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E-H antennas

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(Pictured: Hans Zimmerman, F/HB9AQS)

INSIDE

'Venus 80' and 'Venus 160'

Despite some initial scepticism, low-bands expert Don Field, G3XTT, concludes that these controversial antennas for the low bands really do work - at times very nearly as well as a full-size dipole.

When I was asked if I would review the E-H antennas for 160 and 80m from Arno Elettronica of Italy (the 'Venus 160' and 'Venus 80' models), I approached the matter with great interest, but also some trepidation. The theory behind the working of E-H antennas is controversial, to say the least, and has been the subject of some quite intense correspondence in 'Technical Topics' and elsewhere.

The 40 and 20m versions of these antennas were reviewed in *RadCom* by the late Bob Henly, G3IHR [1]. Since then, Martin Lynch & Sons have become the official UK importer, and the range of E-H antennas has been expanded to cover all the HF amateur bands. G3IHR was to review the LF versions but, sadly, passed away before the work was complete [in this article, the term 'LF' is used informally - as it frequently is by many amateurs - to mean the 160 and 80 metre bands, and not 136kHz, the only 'true' amateur LF band - *Ed*]. This is where I came in. I have no intention of entering the technical debate, as better qualified people than me have already crossed swords on the subject. However, as an LF enthusiast I was keen to see whether, for those without the space for a full-size LF antenna (which means the majority of UK amateurs, I suspect), the E-H antenna would be a suitable substitute. Both the 80 and 160m antennas are just 8ft in length, which is a far cry from the 67ft or so height required for an 80m quarter-wave vertical or 135ft length for an 80m dipole (and twice these dimensions for topband).

Below:
A 'display model' of the 80m E-H antenna at ML&S, with the outer plastic covering literally cut away to show the antenna elements.

THE E-H ANTENNA

For more background, take a look at [1] or the E-H Antenna website (see 'Web search' below). The website is run by Ted Hart, W5QJR, driving force behind these antennas. For a counter view, you may wish to consult the relevant page on W8JI's website. There is also a dedicated Internet forum where a great deal of relevant discussion takes place. In simple terms, imagine the antenna as two large copper plates along with various tuning components. To make the system more practical, the plates are rolled into the form of a tube, and the whole antenna encased in weatherproof plastic with, I'm pleased to say (because I've been caught out with this on other commercial antennas), a small drain hole to allow any condensation to drain away. The cut-away photo gives you some idea of what the internal construction is like, while other photos show one of the antennas in situ on my tower. Overall, the construction quality appears to be excellent.

Far left:
Although tiny in terms of wavelength, the 160m and 80m E-H antennas are still fairly substantial objects, as shown here by Bob, GU4YOX, at the UK importer, ML&S.

Left:
The 160m E-H antenna mounted on the author's tower at 35ft AGL. The 80m version is exactly the same size.

Installation is simplicity itself. The instructions are a rather quirky (in places) translation of the Italian, but perfectly clear. Each antenna comes with brackets to fix it to a mast of up to 1.5in diameter, and all you then need to do is to connect a coax feed line (there is an SO259 connector at the base of the antenna). It is recommended that the antenna is well in the clear, avoiding metallic guy wires and other metal objects if at all possible.

I should point out at this stage that each of the E-H antennas is single-band, so that, if you wanted to cover all nine bands from 160 to 10m, you would need nine antennas and nine, preferably widely-spaced, supports. In practice, many amateurs buy E-H antennas for the odd band(s) they cannot otherwise cover. For example, an amateur with a tribander may decide to put up an E-H antenna for 30m and perhaps one for 40 or 80m. Personally, I would have preferred the LF versions to come with brackets that would fix to a 2in mast, as most of my hardware is geared around that size, and the weight is non-trivial (4.9kg for the 80m version and 5.5kg for the 160m version). The manufacturers might also consider using green plastic rather than white so that the antenna merges better with its surroundings, but no doubt that's a matter of personal choice!

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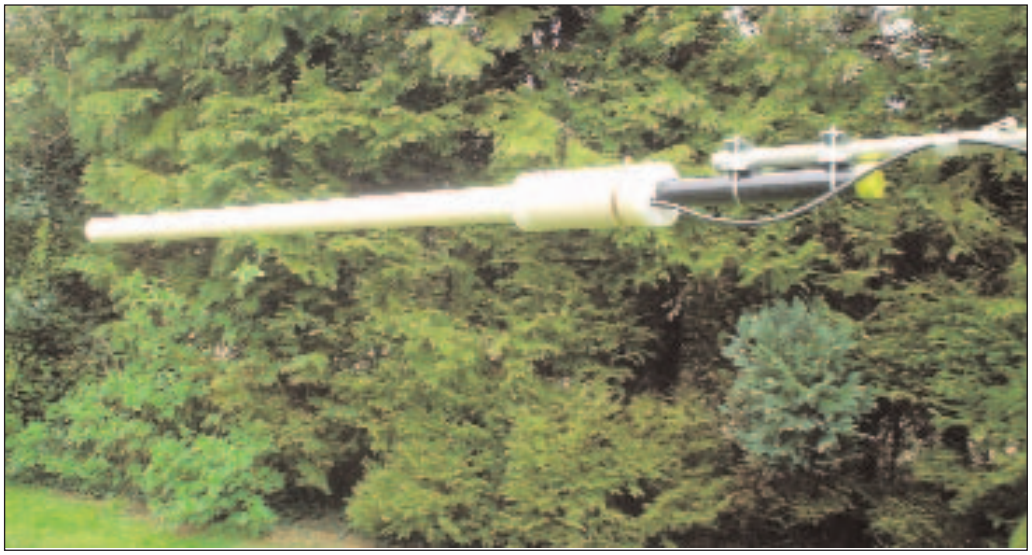
E-H antennas

Editor's note: This article is dedicated to the memory of Bob Henly, G3IHR, who was a keen experimenter with home-made E-H antennas and who reviewed the Arno 40m and 20m versions for *RadCom* in 2003. He had been using the Venus 80 and Venus 160 antennas but sadly died before he could write up the results of his tests.



The E-H antenna on the author's tower, luffed over to show mounting arrangements.

TESTING THE 80m ANTENNA

There is a single model for 80m, with a claimed 2:1 SWR bandwidth of 170kHz. An adjustable copper tuning sleeve around the antenna allows the tuning range to be adjusted to any part of the band. In my case I set the lower end of the 2:1 range at 3500kHz, and found the 2:1 bandwidth to be 180kHz, ie slightly better than specification. SWR at resonance was close to 1:1. Power rating of both the 160 and 80m antennas is 2kW on SSB and CW and 500 watts on continuous modes (RTTY, AM). This should be more than adequate for use in the UK, and I found that I could run 400 watts into the 80m antenna without difficulty. To my surprise, I was able to adjust the tuning sleeve with the tower luffed over, and the resonance didn't change measurably once the tower was vertical and the antenna raised to about 35ft. I felt that a clear location at 35ft or thereabouts would be fairly representative of those with limited garden space. If you could get an antenna much higher you could start seriously considering a full-size inverted-L or something similar.

The specification claims that performance is within 3dB of maximum over a 350kHz range which means, theoretically, that you could cover the whole 80m band by adjusting the resonance to the centre of the band and using an ATU, but personally I would be reluctant to do this as there are likely to be very high voltages present at the antenna away from resonance and damage may ensue (see 160m comments, below). Bear in mind that an ATU only improves the SWR as seen at the transceiver, but does nothing for the situation at the antenna itself.

I used the antenna on 80m CW, comparing its performance on both transmit and receive with my full-size 80m inverted-Vee dipole (centre at about 45ft). I was easily able to work around Europe, with good signal reports, putting some semi-rare DX into the log (ZB2FK in Gibraltar and ZA1AA in Albania, for example). Received reports suggested a one- to two-S unit difference between the E-H antenna and the dipole, and a more accurate test with a local amateur, using a calibrated attenuator, indicated that the E-H antenna was 6 - 8dB down on the dipole. I consider this a good result for an antenna that is so much smaller. My usual 'rule of thumb' is that performance starts to fall off rapidly once an antenna falls much below two-thirds of full-size, but the E-H antenna gave the lie to this. In comparison, I have been singularly unimpressed with small loop antennas that I have had the opportunity to try out in the past.

One of the claims for the E-H antenna is that it can often be better than a full-size antenna on receive, as noise pickup can be lower. I didn't notice this effect, one example being V51AS (Namibia) who I worked on my dipole with solid if weak copy of his signal, but who was barely audible on the E-H. But that was an extreme case. I was able to copy 9G5SP (Ghana) solidly on the E-H antenna, but didn't persevere with trying to work him as the pile-up was huge. It was unfortunate that I came to the review rather late in the LF season (for reasons explained in the introduction), when activity was well down, but nevertheless I felt able to get a good feel for how well the antennas performed.

My overall impression was that the 80m E-H antenna performed remarkably well for its modest size and, with time, a DX-oriented user could reasonably expect to work DXCC (100 countries) or better, particularly if a linear amplifier were used, as this plus the E-H antenna would be roughly equivalent to running 100 watts to a full-size antenna. Not a bad solution, where space is limited. Indeed, because the E-H is essentially a shortened vertical dipole, with vertical polarisation there would almost certainly be occasions where it would outperform a low dipole.

TESTING THE 160m ANTENNA

The 160m antenna is exactly the same size as the 80m E-H, and has a claimed 2:1 SWR bandwidth of 40kHz, and a 3dB bandwidth of 70kHz. Two versions are available, to

cover the 1830 - 1850kHz range (some adjustment of the centre frequency is possible) or the high end of the band (nominally 1913 - 1933kHz).

I used the 1830 - 1850kHz version, installed in exactly the same location as the 80m antenna had been, and extended my 80m dipole for 160m for comparison purposes. The resulting dipole had to be somewhat bent at the ends to fit in my garden, but this is probably a good comparison as that is the best that many users could manage on topband.

My initial measurements showed a 2:1 SWR bandwidth of just 20kHz (consistent with the 1830 - 1850kHz working range claimed in the brochure, though not with the claimed 40kHz 2:1 SWR bandwidth), with a best SWR of 1.6:1, somewhat higher than I would have expected. Some correspondence with the supplier suggested that it would be helpful to disconnect other feeders and ensure that there were no other antennas in close proximity, but I was unable to improve on this result.

But the question was, how would it perform? Initial results were extremely promising. Tests with my local amateur friend suggested that the E-H antenna was no more than about half an S-point down on the dipole. The two antennas were fairly close together (getting two topband antennas several wavelengths apart would require considerably more real estate than I have!) so there may have been a degree of mutual coupling. To overcome this, during the tests I removed the 160m dipole and replaced it with the 80m dipole and this had no discernable affect on the signal received from the 160m E-H. So as far as I could tell, any mutual coupling was insufficient to affect the overall conclusions.

The first few QSOs around the UK and Europe indicated that the E-H antenna worked well, with little or no observable difference between it and the dipole. I was also pleasantly surprised to notice (contrary to my experience with the 80m version) that received signals were much clearer due to less noise pick-up. Indeed, the first contact I made, with an OE7 station (Austria) would not have been possible on the dipole because he was inaudible under local noise.

Where I did have some difficulties was in experiencing some sort of flashover at higher power levels, despite my having taken care not to exceed 400 watts into the antenna. As previously stated, in the brochure it is rated at 2kW for CW and SSB operation (though even the manufacturer had recommended keeping output power below 500 watts, so the brochure figure appears overoptimistic).

In conclusion, as a receive antenna the E-H allowed me to hear stations that were inaudible on my main antenna. Used at the 100 watt level, it would appear to give results remarkably close to a compromise 'full size' antenna and therefore probably no more than an S-point or two down on even a pretty good 160m antenna. This is far better than I had anticipated when I first saw the antenna and realised just how compact it was. However, I would be somewhat concerned at the relatively narrow bandwidth of the antenna and would be reluctant to use one at much more than the 100 watt level, for fear of damage.

An alternative method of mounting the E-H antennas: directly on to a 1.5in dia pole.

CONCLUSIONS

Testing antennas can never be a truly objective process, unless one has access to a professional antenna range. The nearest I can come to this is by asking a local amateur, close enough not to be significantly affected by propagation effects etc, to undertake careful signal strength measurements. Beyond this it is a case of listening and making QSOs on the band, and trying to gauge how effective an antenna is, based in my case on some 37 years of LF operation. Unfortunately, during the period of the tests, lowband propagation and activity was disappointing, but I feel that I can make some reasonably informed comments.

I came away from the tests favourably impressed with the E-H antennas, whatever the pros and cons of the theoretical debates that have been raging. For those with limited real estate the LF bands present a formidable challenge and these antennas appear to offer a very workable solution, allowing contacts throughout Europe and even to more exotic DX when propagation allows. Word has obviously got around, too - while I was at Martin Lynch & Sons collecting the review antennas they took orders for five more E-H antennas and received two phone calls from satisfied users. No, I don't think they laid that on solely for my benefit!

Many existing users chose the E-H antennas because they are unobtrusive enough to get round practical or official restrictions on larger antennas, and it does appear that most customers are very happy with their purchases. However, I have some concerns about using the 160m antenna at higher power levels. The prices start to add up if you choose to run E-H antennas on several bands, but the use of one or two to complement your existing antenna system may well prove to be a worthwhile investment.

My thanks to Martin Lynch & Sons (tel: 0845 2300 599) for their loan of the review antennas, and to Arno Elettronica for technical support. The Venus 80 and Venus 160 each cost £179 from ML&S. ♦

REFERENCE

[1] 'The Arno Elettronica E-H Antennas', H R Henly, CEng FIEE MBCS, G3IHR, *RadCom*, September 2003, p21.

WEB SEARCH

E-H Website (Ted Hart, W5QJR)	**www.eh-antenna.com**
W8JI on E-H antennas	**www.w8ji.com/e-h_antenna.htm**
Internet E-H Forum	**http://groups.yahoo.com/group/eh-antenna/**