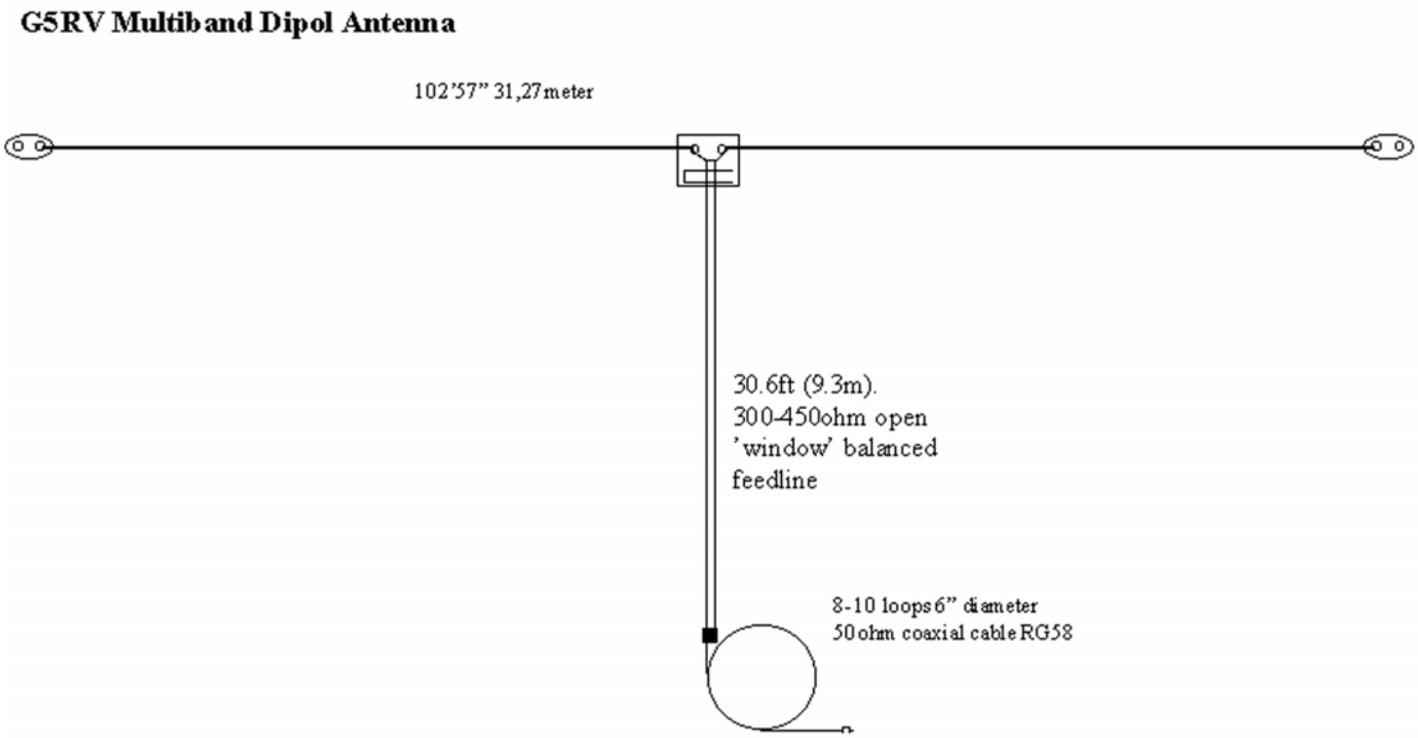

Construction

The dimensions of the antenna and its matching section are shown in Figure 9. The "flat-top" should, if possible, be horizontal and run in a straight line, and should be erected as high as possible above ground. In describing the theory of operation, it has been assumed that it is generally possible to erect the antenna at an average height of about 34ft (10.36m), which happens to be the optimum radiation efficiency on 1.8, 3.5 and 7mhz for any horizontal type antenna, in practice few amateurs can install masts of the optimum height of half a wavelength at 3.5 or 7mhz, and certainly not at 1.8mhz.

If, due to limited space available, or to the shape of the garden, it is not possible to accommodate the 102ft (31.1m) top in a straight line, up to about 10ft (3m) of the antenna wire at each end may be allowed to hang vertically or at some convenient angle, or be bent in a horizontal plane, with little practical effect upon performance. This is because, for any resonant dipole antenna, most of the effective radiation takes place from the centre two-thirds of its length where the current antinodes are situated. Near to each end of such an antenna, the amplitude of the current standing wave falls rapidly to zero at the outer extremities; consequently, the effective radiation from these parts of the antenna is minimal.

The antenna may also be used in the form of an inverted-V. However, it should be borne in mind that, for such a configuration to radiate at maximum efficiency, the included angle at the apex of the V should not be less than about 120 degrees. The use of 14awg enameled copper wire is recommended for the flat-top or V, although thinner gauges such as 16 or even 18awg can be used.

The Matching Section
This should be, preferably, of open-wire feeder construction for minimum loss. Since this section always carries a standing-wave of current (and voltage) its actual impedance is unimportant. A typical, and very satisfactory, form of construction is shown in figure 10. The feeder spreaders may be made of any high-grade plastic strips or tubing; the clear plastic tubing sold for beer or wine siphoning is ideal.

If it is desired to use 300 ohm ribbon type feeder for this section, it is strongly recommended that the type with "windows" be used because of its much lower loss than that with solid insulation throughout its length, and its relative freedom from the "detuning" effect caused by rain or snow. If this type of feeder is used for the matching section, allowance must be made for its velocity factor (vf) in calculating the mechanical length required to resonate as a half-wave section electrically at 14.15mhz. Since the vf of standard 300 ohm ribbon feeder is .82, the mechanical length should be 28ft (8.5m). However, if 300 ohm ribbon with "windows" is used, its vf will be almost that of open-wire feeder, say .90, so its mechanical length should be 30.6ft (9.3m). This section should hang vertically from the centre of the antenna for at least 20ft (6.1m) or more if possible. It can then be bent and tied off to a suitable post with a length of nylon or terylene cord so as to be supported at above head-height to the point where, supported by a second post, its lower end is connected to the feeder.

The Feeder
The antenna can be fed by any convenient type of feeder provided always that a suitable type of antenna tuner is used. In the original article describing the G5RV antenna, published in the , then, RSGB bulletin November 1966, it was suggested that if coaxial cable feeder was used, a balun might be employed to provide the necessary unbalanced-to-balanced transformation at the base of the matching section. This was because the antenna and its matching section constitute a balanced system, whereas a coaxial cable is an unbalanced type of feeder. However, later experiments and a better understanding of the theory of operation of the balun indicated that such a device was unsuitable because of the highly reactive load it would "see" at the base of the matching or "make-up" section on most hf bands.

It is now known that if a balun is connected to a reactive load presenting a vswr of more than about 2:1, its internal losses increase, resulting in heating of the windings and saturation of its core (if used). In extreme cases, with relatively high power operation, the heat generated due to the power dissipated in the device can cause it to burn out. However, the main reason for not employing a balun in the case of the G5RV antenna is that, unlike un antenna tuner which employs a tuned circuit, the balun cannot compensate for the reactive load condition presented to it by the antenna on most of the hf bands, whereas a suitable type of antenna tuner can do this most effectively and efficiently.

Recent experiments by the author to determine the importance or otherwise of "unbalance" effects caused by the direct connection of a coaxial feeder to the base of the matching section had a rather surprising result. They proved that, in fact, the hf currents measured at the junction of the inner conductor or the coaxial cable with one side of the (balanced) matching section and at the junction of the outer coaxial conductor (the shield) with the other side of this section are virtually identical on all bands up to 28mhz, where a slight but inconsequential difference in these currents has been observed. There is, therefore, no need to provide an unbalanced-to-balanced device at this junction when using coaxial feeder.

However, the use of an unbalanced-to-unbalanced type of antenna tuner between the coaxial output of a modern transmitter (or transceiver) and the coaxial feeder is essential because of the reactive condition presented at the station end of this feeder which, on all but the 14mhz band, will have a fairly high to high vswr on it. This vswr, however, will result in insignificant losses on a good-quality coaxial feeder of reasonable length; say, up to about 70ft (21.3m). Because it will, inevitably, have standing waves on it, the actual characteristic impedance of the coaxial cable is unimportant, so that either 50 ohm or 80 ohm type can be used.

Another very convenient type of feeder that may be used is 75 ohm twinlead. However, because of the relatively high loss in this type of feeder at frequencies above about 7mhz, especially when it has a high vswr on it, it is recommended that not more than about 50 to 60ft (15.2 to 18.3m) of this type feeder be used between the base of the matching section and the antenna tuner. Unfortunately the 75 ohm twinlead in the UK is the receiver type; the much less lossy transmitter type is available in the USA. By far the most efficient feeder is the "open wire" type. A suitable length of such feeder can be constructed in exactly the same way as that described for the open-wire matching section. If this form of feeder is employed, almost any convenient length may be used from the centre of the antenna right to the antenna tuner (balanced) output terminals. In this case, of course, the matching section becomes an integral part of the feeder. A particularly convenient length of open-wire feeder is 84ft (25.6m), because such a length permits parallel tuning of the antenna tuner circuit on all bands from 3.5 to 28mhz with conveniently located coil taps in the antenna tuner coils for each band, or, where the alternative form of antenna tuner employing a three-gang 500pf/section variable coupling capacitor is used the optimum loading condition can be achieved for each band. However, this is not a rigid feeder length requirement and almost any length that is mechanically convenient may be used. Since this type of feeder will always carry a standing wave, its characteristic impedance is unimportant, and sharp bends, if necessary, may be used without detriment to its efficiency. It is only when this type of feeder is correctly terminated by a resistive load equal to its characteristic impedance that such bends must be avoided.

Coaxial cable hf choke
Under certain conditions, either due to the inherent "unbalanced-to-balanced" effect caused by the direct connection of a coaxial feeder to the base of the (balanced) matching section, or to pick-up of energy radiated by the antenna, a current may flow on the outside of the coaxial outer conductor. This effect may be considerably reduced, or eliminated, by winding the coaxial cable feeder into a coil of 8 to 10 turns about 6in in diameter immediately below the point of connection of the coaxial cable to the base of the matching section. the turns may be taped together or secured by nylon cord.

It is important, of course, that the junction of the coaxial cable to the matching section be made thoroughly water-proof by any of the accepted methods; binding with several layers of plastic insulating tape or self-amalgamating tape and then applying two or three coats of polyurethane varnish, or totally enclosing the end of the coaxial cable and the connections to the base of the matching section in a sealant such as epoxy resin.