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The InnovAntennas 4LFA-R4

PW Editor Don Field G3XTT reviews a novel 4m antenna from InnovAntennas and gets to use it in the PW 70MHz Contest.

When Justin Johnson G0KSC, proprietor of InnovAntennas offered *PW* one of his new LFA-R antennas for review, I jumped at the chance. This was not only because the 4m band is proving increasingly popular as new countries gain access and more rigs offer the facility but also because InnovAntennas are using the novel LFA-R design for a number of antennas covering the HF bands as well as VHF.

The LFA-R Concept

Historically, most Yagi antennas start with a dipole. Gain is increased by adding a reflector as the first passive element and then one or more directors. There are exceptions, usually where the antenna is a two-element HF Yagi with a very short boom (in terms of wavelength), some reduced-size 40m Yagis having just a driven element and director with no reflector.

InnovAntennas, therefore, appear to be moving in the face of practice and experience by developing multi-element Yagi antennas with no reflector. Intuitively, such an approach would appear to offer poor front-to-back ratio although there is no reason why gain should be any different to other Yagis of similar boom length.

In practice, InnovAntennas appear to have succeeded in overcoming the problem of achieving satisfactory front-to-back ratio. The modelled figures for the 4LFA-R4 (4 elements on 4m) reviewed here show a gain of 7.47dBd (dB relative to a dipole) with a front-to-back ratio of 19.68dB. The three EZNEC plots, **Figs. 1, 2** and **3** show, respectively, the azimuth free space plot (the pattern looking down on the antenna from above), the elevation free space plot (what the pattern would be from the side if the antenna was in free space) and the elevation plot modelled at a height of 6m above average ground. It is interesting to note that the gain of the main lobe in Fig. 3 is greater than that of Fig. 2 as a result of ground gain, that is to say, radiation reflected from the ground adding to same-phase signals radiated direct from the antenna.

The performance of the LFA-R design is achieved by choosing dimensions such as to ensure the correct phase relationships between the various elements. By using a loop for the driven element, similar in design to InnovAntennas other LFA Yagis, the feedpoint impedance is transformed from 12.5Ω to 50Ω so that no matching transformer is required at the feedpoint. It is worth noting that no InnovAntennas products use a matching transformer. Justin G0KSC argues that a properly designed antenna shouldn't need one and if there is nothing to get hot through inefficiencies, there should be no limit to the power the antenna can handle. Justin also makes the case that a loop is inherently narrow band with very high impedance being offered not too far either side of the design frequency. Adding the grounding of the loop opposite the feed point (a point of zero current at the design frequency) compounds this effect. Operationally, this means that the antenna has bandpass filter properties too, by reduction of both received and transmitted out of band signals.

Fig. 1: The azimuth free space plot of the review antenna, modelled in EZNEC.

Fig. 2: The elevation free space plot of the antenna.

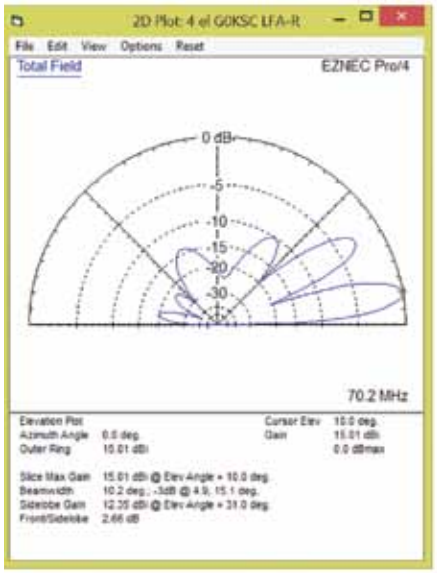

Fig. 3: The elevation plot modelled with the antenna at 6m above average ground – quite different to the free space plot of Fig. 2.

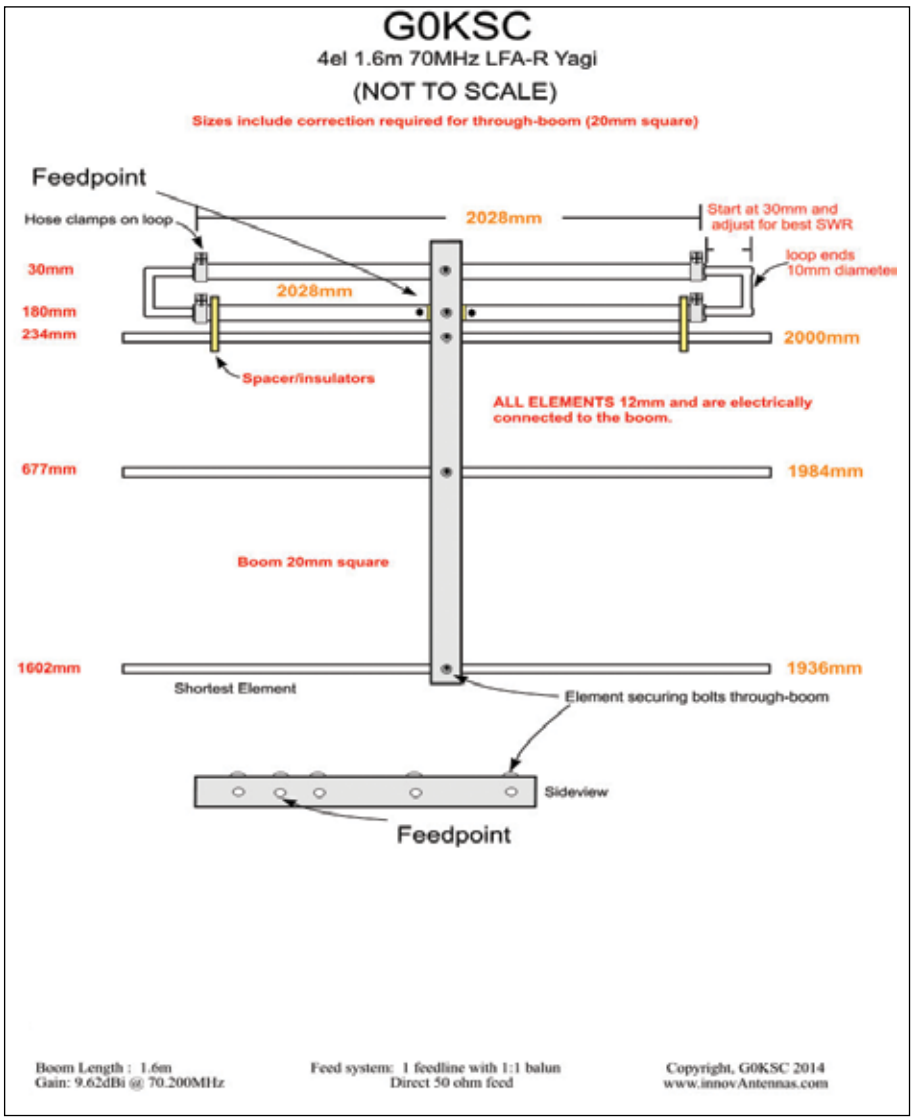

Fig. 4: The antenna construction and measurements.

Fig. 5: The assembled antenna, modelled by young Caitlin.

Reviewing an Antenna

Reviewing antennas is never easy. To test antenna gain in a meaningful way requires a professional antenna test range. What we can do for a magazine such as *PW* is to look at how well the antenna is constructed, how easy it is to put together, value for money compared with similar products from other vendors and whether it is fit for purpose (which could be home or portable use, for example, where the requirements may differ).

The Review Antenna

The review antenna arrived in a substantial cardboard tube and a quick check showed that everything was there (yes, I have had antennas arrive with parts missing before although not from InnovAntennas, I hasten to add). There was a basic instruction leaflet, **Fig. 4**, that proved to be more than adequate because the antenna is very straightforward to assemble. In practice, it took less than an hour with help (or, perhaps, despite help) from my four-year-old granddaughter. In **Fig. 5** she is holding the finished antenna, which gives an idea of its size.

Unlike many products from InnovAntennas, where the elements are insulated from the boom, this is a lightweight design with the elements mounted through the boom. A further advantage of through-boom elements is DC or static discharge capabilities. The whole method of construction makes the antenna very suitable for portable operation, which, indeed, is what I had in mind. All the hardware (screws, fixings) other than the U-bolt and saddle is of marine grade (A4) stainless steel, which doesn't degrade in saltwater environments.

Initial Tests

The driven element is a symmetrical loop so should, strictly, be fed from a balanced line. A coaxial cable is inherently unbalanced and therefore requires some sort of unbalanced-to-balanced transformer at the feedpoint of the antenna or, more simply, a coaxial choke. I opted for the latter, **Fig. 6**, consisting of several turns of cable close to the feedpoint. This serves to minimise any braid currents, which could affect the antenna's directionality and general performance.

I erected the antenna in the garden on a 6m aluminium scaffold pole so that I could easily make measurements. The SWR curve was very flat with a resonance at 70.18MHz at an indicated SWR of less than 1.2:1, **Fig. 7**. I didn't, therefore, make any attempt to adjust the dimensions because this seemed wholly satisfactory. The RSGB 70MHz Trophy contest was the following day and this was an early opportunity to test the antenna. I made a number of QSOs but spent more time listening, mainly to get a feel for the

antenna's directionality and front-to-back ratio. The latter didn't initially seem to be as good as I had hoped but, as you'll read below, that probably had more to do with the arrival angles of the close-in stations and the difficulty of assessing antenna performance without a proper test range.

PW 70MHz Contest

The following weekend, I was determined to head out to a suitable hilltop for the *PW* 70MHz Contest, the results of which appeared in last month's issue. This proved to be a much better test of the antenna because I had a clear take-off in all directions and was hearing and working stations at much greater distances than from a low antenna in my back garden surrounded by trees, **Fig. 8**.

From this portable location the antenna's front-to-back ratio was much more in evidence. I won't make any claims as to what the figure might be because I have no idea what the S meter calibration might be on the FT-847 I was using. Suffice to say, for example, that one of my early QSOs was with ON7EQ/P who was a big signal on the front of the antenna and barely audible off the back.

Other LFA-R Antennas

As I said earlier, InnovAntennas now have several antennas based on this LFA-R design. Although I was testing one for 4m and, indeed, plan to make it my main 4m antenna for the 2015 season, the design perhaps comes into its own on the HF bands where it offers great performance on a relatively short boom. At the time of writing, InnovAntennas have LFA-R designs available for the 40, 30, 17 and 12m bands, some of them being dual-band designs. The antenna shown in **Fig. 9** is a two-element 40m LFA-R being installed at SM7SJR in Sweden. This is a full-sized 40m Yagi and is designed to stay up when covered in snow. The antenna elements start with 64mm (2.5in) diameter tubing (3.2mm wall) and taper to 9.5mm (3/8in) diameter (1.6mm wall).

Conclusions

The LFA-R concept is a novel one and appears to lend itself to some interesting single- and multi-band antenna designs. The construction and performance of the 4m antenna that I reviewed was excellent and it would be a great antenna for either portable or home station use. The list price of that particular model is £79.95. InnovAntennas have a very wide selection of antennas for all bands. There is lots of further data on their website although not all models (the review antenna included) appear there at the time of writing. My thanks to Justin G0KSC at InnovAntennas for the loan of the review model and help in answering my questions.

www.innovantennas.com

Fig. 6: A coaxial choke at the feedpoint.

Fig. 7: Resonance, SWR and feedpoint resistance as measured on an MFJ-259

Fig. 8: Out portable in the PW 70MHz Contest.

Fig. 9: A two-element LFA-R antenna being installed at SM7SJR.