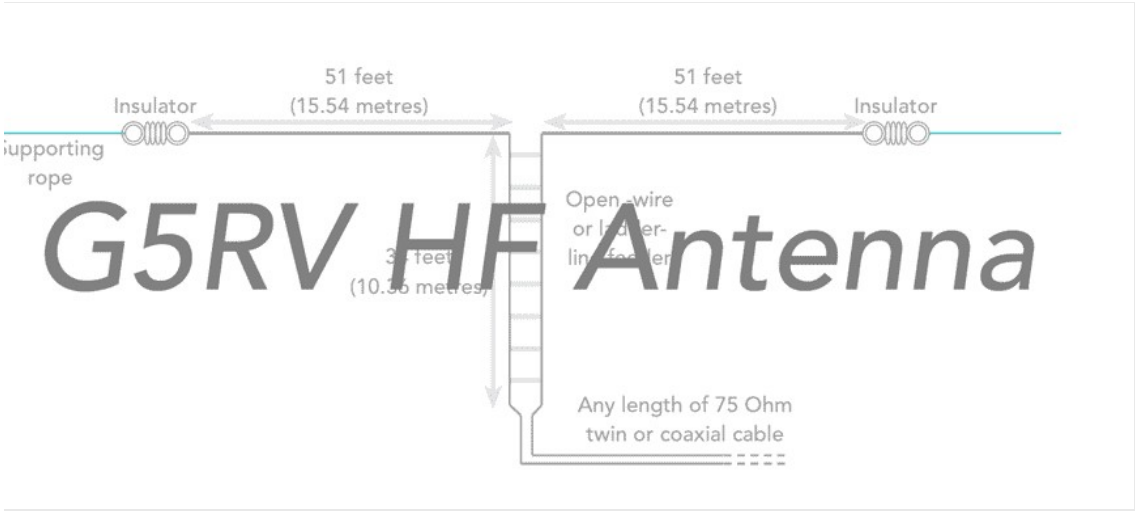
V Multiband Ham Radio Antenna

5RV is a multiband HF wire antenna widely used by radio amateurs because ides an effective antenna solution for multiple bands at little cost: details, uction, performance.

ntennas Include:

V multiband wire HF antenna provides a very convenient, cost effective multiband antenna solution for HF ɔ communiations and as a result it has been popular for many years.

V antenna is based upon the doublet antenna concept and it was designed by Louis Varney, who held the radio callsign, G5RV.



gn was originally devised in 1946, but it was not until 1958 that it was published when it appeared in the July GB Bulletin (the predecessor of the current RSGB RadCom journal.

en further notes appeared in RSGB Radio Communication in July 1984 and the antenna has been widely l even manufactured by a variety of companies.

V HF multiband antenna operates on all amateur bands from 80 metres to 10 metres, although the VSWR is some bands than others. It can be built from readily available components, or there are many versions that able commercially.

onal advantage, is that is does not occupy as much space as a full size 80 metre dipole and this can be an e for those with smaller areas for their antennas.

e with limited space there is even a half size G5RV, often called the G5RV junior which is available, and it half the space.

V antenna basics

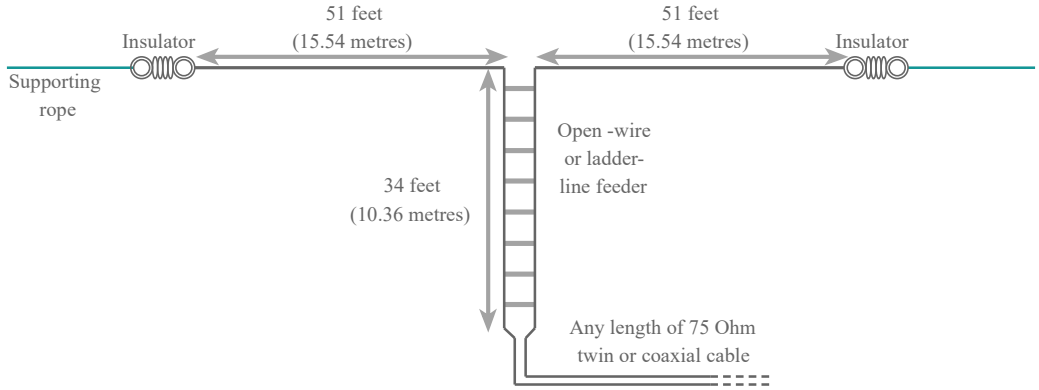
V antenna is an amateur radio centre fed doublet with a symmetric resonant feeder line, which serves as ce matcher for a 50Ω coax cable to the transceiver.

e two implementations of the G5RV antenna. The utilises 34 feet (10.36 metres) of open wire feeder, whilst nd uses any convenient length of open wire feeder which is connected directly to an antenna matching it.

V antenna that transitions directly to 75 Ω twin cable or coax is probably the more popular and it is shown owever when using this option it is best to incorporate a balun in the circuit.

transmitter will need to have a suitable tuning capability or external tuning unit by the transmitter to ensure n match the antenna.

it is meant to offer a reasonable load, the actual load on most frequencies is will fall outside the range which adio communications transmitters can tolerate without the PA protection circuitry reducing the power levelsf.



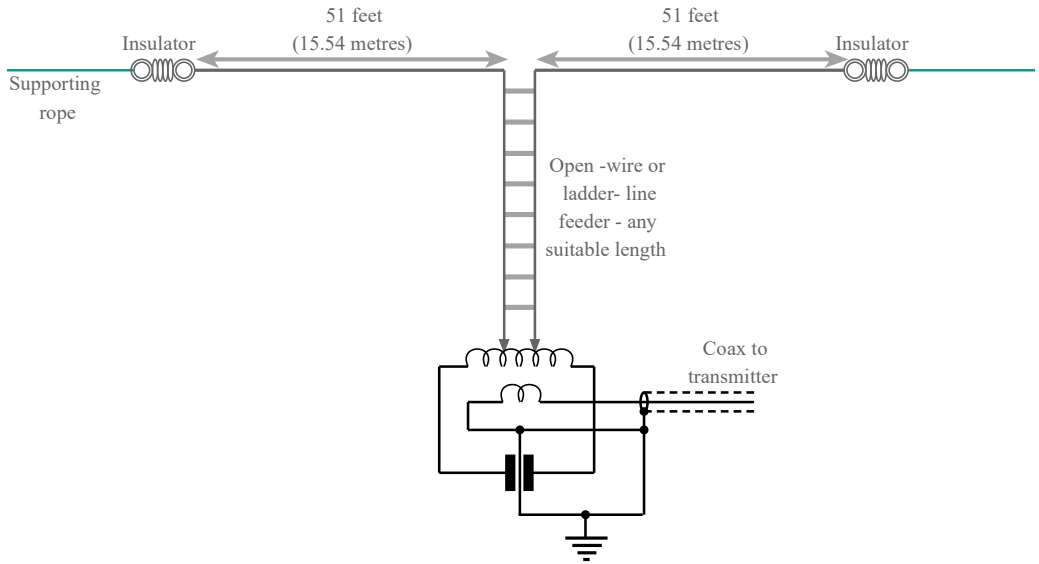
Basic G5RV antenna with 31 feet of twin transitioning to 75 Ω twin or coax.

the G5RV antenna with 31 feet / 10.36 metres of open wire before transitioning to twin or coax is a nt option, another solution is to use an antenna tuning unit.

ustments took account of the different type of balanced feeders that could be used:

FEEDER TYPE	LENGTH (IMPERIAL)	LENGTH (METRIC)
Open Wire	34 ft	10.36 metres
Ladder line	30.6 ft	9.33 metres
TV 75Ω twin	28 ft	8,53 metres

nal G5RV antenna design included the circuit for a suitable tuning unit, although there are many tuning units able to provide a good match. It is necessary to ensure that there is a balanced to unbalanced transition, i.e. s used.



G5RV antenna with Antenna Tuning Unit.

nna tuning matching unit provides two functions. One is to match the impedance because. Like any antenna, give an exact match. The second is to provide the balanced to unbalanced transition.

the best option is to use the antenna with an external or remote tuner unit and then the run though any can be coaxial cable with a low VSWR.

V antenna operation

V antenna operates over a wide band and is able to provide a reasonable match on most of the amateur ds. The antenna was originally designed in 1946 when the number of bands was much less than it is now. In s designed to meet the needs of the then bands: 80 metres, 40 metres, 20 metres and 10 metres. At this n 15 metres was not an allocated amateur radio band.

f the number of different bands on which the antenna operates, the way in which it works is slightly different, umber of wavelengths in each section and hence its performance.

Hz, 80 metres: On 80 metres the G5RV antenna uses the flat top as well as about 5 metres of the ing section to form a half wave dipole. As a result it presents a reactive load it its input.

z, 40 metres: On 40 metres the G5RV antenna operates using the top section plus nearly 5 metres of the ıing section and it operates as a partially folded collinear array with two half waves in phase. Again the na presents a reactive load to any transmitter at its input.

Hz, 30 metres: On this band the G5RV operates as two half waves in phase and as a result it presents a eactive load at the input.

Hz, 20 metres: This is said to be the band for which the antenna was originally designed. It operates as a 3 dipole and presents a resistive load of about 90 Ω at its input. This provided a good match to the 75 Ω coax 'as widely used at the time.

Hz, 17 metres: The G5RV performs as two in phase full wave antennas which extend slightly into the r section. The antenna is slightly reactive, but presents a high impedance in view of the top section being fed igh voltage point.

Hz, 15 metres: The antenna performs as as a 5 λ / 2 antenna. As it represents an odd number of engths it is fed at a current node and it is only slightly reactive.

Hz, 12 metres: The G5RV performs as a slightly long 5 λ / 2 antenna and as such it is slightly reactive, but 'erall impedance is not too high.

Hz, 10 metres: The antenna acts as two 3λ / 2 sections fed in phase. It gives a high impedance load which htly reactive.

nna is very much a compromise and it presents a variety of different loads to the transmitter. Whilst this may :n acceptable in the days of vacuum tubes / valves when it was designed, modern semiconductor PAs do not /ariety of loads and an antenna tuning unit must be used.In terms of radiation, the G5RV antenna provides nce almost equivalent to a dipole on 80 and 40 metres. On 20 metres the extended length means that the lobes provide a lower angle of radiation in some direction and therefore it can favour long distance signals in tion of the lobes as these will tend to arrive at a low angle. In fact Louis Varney always maintained that the worked best on 20 metres.

V antenna and balun

:V antenna is a form of doublet antenna which has a balanced format, i.e. neither of the two feed wires is However one of the main methods of feeding the antenna is to use coaxial cable, which by its very nature is :ed.

to feed the antenna and have the conversion from the balanced open wire or ribbon cable feeder to coax the use of a balun - a balanced to unbalanced transformer.

n can take many forms. It could be constructed around a ferrite core, but more usually for this type of on, the balun can consist of 8 to 10 turns of the coaxial cable with around 6 inch diameter, if the bend radius oax will tolerate this. Thhis configuration acts as an RF choke and prevents any common mode currents long the coax.

it adds weight to the G5RV antenna, this approach is often very successfully used.

V antenna & VSWR

y in 1946, Louis Varney did not have access to any computer modelling for his G5RV antenna. In more ears computer simulations for the antenna show that it provides a high level of VSWR on most bands. Typical ight be: 6.5:1 on 3.7 MHz, 5.5:1 on 7.1 MHz, 2.4:1 on 14.2 MHz, 4.6:1 on 21.2 MHz and above 10:1 on 28 other HF amateur radio bands.

ans that with modern transmitters with semiconductor power amplifiers it is essential to use an antenna uit. Without this, the power amplifier will see an unacceptably high level of VSWR and will either be possibly oyed if no VSWR protection is incorporated into the circuit, or the protection circuitry will reduce the output to here the levels of current and voltage resulting from the high SWR can be tolerated.

en an ATU is used with the G5RV antenna the level of reflected power can result in high levels of loss if the eeder does not have a sufficiently low loss. If the loss of the coaxial feeder is high, then the VSWR will not oad because the forward is attenuated, and the reflected power is attenuated, again. This means that the power seen at the transmitter is much lower making any metering think that the VSWR is not nearly as bad.

V performance and choice

V antenna has many advantages, but when selecting an antenna it is worth understanding all the trade-offs ne advantages.

F antenna advantages

band capability: The G5RV antenna provide a multiband capability. It is able to operate on all amateur s between 80 metres and 10 metres.

le construction: The G5RV can be made quite easily using components available from amateur radio s and outlets.

cost: It is possible to construct a G5RV antenna for very little cost - there are no high price items

: antenna disadvantages

romise antenna: The antenna does not provide a good match on many frequencies - an antenna tuning always **very** advisable.

re loss on coax: With some commercially manufactured antennas may use relatively lossy coax cable. nay give a better VSWR figure at the transmitter, but it will result in signal loss. Check before buying, or if g a G5RV yourself, use low loss coax.

tive pattern: The directional pattern of the antenna will vary according to the frequencies in use. This may a particular issue in many cases.

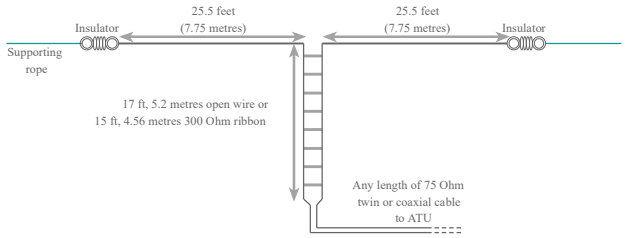
V antenna was initially developed before the advent of semiconductor technology, when valves / thermionic re used. These devices were relatively tolerant of poor VSWR, and therefore high levels of VSWR were eptable in antennas. Today with the use of semiconductor output devices, VSWR is more important, and an antenna matching unit should always be used to protect the PA.

size G5RV antenna

ugh the traditional G5RV is smaller than a half wave dipole for its lowest band (80 metres), this can still be for some stations. To meet this need, an antenna called the half size G5RV or G5RV junior antenna was d. Rather than covering the HF bands from 80 to 10 metres, the G5RV junior only covers the bands from 40 10 metres and is about half the size.

n 1966, Louis Varney stated that it is possible to scale the antenna down to half size - both the top wire nd the length of feeder stub need to be shortened in this manner.

ıns that the top section of the antenna should be 51 feet or 15.5 metres and the matching twin feeder can be ır 5.2 metres in the case of open wire feeder, or 15 feet or 4.6 metres in the case of using 300Ω ribbon



Half size G5RV or G5RV junior for 40 - 10 metres

me way that the both sides of the feeder can be strapped together and the whole normal size G5RV antenna ı a good ATU to provide coverage of 160 metres (Top Band), so too the same technique can be used with ized G5RV antenna to provide 80 metre coverage.

nna, like its full sized big brother operates with high levels of VSWR and therefore, for any transmitting radio cations, the antenna tuning unit is essential.

V antenna has much going for it and it can provide a solution for many situations where a low cost multiband nna is needed for HF ham radio communications. The antenna has been used for many years by thousands and given some useful results, although the variable impedance presented to the transmitter means that ent semiconductor based transceivers an antenna tuning unit is essential to keep the VSWR within tolerable so the use of low loss coax is required to keep the loss levels down when operating with the high levels of een on virtually all bands.

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