

Receive Antenna Fall Cleanup... and a New Antenna !

October, 2017. (Halloween) Jeff VE1ZAC Rev:typos, pics 6

It's been a few years since I have tried any new receive antennas, and it was time to cleanup the yard. I did an inventory of current receive antennas . I had the Lankford inspired mini DADFA (flag array), a pair of active whips to a phaser, and an active magnetic loop on a rotator. I had also been eyeing the Shared Apex Loop from Array Solutions. It was time to do house (yard) cleaning and during the antenna assessment I decided it was time to retire the active whips and the mini DADFA plus a base tuned 40M vertical which I seldom used. Those three antennas were removed, along with a pile of control boxes in the shack which were used to control these things. I also have a new end fed 40M wire in place to fill in one of my contest band/direction gaps. My mainstay contest antennas are an 80M OCF dipole and a Steppir 2 element beam, along with the new 40M end fed.

The DADFA and the whips, while great performers for DX use, were not that helpful to me in a contest. The whips were good at rotating a double ended null around for noise sources, but too finicky for contesting. The DADFA is capable of deep nulls in one fixed direction but too limiting for contesting.

I decided to keep the rotating active mag loop and ordered a SAL-20 MKII DX parts package from Array Solutions. This antenna needed a 22 foot aluminium mast which I happened to have on hand. A little yard surveying produced a compromised clear spot for the antenna. It's not ideal, according to the SAL-20 instructions. It is between two houses, the ground slopes up on two sides, and it is a tad close to my transmit antennas. One of my active whips used to be in the same area, and never had a transmit caused destruction issue. Lightning damage, yes, but no transmit oriented failures. That encouraged me to go for the site and I laid out some markers and readied the mast while waiting for my parts to arrive. I also installed a fresh run of RG-6 and arranged for a generous ferrite RF choke for each end.

Link to SAL website: <https://www.arrayolutions.com/sal-general-info>

The parts arrived by postal priority service in record time (in my experience). Texas to here was a long shot to have the antenna ready for the fall contests, but arrive it did in approximately a week. Not bad. To Canada, this is still the optimum and economic service from the USA. One evening of measuring and preparing the loops and the next morning I was able to install the antenna and make the connections by myself. I used a step ladder as a temporary mast support. I set the couplers at the default position, checked the coax health for shorts and continuity and hooked everything up.

One minor problem I encountered involved my locations inability to allow me to space the elements on the exact cardinals provided in the instructions. I didn't see that as a

problem as I could put indicators on my controller to indicate where N, S, E and W were actually indicated. That worked out fine.

First Operation

I fired it up on the MW band in daylight hours. There are a couple of AM broadcasters that can be heard here, but they are typically weak and require lots of gain. I could hear nothing on the SAL-20. That was unexpected, and obviously a clue that something wasn't right. I checked over all the connections again, and then added an external 12 dB Norton preamp on the output. That helped some and I could hear the AM stations a little better. Front to back ratios weren't very good either. After playing with coupler spacing for a while I went back to my receive antenna connections and discovered I had same reception whether the SAL-20 was on, or not. Ooops ! I had done some spring cleaning on my compensated receive antenna splitter and antenna selector the week before and now discovered I had some cables mixed up. Fixed that problem and the SAL-20 started behaving properly with the F/B ratios. Quite nicely in fact. But the gain was still very low. I needed to add about 20 to 25 dB of external gain to bring the signal up to something useable at my IC7700 input.

The antenna switched perfectly and functioned as described in the manual. The gain was just too low. I contacted Array Solutions and Dave AA5KA/HK1A got back to me with some suggestions involving the preamp. I checked that out but could find nothing wrong. I went back to the controller end inside the shack and looked at the unit. Previously I had measured 2.4 K ohms with an ohmmeter in the radio connection port. I didn't think anything of that at the time, but if the output was designed as a 50 ohm source, that reading was bit odd. On dismantling the unit, I discovered an output matching toroid with enamel wires, and a common mode choke on the output. The reading should have been almost a dead short, just ohmmeter lead resistance, really. Sure enough, one of the toroid leads was a funky solder joint to the board. The enamel may not have been cleaned fully off or something.. those kinds of connections are always a difficult. Re soldering the joint brought the unit right back to life ! Lots of gain.

Thanks to Dave, Jim and the folks at Array Solutions, they were very helpful. They generously sent a couple of schematics to help troubleshooting the signal path, as well.

So, now, the performance review. This is only a comment after a few days of use, including lots of listening during CQ WW SSB.

I am pleased to say, it easily exceeds any claims and reviews I have seen online. It really is a great receive antenna. Even though my installation is a compromise, as you can see in the pictures, it performs exactly as claimed, or better. Using my 7700 S-meter, I can regularly find 30 dB nulls (or F/B ratios) and sometimes even 40 dB (by S-meter reading) This compares favourably with the active magnetic loop and the mini DADFA (now removed). I was a bit startled at how well it works right up to 30M, allowing for

signal propagation characteristics, of course. The higher the elevation of the signal arriving at the antenna, the less the F/B ratio will be.

Here are my observations divided by receiving subject:

Local Noise Sources

This antenna is, without over statement, the best local noise source killer I have ever used. In directional mode it can very quickly put a null on those virulent local buzzings and hash from washing machines, plasma TV's, streetlights and all the other RFI sources with which we surround ourselves these days. I can do similar 180 degree nulls with the rotating active mag loop, but the null extends in both directions which can be a show stopper sometimes. A noise null is 10 times easier to perform with the SAL-20. This alone makes it a highly valuable contest aid. 30 dB nulls (5 S units), or more, are consistent and easy to place on the noise source.

Directionality

There are two directional modes. One uses opposing loops with elements that point in opposite directions. The combiner generates a bigger signal in this case (unless the signal has a high arrival angle). It is similar to the magnetic loop in this regard. Useful for weak signals, although I haven't seen the need to do this so far. The single direction capability is outstanding. You can rotate the peak (or the null, behind you, really) instantly in 8 directions with a button push. The reversal is another button push. This is very easy to use. I mounted my controller just under the tuning knob on the IC7700 making it very convenient to make changes as you tune around. In practice, I have found plenty of sensitivity in this mode, which is where it stays most of the time.



I formerly had a working K9AY set up here that provided 4 direction changes with useful nulls of 20 to 24 dB. But the effectiveness of the SAL-20 is much better with the 8 directions. There is often a sharp “receive – no receive” difference in one sector change. This is quite useful and even awe inspiring.

Sensitivity

Unfortunately for me, I do not have a Beverage of any size to compare with the SAL-20. However, I did have a very effective directional flag array known as a DADFA.. two active delta flags with a passive phase shifter to provide a directional null. (Many folks claim these have beverage equivalent performance) I can say that the sensitivity of the SAL-20 is equal or greater than the DADFA. I have three areas of comparison. The first is the ability to discern trans-Atlantic MW stations (TAs) here in Nova Scotia in the early evening. I had never heard these things in quantity until I built the DADFAs. Last night I pointed the SAL-20 NE at Europe and was amazed to see over 2 dozen TA's in the bandwidth of the SDR-IQ I use for this kind of reception. Several of them had quite good audio. This is an impressive feat and compares well with the mini DADFA. I expect the full sized DADFA might be better, but it is also a much larger antenna. Impressive. I also had a listen for some weak signal DX from 3C1L and some VK's this morning.. all were workable on the SAL-20 and showed receive signal strengths similar to my 80M OCF and 40M End Fed wires, but with improved SNR.

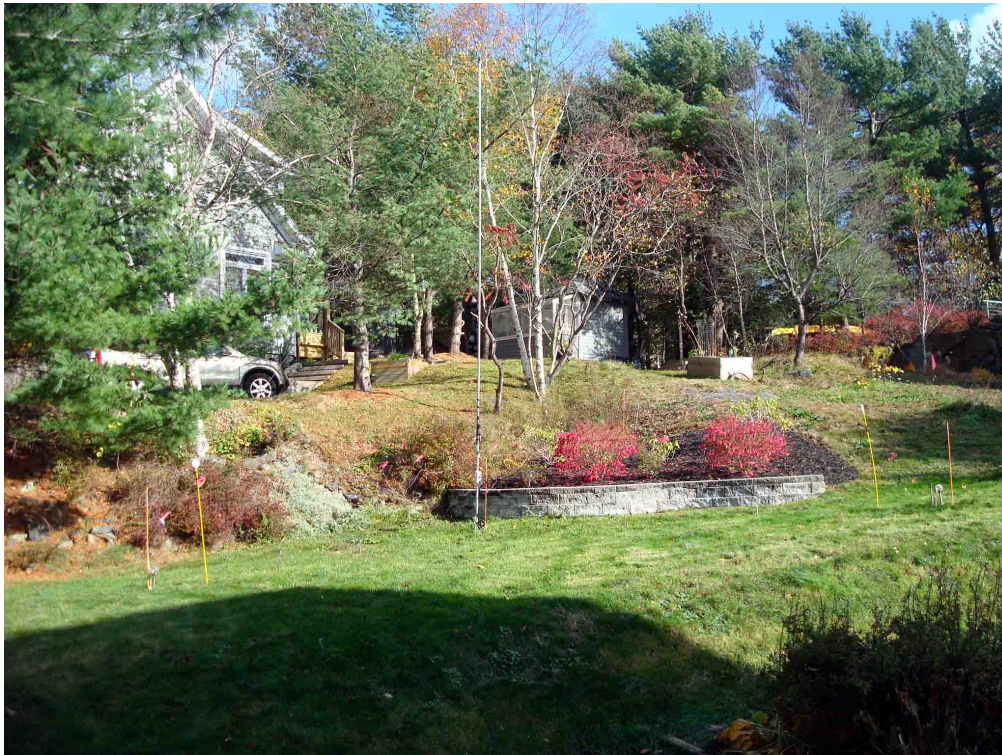
The last case is the VLF Euro stations 150 kHz to 250 KHz. A former large DADFA received these handily in the evening. The mini DADFA did not hear these so well, if at all. My active mag loop can detect them, but rarely can hear audio on more than one. However, the SAL-20 does a decent job on these signals. I used the dual -direction mode and nulled the local noise, and there they were! I detected the usual 5 or 6 stations and could hear audio on three of them. This is quite an accomplishment for such a small antenna on this band.

Overall opinion

I am really pleased with this antenna for my urban QTH. I think it will easily replace the various receive antennas I have played with over the last few years, with the best features of the various antennas rolled into one, and a very convenient control. It is a little on the pricey side, but judging from the performance I have seen so far, it looks justified. If you are really looking for directional receive on a budget, you may do fine with either a pair of phase controlled active whips, a DADFA, pennant or a K9AY for less investment, as you can handily build your own. The SAL-20 however, offers top of the line receive performance if you are willing to make the investment. And the footprint can't be beat.

My Installation

This is clearly a compromised site, with ground sloping up behind two of the loops, and the proximity to neighbours. Yet, it works very well. I would encourage others to consider installing one, even if you don't have a large flat (ideal) site. You can see the choke I installed on the coax. There is one inside the shack as well. I have no idea what performance would be like without them, but they can't hurt and for sure reduce conducted common mode signals coming into the receiver location.



The yellow stakes are fiberglass snow markers which are used to hold up the ends at the correct level. They are bent slightly to preload the tension on the guys and keep everything snug with a bit of spring. We just went through a storm with 90 KPH winds with no problems.



You can see some of the solar lights I placed under the wires and on the mast to indicate a hazard presence at night. My neighbours thought it quite artful.

A night time view (slightly blurry time exposure)



I may do another review of the contest features of the SAL-20 in the new year as I accumulate some experience with it. I am expecting good things !