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The AMRAD Active Antenna

In QST of September 2001, an active whip antenna construction project was described that was optimized for use at low frequencies but was supposed to be usable to above 26 MHz. Its design was claimed to minimize strong signal overload as well as minimize sensitivity to local electrical noise. Although there is no ready-made version of this antenna, circuit boards are available from Far Circuits (http://www.farcircuits.net/) to simplify construction.

I have built a couple of these units, and have been able to compare them with a short sloper antenna and a 1 meter square unamplified box loop antenna at home, as well as with Beverage antennas. In addition, I used one on board a ship in the open Pacific. A Drake R8 was used in all tests. So, how does this antenna work?

There is no argument that this, like most other active antennas, can put signal into the receiver. One of mine, using a 1.25 m whip was placed at the peak of our house, 9 meters above ground, and at least 20 meters away from some trees which were taller. In this configuration, it easily delivered at least 15dB more signal than my 1 meter square tuned loop antenna, or than a 12m long sloper (which was 4m above ground at its high end and used an isolated matching transformer at the ground end). However, there was electrical noise all over the longwave beacon band, and a generally high level of splatter on medium wave, even on relatively open channels, which seemed to indicate overload from my two nearby 10 kw locals.

The first problem was mostly solved by attaching the shield of the coaxial cable from the antenna to a ground rod where it entered the receiver interface unit, although AC ground worked nearly as well. This simple fix pleased me until I discovered that powering the antenna with a couple of small 12 volt batteries rather than the power supply minimized electrical noise heard even without the local grounding. Other external power supplies seemed no more susceptible to local noise than was the recommended supply.

After reducing the size of the whip to 30 cm to minimize overload, the AMRAD active antenna was now roughly comparable in sensitivity on medium wave to the 12m sloper, and the antenna seemed to produce less undefined splatter on MW than with the 1.25m whip. But, if there was an advantage in readability, it was with the sloper which occasionally showed a little less local noise, and which did not show a couple of second-order spurious signals from my locals which the active did. On longwave, the active antenna delivered up to 4 S units greater strength than the sloper, but even then, there was one instance of a beacon being slightly more readable in the local noise level using the sloper despite its lower output signal. On the tropical bands, the AMRAD again delivered stronger, but noisier signal levels than the sloper.

I also compared this antenna with two 250 m Beverage antennas on the Washington coast, and found that it didn't appear to be a substitute for the ultimate MW antenna. The active, using a 1.25m whip, was placed about 2.5m above the ground, higher than any nearby buildings or shrubbery. It was consistently more responsive to local electrical noise, even when grounded both at the antenna and at the receiver interface, and was unable to hear most of the trans-Pacific DX which was being heard on the Beverage antennas. As conditions were not very good, it's likely that the directivity of the Beverages was making the difference, as the active was much better at receiving domestics that the Beverages were partially rejecting.

A final, and rather tortuous, test on board a ship offshore revealed that the antenna using a 1.25m whip was not nearly as sensitive as an 8 meter vertical with matching transformer previously used on the same ship. It was also overloaded by ship's transmissions that the vertical had not been. However, it rejected most of the shipboard electrical noise by grounding the coaxial cable shield to the ship at both the antenna and at the receiver interface. But the sensitivity was so poor for that weak signal location that little DX was heard with it.

These tests should not be seen as a universally applicable evaluation of this antenna; a more careful placement of it might have meant lower electrical noise levels. However, the only solution to overloading from strong local signals is to reduce the whip antenna length, which reduces desired signal strength as well.

Overall, I'm not sure the AMRAD active antenna was worth the effort. My limited experience with active antennas indicates that its isolation of receiver ground from antenna ground makes it somewhat easier to judiciously use earth grounds to attenuate local electrical noise, normally a problem with such antennas. I'm not sure the recommended power supply circuit is as much help as advertised in the battle against local electrical noise, as even cheap wall mount supplies seemed to be no more susceptible to noise. As far as MW signal handling and sensitivity goes, I think I would prefer to use it in the open and high up in a rural area, rather than in the city, and even then, only if there were not other antenna alternatives available.

The Wellbrook ALA 100 Large Aperture Active Loop Antenna

This wideband (50kHz-30MHz) active antenna from the British company, Wellbrook Communications, is composed of a solid little amplifier head in a small plastic box and a slightly larger interface unit that sits next to the receiver and is powered by a regulated 12V wall mount transformer. The user supplies the BNC to BNC coaxial cable (up to 100 meters long) connecting the two boxes, and 8 to 18 meters of wire which can be formed into a single turn loop. Each end of this wire is connected to the input binding posts of the amplifier head. Further details can be seen at http://www.wellbrook.uk.com/ALA100.html

I hooked up the ALA 100 to a 4m x 4m single turn loop and was impressed with the signal levels which were delivered to my Drake R8 on long and medium waves, as well as on tropical bands. The gain compared with the loop with its matching transformer only was on the order of 18 dB. I soon found that the Drake was being overloaded, however, so needed to switch in its front end attenuator to avoid spurious signals on otherwise quiet daytime medium wave channels.

I have only two local MW radio stations, but both are 10 kw full-time, and both are within 5 kilometers of my listening location, with part of the path being salt water. This is a fairly tough RF environment, though there are worse urban sites with more stations. The unamplified loop delivered –19 dBm and –26 dBm from these two stations, on 900 and 1070 kHz respectively. Using the ALA 100, I started to look for intermodulation products, and unfortunately found a few. These were predictable, a second order products at 170kHz and 1970kHz, third order ones on 730 and 1240 kHz. The hunt for them was complicated by the fact that the R8 without front-end attenuation would show some of these products itself, if driven by the output of the ALA 100, or by a random wire. But I was able to establish that a third order product on 730 kHz was due to the ALA 100 by using it to drive my homebrew receiver that has several tuned circuits at its front end. The homebrew had shown no sign of overload on 730 kHz from random wires that deliver a similar signal level to the output of the ALA 100 using the 4m x 4m loop. Yet there was a definite mix of my locals on 730 using the ALA 100. This is not to disparage the ALA100; it was working within its specifications, and no commercially available broadband amplifier would be able to handle my RF environment any more comfortably. And if my listening location had been 10 rather than 5 km away from the transmitters, third order intermodulation products would likely have been 6 S units lower, and in the noise.

Although I haven't tested this extensively, I found that placing a series LC circuit between the ALA100 amplifier's input leads from the 4m x 4m loop and tuning it to my strongest local meant that the distortion products dropped by at least 15 dB, without attenuating desired signals. I also tried using a 1.7m x 2m loop instead, and the third order products disappeared pretty much completely, though there were still second order products heard on 170 kHz. One must note that there were weaker second order products audible even with a random wire, so part or all of the fault may be in the R8 rather than the ALA 100 in this case.

But, a 5m high vertical wire with capacity hat and isolated matching transformer, as well as my 1m square indoor tuned loop, put out similar signal levels as the 1.7m x 2m loop / ALA 100 combination did, so why would I go to the expense of using the ALA 100? In my situation, the ALA 100 might have an advantage in its directionality over the random wire (1.7m x 2m is small enough to think of remotely rotating), and in the fact that it picked up less local electrical noise than either of the other antennas, but, it's not a stunning improvement over the other antennas.

However, if the tuned loop had been unusable due to an electrically noisy indoor environment and I did not have the space for a random wire, I would need some sort of active antenna. The only other easily available choice in such a circumstance is an active whip or active dipole antenna. I have an AMRAD active antenna (reviewed above) that is said to be one of the better active whips for signal handling and for rejection of local electrical noise. I had needed to limit its whip to 30 cm at this location to avoid strong signal overload, rather as I had to reduce the size of the loop used with the ALA 100. The signal strength seen at the radio is quite similar with these two antennas, but the second order responses are stronger on the AMRAD active whip. Reducing response to local electrical noise was a bit of a chore with this active whip, while there were no problems with excessive electrical noise in any manifestation of the active loops. The active whip is placed at the peak of the roof, about 9m above ground, and as much in the clear as I can get it, while the active loop is mounted around the outer wall of a garden shed, so that the bottom of it is mere centimeters above the ground. There is no argument as to which antenna was easiest to mount in place, and there is no argument as to which antenna generally provides less response to local electrical noise from 200kHz to 20MHz. Because noise response of an active whip antenna is heavily determined by its location, others may get different results in comparing the two types of antenna, but I have tried these antennas in several locations around the back yard; the loop is definitely less sensitive to its location. Based on my experiences, I would definitely recommend the ALA 100 if one needed an active antenna.

One advantage of the active whip for the traveller is that it is very portable, and might be used as a "stealth" antenna. A loop 2m x 2m or larger is rather harder to hide outdoors, but it folds up easily, and the fact that it can be draped around something non-metallic near the ground is a point in its favour, as is its rejection of local electrical noise. I'm looking forward to trying the ALA 100 with larger loops at coastal locations. Finally, I did try the ALA 100 with a one meter diameter loop of wire, and the signal strengths were weaker by 10 to 15 dB, but a little post amplification at the receiver might work to create a portable DX arrangement. Of course, one could investigate Wellbrook's smaller, but higher gain, ALA 1530 active loop under this set of circumstances.

(the above reviews are from the upcoming fourth edition of IRCA's A DXer's Technical Guide)

**** Mark Connelly has recently written an article "Medium Frequency Amplifiers Compared" which analyzes various active antenna preamplifiers, most of which can be homebrewed. The article can be found at http://www.qsl.net/wa1ion/amp/amptests.pdf for .pdf format or http://www.qsl.net/wa1ion/amp/amptests_doc.zip for .doc format.