

# Review: The Aaronia BicoLOG 30100X and HyperLOG 7060 EMI antennas

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The majority of my work includes troubleshooting and pre-compliance testing for clients and I'm always on the lookout for useful EMI equipment to make my job easier. I've known of the various antennas by Aaronia AG, a company based in the small country town of Strickscheid, Germany, but until recently, have never had a chance to try any out. Manuel Pinten, sales manager at Aaronia, offered to let me borrow a BicoLOG 30100X (30 to 1000 MHz active antenna with attached 40 dB preamp) and a HyperLOG 7060 (700 MHz to 6 GHz log-periodic) for the purposes of this review. The antennas arrived in a nice quality custom padded transport case (Figure 1), along with extra coaxial cables, battery charger for the preamplifier, two tripods, a very nice pistol-grip tripod head, some extra tripod antenna spacers, and the calibration data for the two antennas on CD-ROM (Figure 2).



Figure 1 - The antenna kit as received includes the 30100X BicoLOG and HyperLOG 7060 antennas with all the accessories. The HyperLOG 7060 and larger tripod were optional extras, apart from the main kit for the BicoLOG antenna.



Figure 2 - The contents of the kit as received. The larger tripod and HyperLOG antenna were extras included for evaluation.

### Basic Descriptions

The **BicoLOG 30100X** was my primary interest, as it could be used for most of my troubleshooting and pre-compliance testing in the 30 to 1000 MHz range. It is a shortened biconical dipole with elements of painted metal. Attached to the "X" model is a small 40 dB gain broadband preamplifier good from 30 to 1000 MHz (but with useable gain to 6 GHz; see Figure 11). The antenna has a standard 1/4-inch camera tripod mount. The preamplifier is mounted piggyback at the rear of the antenna. Both antenna and preamplifier were of the typical German high quality construction.



Figure 3 - The BicoLOG 30100X 30 to 1000 MHz biconical dipole active antenna with attached 40 dB gain preamplifier. The antenna connector is SMA.



Figure 4 - The 30100X antenna mounted to the larger aluminum tripod, which may be extended to just over 1m in height. While perfect for these two antennas, the light weight design does not lend itself to larger EMI antennas.

Aeronia supplied measured data for gain and antenna factor (Figures 5 and 6) for the BicoLOG 30100X and it's interesting to note that, because of the high gain preamplifier, the antenna factors are all negative. This requires they be subtracted from the calculation of E-field, rather than added. In actual use, the output from this active antenna is high enough, you won't likely require additional preamplification in your spectrum analyzer or EMI receiver. Aeronia also wished to make clear that these gain and antenna factor curves are not "smoothed", as many other manufacturers present the data.

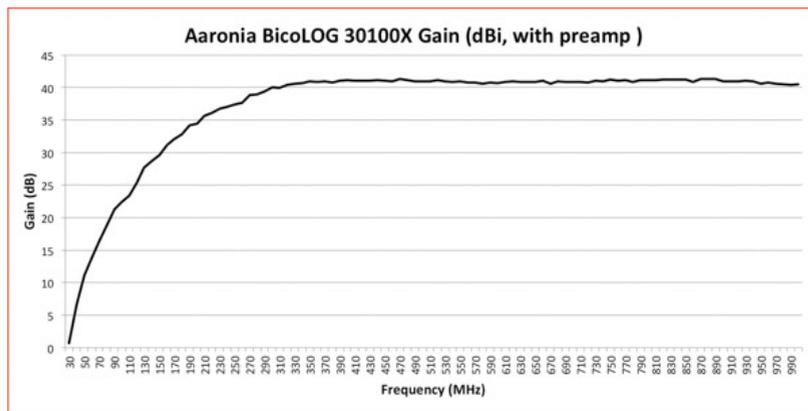


Figure 5 - The measured gain (dBi) of the BicoLOG 30100X antenna (data courtesy, Aeronia AG).

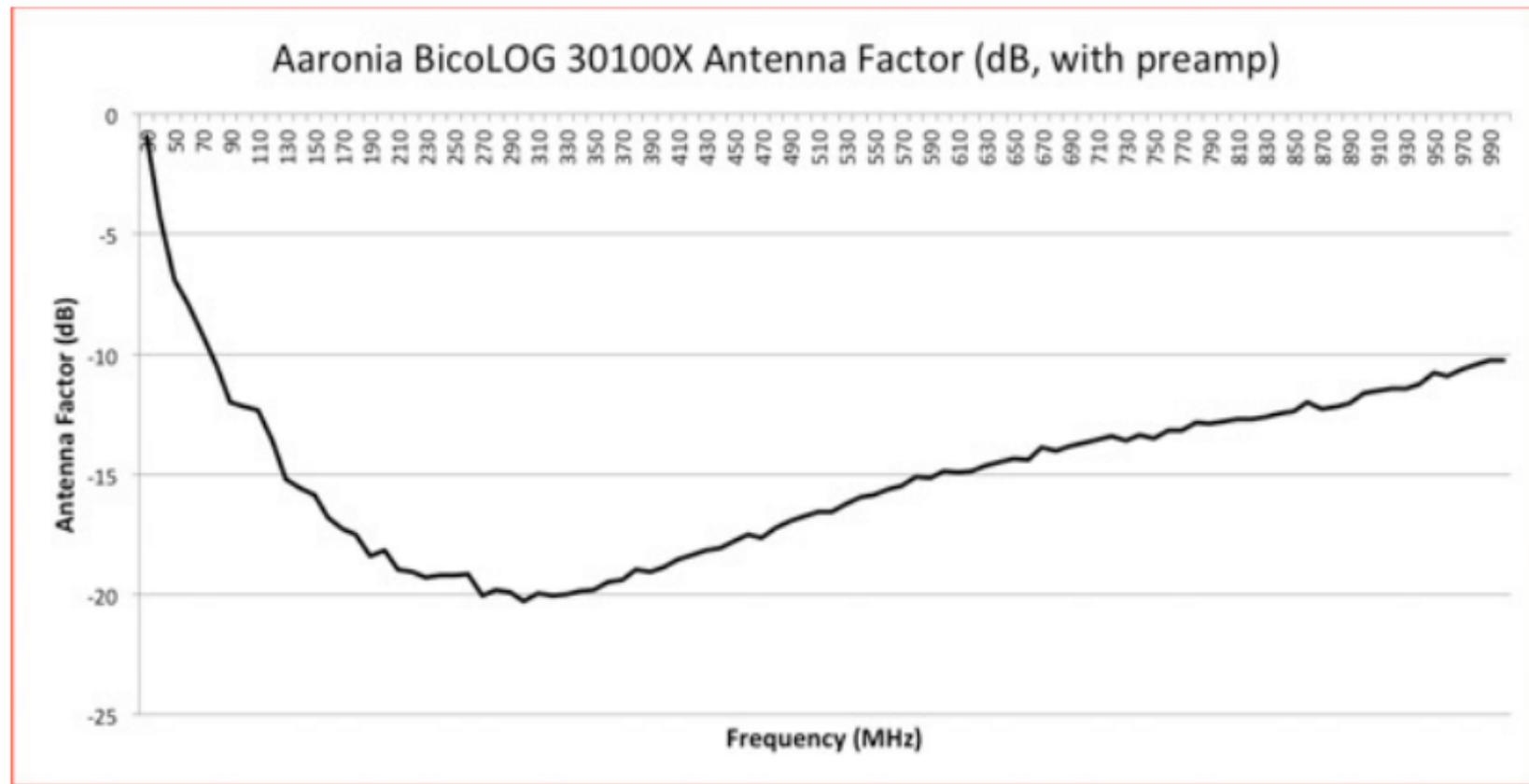


Figure 6 - The measured antenna factors for the BicoLOG 30100X antenna (data courtesy, Aronia AG).

The **HyperLOG 7060** (Figure 7) is a cute package housing a PC board-based gold plated log-periodic antenna etched onto a high frequency dielectric substrate. The antenna connection is an SMA connector and uses a standard 1/4-inch camera mount at the bottom. This model did not come as the “X” model with built-on preamplifier, but this may be ordered and mounted to the protruding tabs at the rear. The HyperLOG 7060 would be the ideal antenna for pre-compliance testing and troubleshooting of signals between 700 MHz and 6 GHz. The gain is approximately 5 dBi across the band. Being physically flat, the antenna should be easy to pack. The small table top tripod may be also used as a handle (Figure 8).



*Figure 7 - The HyperLOG 7060 antenna mounted to the small plastic table top tripod. The two long tabs on the back are designed to mount an external broadband preamplifier in the “X” model of the antenna.*



Figure 8 - The small table top tripod may be folded up to form a handle to ease “sniffing” of GHz emissions.

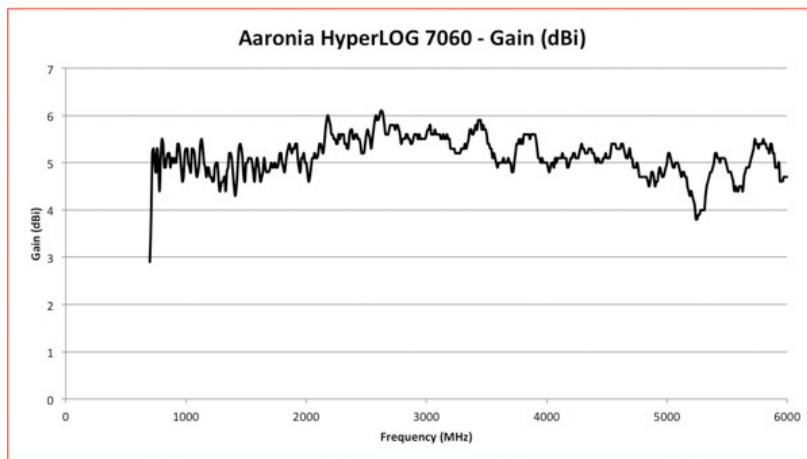


Figure 9 - The measured gain (dBi) of the HyperLOG 7060 antenna (data courtesy, Aaronia AG). The ragged look of the gain is pretty typical of log-periodic antennas as the resonant point moves back and forth along the elements.

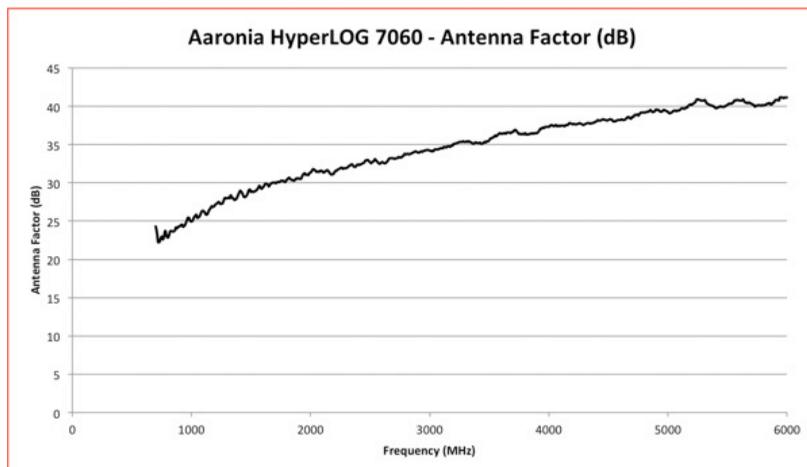


Figure 10 - The measured antenna factors for the HyperLOG 7060 antenna (data courtesy, Aaronia AG).

The broadband preamplifier, model UBBV, was packaged in a small aluminum housing and includes a built-in lithium-polymer (Li-Po) chargeable battery. A small “push on/push off” power button activates the preamplifier. A small red LED indicates power is on. The gain is relatively flat out to about 1.5 GHz, but then rolls off gradually to just above 30 dB (Figure 11). Interestingly, the

preamplifier also has the means to pre-load calibration factors via a USB port on the side. The instructions for loading these factors is supplied on the CD-ROM. The RF output from the preamplifier can exceed +15 dBm, so care must be taken to avoid overdriving the spectrum analyzer input. Note that Aaronia also has a 25 dB gain preamplifier, if the extra 40 dB gain is not required.

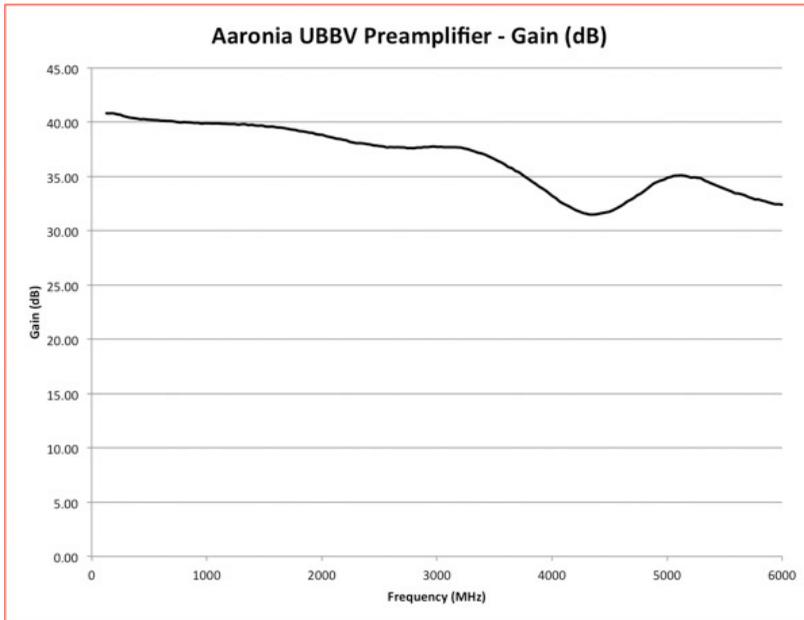


Figure 11 - The UBBV broadband preamplifier gain from 130 MHz to 6 GHz. Note that for the usual application of 30 to 1000 MHz for the BicoLOG 301000X, the gain is quite flat at about 40 dB. It still has plenty of gain out to 6 GHz (data courtesy, Aaronia AG).

### Typical Use

When troubleshooting an EMI issue, I'll set up both the analyzer, antenna, and equipment under test (EUT) on a six to eight foot long workbench, with the EUT at one end and the antenna 1m away near the other end (Figure 12). By positioning the antenna a short distance away, you'll be able to detect the actual emissions from the EUT. For more information on this technique, please refer to my article in the references below, or in the book, EMI Troubleshooting Cookbook for Product Designers. This troubleshooting technique is powerful, in that you can see immediate results as you manipulate cables or apply various fixes.

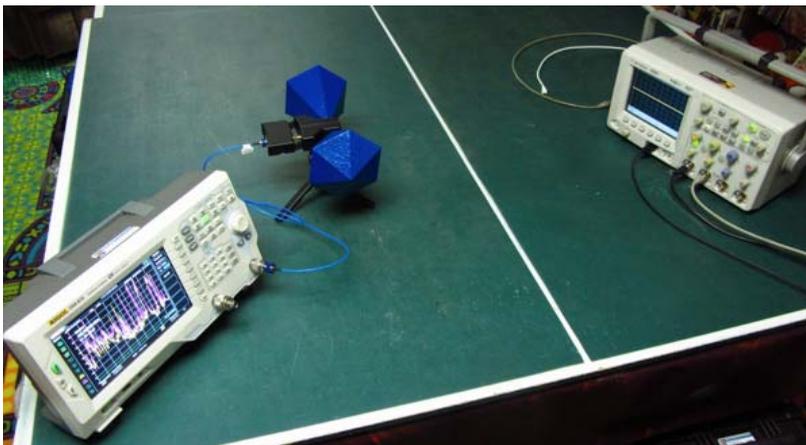


Figure 12 - This is the typical test setup I use when troubleshooting, except the antenna to unit under test should be closer to 1m. The EUT is on the right with several I/O cables attached. Note the relatively high signal amplitudes, due in part to the preamp gain and 5 dB per division on the analyzer.

Although, much of my troubleshooting work is performed in conference rooms or office cubicles,

it's best to perform this in a shielded work area to eliminate all the ambient RF signals. When working outside a chamber, I try to capture and save an ambient sweep with the EUT "off"; then compare with a second sweep in order to compare the differences (Figure 13). Once the major harmonic emissions are identified, then troubleshooting can commence.

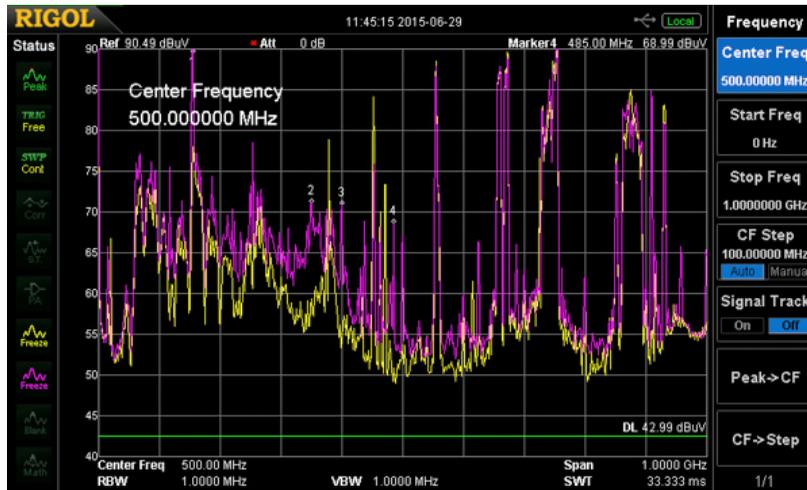


Figure 13 - Screen capture of the test setup above. When testing outside a shielded room, it's wise to capture in "max hold" and store a reference on trace 1 with the EUT off. Then using trace 2, turn the EUT on and recapture the signals, noting which new ones pop up. I've identified a few of these with markers.

## Summary

Both these models are high-quality and relatively low cost EMI antennas useful for troubleshooting or pre-compliance testing. I suspect both could also be used for compliance testing, if the antenna factors were verified by a NIST-traceable test lab. Both appeared to be built ruggedly enough for daily use. The performance of the antennas was outstanding and I really appreciate the ability to troubleshoot EMI with such a small antenna. If anything, the preamp gain might be a little too high - I suspect 20 a gain dB would be perfect and fortunately, Aaronia does sell a 25 dB gain model that may be swapped for the same total price. Also, I've not tested this setup in a high RF environment. It's possible for sensitive preamplifiers to saturate and create their own harmonic products, adding "phantom" harmonic signals. Fortunately, it's possible to remove the preamplifier, if required. As I get more experience with real-life consulting examples, I'll see if these issues are really true.

I loved the fact the supplied connecting coax cables had the plastic knurled knob pressed around the male SMA connectors. This makes it easy to attach and detach the connector, without the necessity of a wrench.

The two tripod models are obviously designed for photography, but work well to mount the antennas. Vertical polarity would not be feasible with the smaller table top tripod, due to the short height. They both collapse down nicely. To get the BicoLOG in the vertical position with the larger tripod required the use of several of the antenna spacers to get it away from the tripod legs. This would not be an issue with the larger grip-style tripod head, however, the weight of the grip head tends to make this tripod a little top-heavy, and with the legs only able to spread out so far, care must be taken to avoid knocking the whole thing over.

I did have a very minor issue with a spring-loaded pin that sticks up above the surface of the flat tripod mount on both tripods. When using the antenna spacers this pin sticks up into the spacer, and because of strengthening fins on the inside, requires some "fiddling" to orient the antennas into a vertical position, yet still keep the spacers screwed down tightly to the tripod head. If it was me, I'd take pliers and remove these small plastic pins. The larger tripod grip-style head does not have this issue.

The BicoLOG 30100X (with preamplifier) and the HyperLOG 7060 and all accessories are relatively low cost. Aaronia has a whole line of HyperLOG and BicoLOG antennas in various frequency ranges.

Bravo, Aaronia, for creating a well-designed set of EMI antennas! Highly recommended.