Receiving loop comparison: Pixel vs 20 ft and 40 ft passive loops

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For the second night of the ARRL contest, I set up three receiving loops with a switch to compare them in realtime. A Pixel circular loop (10 foot perimeter) using the 30 dB Clifton Labs preamp that comes with it was the first antenna. The second one was a square 20 foot perimeter shielded loop as I described in the Sept./Oct. 2009 National Contest Journal:

http://www.n6rk.com/loopantennas/NCJ_loop_antenna_N6RK.pdf

The third antenna was a square 40 foot version of the loop in the NCJ article. No external preamp was used with the 20 and 40 foot loops. The receiver was a Yaesu FT-1000 with its internal preamp turned on. All three loops were oriented to null at 30 degrees azimuth on ground wave, which minimizes the noise at this QTH.

After comparisons on dozens of stations in the contest, the clear winner was the 40 foot loop. In general, the noise levels of the Pixel and the 40 foot loop were similar. However, the latter had 6 to 10 dB more signal, resulting in a markedly improved S/N ratio. There were numerous stations where a signal that was Q5 on the 40 foot loop was inaudible on the Pixel.

I ended up just leaving the switch on the 40 foot loop for the balance of the contest. If I had to have only one loop to use, it would be an easy decision to go with the 40 foot one.

The 20 foot loop had signal levels comparable to the Pixel, but the noise level was considerably lower. It came in 2nd place. The signal level of the 20 foot loop has always been marginal for the FT-1000 without external preamp. It might help to have some preamplification on it. I would rather use a larger loop than fool with a preamp. We have strong BCB signals, including one at 1,700 kHz, so preamps are always problematical.

The 40 foot loop will work (on 160 meters only) with an unmodified antenna circuit board, however, I ran into BCB QRM of the tuning diodes. I removed one of the two tuning diodes, which allowed the tuning voltage to rise. This helped on the BCB QRM, but there was still some light hash heard. Finally, I went to four diodes in a series parallel configuration as described in the article. This fixed the BCB QRM. The final configuration tunes from about 1.25 to 2.5 MHz, covering WWV.

I also compared to the transmit vertical. In most cases, stations could be copied on the vertical, but maybe not at 100%, and even when they could be copied, there was the usual unpleasant impulsive noise, as compared to the gentle rushing noise of the loops. From a listening fatigue aspect, it is not good to have to listen on the vertical. I have no technical theory to explain why this is, I just observe it consistently.

The Pixel loop covers all the way to 30 MHz. It still may be a useful receive antenna on the higher bands. When I purchased it for evaluation, I suspected that 160 meters was not its strong suit. Below 160 meters on BCB, the signals are much stronger and the Pixel should have no problem. Thus the take away is only that the Pixel isn't very useful on 160 meters.

The mechanical construction of the 40 foot version is much more difficult than the 20 foot version. My initial attempt was successful enough for these tests, but was basically a discovery of what NOT to do. It did become clear that it is much easier to guy the vertical support rather than making it self supporting. I am interested in hearing about successful large loop construction techniques.