SHARED TELEVISION AERIALS

Methods of Feeding Several Receivers

IT is not always realized that it is a simple matter to operate more than one television receiver from a single aerial. There is, of course, a loss of signal, for in the ideal case the signal power provided by the aerial is divided equally among the receivers connected to it. The loss is rarely a serious one, however, except in areas of low field strength.

The most obvious way of connecting several sets to a common aerial is by means of a transformer, for then there is no loss in the network, apart from some unavoidable transformer loss. This is shown in Fig. 1 and if each receiver is designed for a feeder impedance Z_0 and the aerial feeder impedance is also Z_0 the transformer must have an impedance ratio $Z_0 : Z_0/n$ where n is the number of receivers. This is a turns ratio of $1 : N = 1 : \sqrt{1/n}$. Ignoring transformer losses, the input to each individual receiver is $10 \log n$ db below the aerial output.

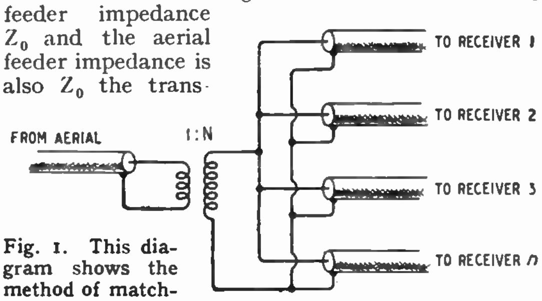


Fig. 1. This diagram shows the method of matching a feeder to several receivers by a transformer.

Where only a few sets are used it is much simpler to use a resistance matching network, but it is rather less efficient. The arrangement is shown in Fig. 2. It can be seen by inspection that for proper matching it is necessary to have

$$Z_0 = R + \frac{Z_0 + R}{n}$$

whence

$$R = Z_0 \frac{n - 1}{n + 1}$$

The aerial current divides equally among the receivers, therefore the input power to each is $20 \log n$ db below the aerial output. The power lost in the resistors is as much as that fed to the receivers.

The commonest use of this circuit is to connect two receivers to one aerial. Then $n = 2$ and $R = Z_0/3 = 24\ \Omega$ if $Z_0 = 72\ \Omega$ as is usual. Each receiver input is 6 db below the aerial output. The resistors can be the ordinary small composition type and in this instance it would be convenient to use for each two 47-Ω components in parallel, since this would permit the use of standard-value components.

The matching unit can be connected at any convenient point. Where it is desired to operate several receivers simultaneously in the same room, as in a demonstration showroom, the unit would obviously be fitted where the aerial feeder enters the room and short lengths of feeder run from it to each set. On the other hand, a pair of semi-detached houses might decide to share an out-door aerial. It might then be desirable to fit the matching unit fairly close to the aerial and run separate long feeders from it into the separate houses. In this case the unit must be carefully weather-proofed.

The unit can equally well go in the middle of a cable run. Thus, two flats on different floors might share an aerial, and the obvious place for the unit is at the entry point of the cable into the upper of the two.

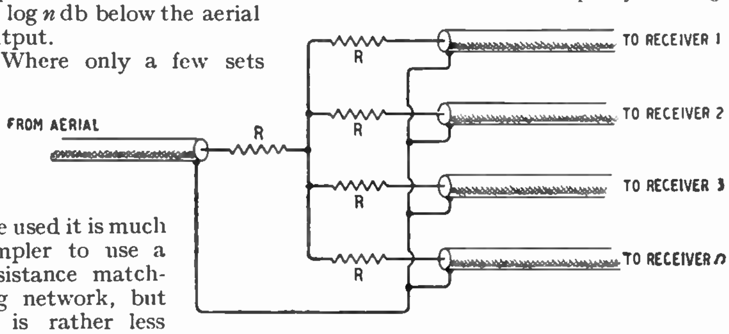
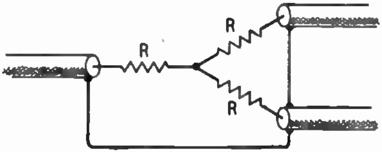


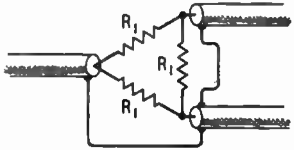
Fig. 2. Here a resistance network is used for matching several receivers to an aerial.

Since the loss of signal for two sets is 6 db the scheme may be inapplicable in fringe areas. There is, however, the possibility that if two neighbours combine they could for the cost of two separate aerials erect one more elaborate and lofty structure which would provide an increase of more than 6 db in signal. However, the transformer matching system is likely to be more satisfactory under this condition.

For two receivers the unit has the form shown in Fig. 3 (a). An alternative form which is exactly equivalent is shown in Fig. 3 (b). By the star-delta transformation since it is obviously inapplicable to coaxial feeders. One resistor R_1 is still needed. The aerial feeder is properly matched without it and as it is connected to points of equal potential there is no current in it and no power loss in it. It is needed to retain proper



(a)



(b)

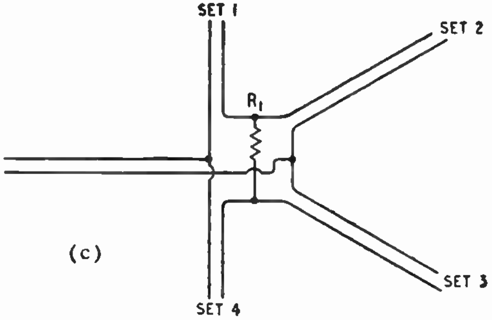


Fig. 3. When two receivers only are fed from a common aerial the circuit of Fig. 2 reduces to (a) and this has the exact equivalent (b) in which R_1 equals the feeder impedance. If twin feeders are used two of the resistors can be replaced by feeders (c) and four sets fed without extra loss.

theorem $R_1 = 3R = Z_0$. Therefore, the resistor and the feeder impedances are the same. Hence, two of the resistors could be replaced by feeders and so four sets could be operated without any loss.

This scheme is sketched in Fig. 3 (c) for twin-wire lines, matching looking in from the receiver feeders.

It should be noted that none of the receiver feeders is balanced to earth in this arrangement, but the aerial feeder is. Such a unit should, therefore, be used only when but short connections to the receivers are needed.