site in the city, to the east. However, their 'technical rep.' assures me that their 10 kW transmitter will put such a strong signal into those areas that an antenna will not be necessary!

Installed at a height of roughly six metres above ground level, the antenna gave a good account of itself. Admittedly, as far as the local TV and FM transmitters are concerned I live in a strong signal area, although we have in the past suffered from ghosting on TV signals from the south. The good front-to-back ratio improved this problem considerably.

Listening to a variety of VHF signals with a general coverage VHF receiver produced good strong signals on the aircraft frequencies from Bankstown light aircraft aerodrome — much as expected. Quite readable signals from as far away as Wollongong were also copied. Video and sound from channel 0 in Wagga were audible, sometimes at quite good strength, in Sydney on the 60 — 250 MHz model!

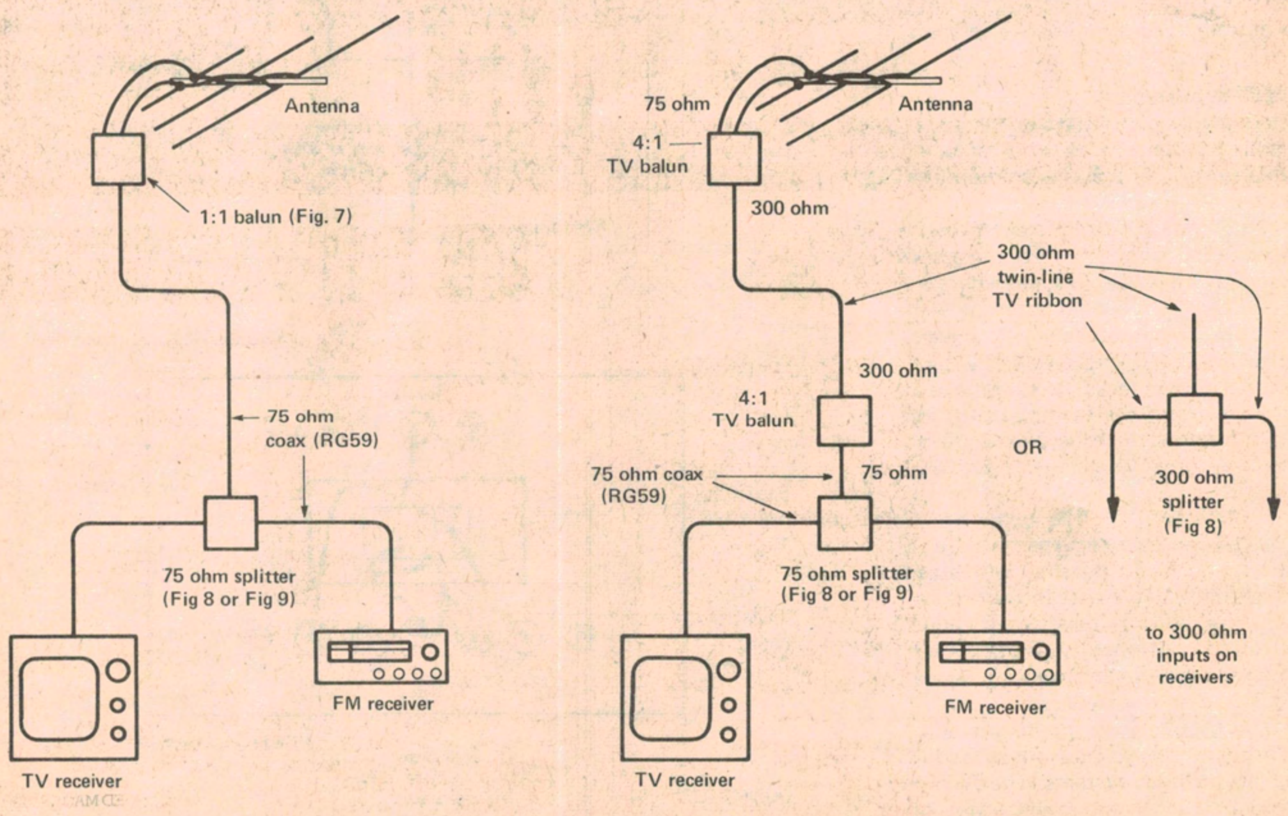


Fig. 10. Feedline and splitter systems installation.