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Antennas

There are some situations where feeding an antenna with coax poses some mechanical problems. One of these is a dipole arrangement using a kite or a balloon as a support. Invariably the element to be fed has to be λ/4 long to present a low impedance to the coax feed. This requires some sort of radial or lower element, complicating the mechanics. Introducing the RFD (resonant feed-line dipole).

This was described by AB2EZ in [1] and described as the RFD (resonant feed-line dipole). This arrangement, shown in **Fig 1**, shows the centre of the coax feed connected directly to end of the quarter-wave wire element and the braid left open-circuited. The coax braid currents are choked off λ/4 down from the feed-point by simply coiling the feeder into 13 turns.

According to AB2EZ, the method gives good results using 20m and 80m versions, with a SWR of better than 2:1 over the bands.

A VHF RFD DESIGN

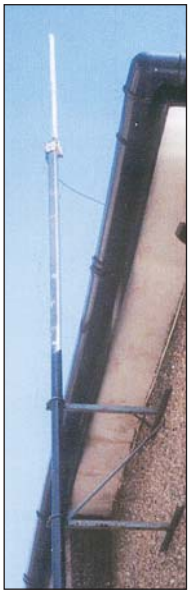
I received a description of a similar antenna for 2m from Peter Grant, G8HAR. For many years he had been using the traditional Slim Jim with good results.

G8HAR then tried an experimental RFD for 2m by simply removing quarter of a wavelength of braid from a length of coax feeder and making a small multi-turned loop of the feeder, quarter of a wavelength down from the point where the braid was removed. The antenna appeared to work well and this encouraged him to make a more permanent arrangement as shown in **Fig 2**.

The upper element is made from λ/4 of coax cable with the inner conductor and the braid soldered together with the centre of the feeder coax connected to this point. The feeder and the coax element are fixed to a plastic or wooden support using tie-wraps.

The coax choke is made by coiling the coax around the antenna support five and a half times and also fixed into place using tie-wraps.

The antenna is adjusted for minimum SWR by trimming the length of the top element and adjusting the position of the choke relative to the feed-point. When the adjustments are complete, the choke is fixed in place with the tie-wrap. The centre feed-point and the end of the elements should be then sealed with shrink-wrap.

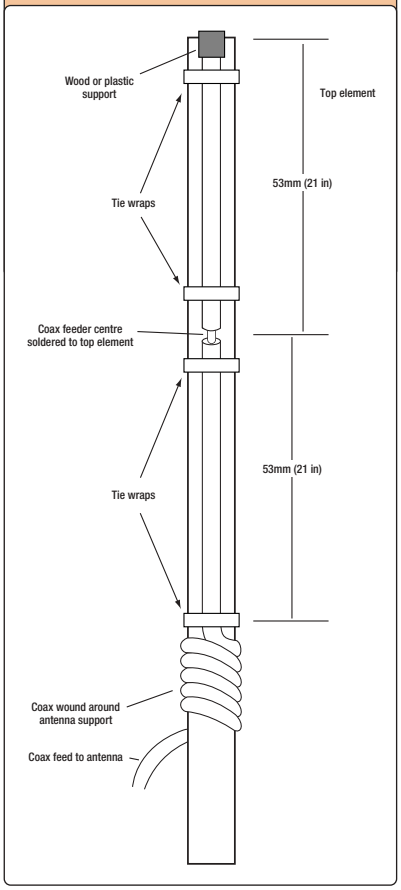


The G8HAR RFD antenna, which is claimed to work as well as the Slim Jim antenna.

Fig 1: The AB2EZ RFD half-wave dipole antenna for 80m [1].

Fig 2: The G8HAR RFD half-wave dipole antenna for 2m. After adjustment (see text) the SWR readings were 1.4:1 at 144MHz, 1.0:1 at 145MHz and 1.2:1 at 146MHz.

FIG 2 © RADCOM 417



FURTHER EXPERIMENTS

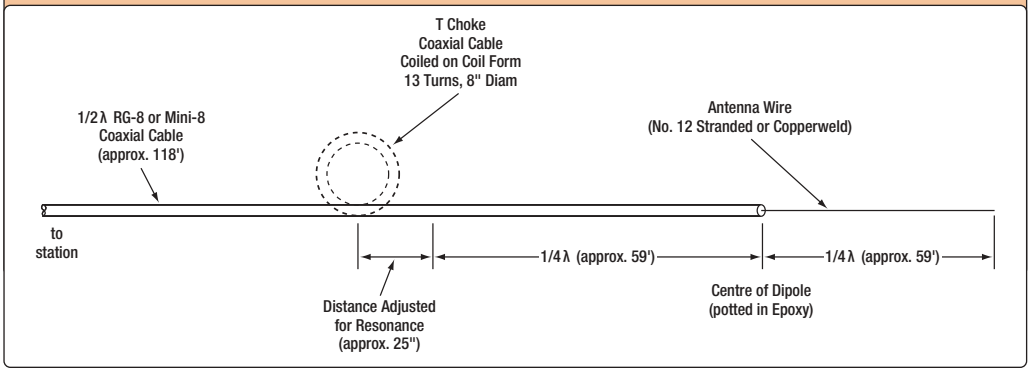
When I first received the description of the G8HAR RFD antenna, I felt unsure about it - it didn't seem right somehow and only decided to pursue the matter after coming across the antenna by AB2EZ [1]. This antenna does not feature in any other of the antenna books that I possess.

The normal method of feeding a coax centre-fed vertical is to use a bazooka λ/4 tube with the coax fed up the centre and the coax braid connected to the tube at the feed-point. I decided to make one of these RFD antennas for the 70MHz band. Pruning and adjustment resulted in a top element 0.93m while the distance from the feed-point to the choke was 1.2m. The choke comprised a single layer of the feeder wound on a 50mm (2in) cardboard tube and held in place using plastic clothes pegs. This arrangement made it easy to adjust the position of the coil on the feed-line and to also adjust the number of turns.

I am not so sure about this 'choke'. I found the number of turns as well as the position on the feeder had quite an affect on the resonant frequency of the antenna. Also, the position of the coil and the number of turns affected the feed-point impedance (measured using SWR). Could the turns be acting as a tuning coil similar to the arrangement that could be used to end-feed a half-wave dipole? Touching the coax above the 'choke' while making tests showed huge changes in SWR, while touching the coax below had no effect on the SWR so clearly the common-mode, or antenna currents, on the line were quite low.

My thoughts on using a kite- or balloon-supported antenna for 80m is that a single wire is much lighter than the lightest weight coax feeder. It might be better to use a single λ/2 wire with a simple parallel tuned circuit ATU at the base as described in [2]. ♦

FIG 1 © RADCOM 416



REFERENCES

[1] 'Experiments with a Balloon-Held Vertical Antenna', Stewart D Personick, AB2EZ. *ARRL Compendium*, Vol 7.

[2] *The Amateur Radio Mobile Handbook*, RSGB.

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Antennas

The description of the RFD (resonant feed-line dipole) in February's 'Antennas' resulted in some informative and constructive mail and I was surprised at the amount of work some readers have done on this antenna

John Heys, G3BDQ, says that he came across the RFD design in a small book called *Simple Low-Cost Wire Antennas for Radio Amateurs,* by Bill Orr, W6SAI and is described as a 'Cobra Vertical for 10 and 6 Metres'. This antenna uses a choke constructed by putting three turns of the feeder through a ferrite ring.

Neil Robertson, GM8EUG, also drew my attention to the W6SAI book, which describes the construction of the Cobra antenna; he also sent me a copy of the Cobra description. GM8EUG adds, "I have just been playing around with a similar design trying to get it to work on 15m. I was never able to get the SWR below 2:1; however (as you mentioned in your article) the choke seems to work as I could also touch the coax below the choke and the SWR did not change".

I find that I have a copy of *Simple Low-Cost Wire Antennas for Radio Amateurs,* and sure enough the Cobra antenna is described. I missed it because it was described as a 'Cobra' rather than a RFD.

Geoff Mackenzie-Kennedy, GM4ESD, says "Both the RFD-1 and RFD-2 antennas were the subjects of an article by James E Taylor, W2OZH, in *QST* August 1991. The article is also contained in ARRL's *More Wire Antenna Classics* - Volume 2. On 40m, one I tried as a vertical half-wave worked very well. One that I tried for 17m did not. Like yourself, I am not sure about the choke".

Bernard Spencer, G3SMW, has made Cobra antennas for 145MHz and for 14MHz. Also sometimes with traps to make them dual-band (eg 14/18MHz). He usually fixes it vertically on a fibre-glass telescopic mast, or sometimes horizontally from the house for HF.

CHOKE DESIGN

G3SMW has things to say about the chokes in this application. "You mentioned choke problems, and indeed there are, not only for Cobras, but also for practically all coax-fed vertical antennas, including ground-plane antennas, J-poles, and those with a quarter-wave bazooka balun like the original 'Coaxial Dipole'.

"There are two effects, both distinctly undesirable, and they are not known to all manufacturers or amateurs, as I know from work and play. The worst one is an upwards tilt of the lobe in the elevation plane which should, of course, be horizontal for VHF/UHF antennas. This often results in the signal being between 3dB and 6dB less than it should be, and the user may not realise this. To eliminate this effect generally requires two 'chokes' on the feeder, one at the top near the base of the antenna, and the other about a quarter of a wavelength below it. Even if the top choke is perfect, the first half-wavelength of coax below it will usually have sufficient current induced on its outside from the antenna to cause this upward tilt (it does not require much, as can be seen if modelled in *EZNEC* etc). So the best place for the second choke is in the middle of this top half-wavelength of feeder ie a quarter-wavelength below the top choke, but the position and inductance of this second choke are not critical and it does not need to be a trap.

"For the top 'choke', which determines the length of the bottom half of the radiator, what is required is a high inductive reactance compared to the impedance at the end of the dipole, not always an easy thing to fabricate! A better way in principle (and practice) is to use the feeder coiled as a trap with a shunt capacitor, and tuned to the centre frequency of the antenna. This does not require a great deal of inductance, and the impedance will be very high at its resonant frequency. It is more tricky to make and adjust than just winding the coax into a coil of arbitrary inductance, but is better for defining the length and for reducing currents on the feeder.

"The second problem is that current on the outside of the coax feeder can be the cause of an unacceptable mismatch in the feeder. This may occur when there is only one choke, giving a disappointing match to the rig that changes as you run your hand along the coax."

G3BDQ also referred to an article he had written in *Practical Wireless* (August 1995) called 'The Slim Cobra'. By chance I had a copy of this magazine and the article, which describes the experimental work done by G3BDQ and G4SLU. Details of the construction of the G3BDQ Cobra antenna are shown in **Fig 1**.

FIG 1 © RADCOM 455

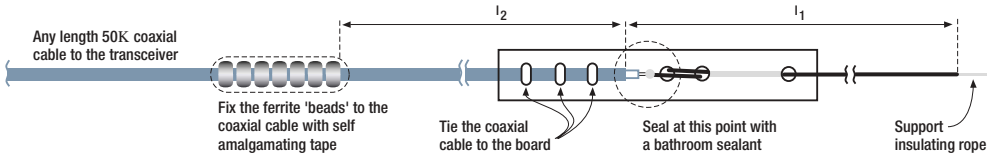

Fig 1 Details of the Slim Cobra antenna by G3BDQ from Practical Wireless. The dimensions of l1 and l2, respectively, are 29MHz – 2.46m (2.66m); 28.1MHz – 2.54m (2.74m); 21.1MHz – 3.38m (3.65m); 18.1MHz – 3.95m (4.26m); 14.1MHz – 5.07m (5.47m); 10.1MHz – 7.07m (7.64m); 7.05MHz – 10.14m (10.95m).

OTHER COBRAS

Be aware that there are other antenna designs under the banner of Cobra. One of these is a balanced HF centre-fed dipole that uses what appears to be a linear loading arrangement and can be found on [1]. The other describes research into the microwave Coaxial Beam-Rotating Antenna (COBRA) [2]. ◆

WEB SEARCH

[1] www.hamuniverse.com.cobraantenna.html
[2] www.vosssci.com/randd/cobra.html