Antennas

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IN THE November 2002 'Antennas' column I described a method of plotting the polar diagram of an antenna using a computer. I said that all my early work was done using a BBC computer, and although the idea was not mine the original had been written by G4IJE and G3NOX [1].

I received a letter from Tom Lawless, GM6JOD, stating that he had written such a program for the BBC computer and that it had been published in 1984 [2], predating [1] by three or four years. Tom sent me a copy of this article, which includes a computer listing and an interface circuit for connecting the receiver S-meter signal to the BBC computer ADC input. The listing has only 60 lines of code; BBC BASIC was a nice tool for small computation programs in amateur radio.

MULTIBANDING THE MOXON RECTANGLE

SOME MONTHS AGO I asked if any of you had built a successful *multiband* Moxon rectangle or VK2ABQ beam. To those of you who replied, my thanks. It would appear those of you who built the design by G6XN were satisfied with the results. The photo shows the antenna built by Reg Gibbs, GM3SVE, who has built several similar antennas over the years, starting with the square VK2ABQ arrangement while the latest was the G6XN design. He reports a gain of approximately 4dBd and a front-to-back better than 25dB.

This antenna is for the 10, 15 and 20m bands. During assembly and test some interaction between the bands was evident and was overcome by adjusting the highest-frequency elements first.

A HYBRID TRIBAND MOXON-YAGI

W4RNL HAS AN excellent website about antennas (see WWW below) and the quotes below are from this source. He received a number of notes enquiring if parasitic elements might be added to a 20-metre Moxon (the close-spaced W4RNL design) to produce a triband beam. The addition of a 10 metre director and a 15 metre reflector yields some forward gain, but there are large excursions of feedpoint impedance, precluding the direct connection of coax.

He goes on to say "These initial steps into developing a tri-band antenna around a 20 metre Moxon tend to stop short of something truly satisfactory. What is required for easy use is a system that permits a 50Ω feed for each band. The result will be more elements, but not a major increase in the footprint over and above the initial addition of a reflector and director.

"To develop a beam of this order, one might well adapt some of the principles underlying the Force 12 C3. This popular antenna uses a 2-element 20 metre driver-reflector Yagi at its core. It also places a 15 metre driver-reflector combination behind the 20 metre driver. The two drivers are close enough to permit open-sleeve coupling. Ahead of the 20 metre driver are three 10 metre elements - a driver (also open-sleeve coupled to the 20 metre driver) and two directors. The furthest director provides the essential pattern shaping function, while the closely-spaced first director functions much like the added director on the NW3Z/WA3FET OWA designs: it helps form a wider band feedpoint impedance than a single director could provide. Performance remains essentially the same as a two-element driver-director Yagi, but over a larger portion of the band.

"It is possible to replace the 20 metre elements with a Moxon rectangle and obtain triband performance on a 16ft boom. **Fig 1** shows the general outline. For this exercise, the 20 metre elements were set at 1in diameter, the 15 metre elements at 0.75in diameter, and the 10 metre elements at 0.5in diameter. Since the design uses open-sleeve coupling, a single feedpoint suffices for all bands.

"The antenna was designed using *MININEC* (AO 6.5), since the close spacing of the drivers produces excess gain estimates in NEC-2. The error is an especially large overestimation of gain on 10 metres. Hence, *MININEC* is the core

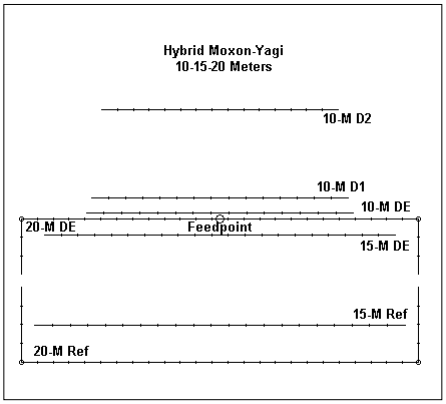

Fig 1: *MININEC* (AO 6.5) model of the W4RNL hybrid tri-band Moxon-Yagi.

The three-band G6XN antenna by GM3SVE. The top mast section is aluminium scaffolding pole fixed to the top of a 40ft Tennamast via a rotator. The fibreglass rods are fixed to the mast using 2in aluminium angle.

of choice for this exercise. On 20 metres, the Moxon rectangle performs normally, with a typical Moxon rectangle pattern. On 15 metres the pattern is that of a two element driver-reflector while on 10m again it is a typical two-element Yagi pattern, with a slightly better front-to-back ratio due to the use of directors.

"Undoubtedly, one can improve on this hybrid design. Indeed, the requirement for adjusting element lengths and spacings to account for element diameter taper schedules would enforce an exploration of possible improvements. As with all models of open-sleeve coupling, considerable adjustment may be needed in the slaved drivers to achieve the correct impedance and bandwidth. Moreover, although home construction of single antennas for personal use requires no special attention to any legalities, any other use of the non-Moxon-rectangle techniques noted in the design should involve consultation with Force 12 to ensure compliance with any proprietary or patent rights held by that company".

So I was interested to see a description in W8FX's column in *CQ* magazine [3] on what appears to be a commercial application of the computer designed multiband antenna described by W4RNL above. The antenna is manufactured by a German company called Optibeam and antenna model is the OB6-3M. A full description and photo of the antenna can be found on their website. It appears to have a shorter boom length that the design by W4RNL.

REFERENCES

[1] 'VHF/UHF' column, Ken Willis, G8VR, *RadCom* Jan 1987.
[2] 'Polar Plotting', by B P Hainey and Tom Lawless, *Computing in Radio,* autumn 1984.
[3] 'What's New', Karl T Thurber, W8FX, *CQ Amateur Radio*, October 2002. ♦

WWW.
W4RNL antennas: www.cebik.com/radio.html
Optibeam: www.msl-net.de/optibeam