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The Loop-Sensor Cardioid Array

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1) Introduction. This is the first of at least a three-part article on the Loop-Sensor Cardioid Array and will serve to familierize the reader with the unit, determine the need for such an array by the DX community, and to compare an ideal Loop-Sensor Cardioid Array with the ideal standard, figure-8 loop. Part II will cover the technical theory of the operation, assuming a knowledge of reactance and resonance by the reader (who is advised to brush up on these subjects in preparation). Part III will deal with practical construction and operation, noting the experiences and difficulties encountered by the author. See Reprint A7/sic.

2) What it is. The LSCA (Loop-Sensor Cardioid Array) consists of two separate antennas: One is any standard figure-8 loop such as the one you are likely using now; the other is, ideally, a vertical wire running the center of the loop plane, but a horizontal long-wire will do fine in many cases. The signals from the two antennas are combined with the correct ratios of voltage and phase to form a $K + \cos\theta K$, $(K = 1)$, differential pattern of reception known for its shape as a "cardioid".

3) Directivity. The primary characteristic of the LSCA is its unidirectional (one peak/one null) pattern of reception. The peak and null are separated by 180° in bearing, the peak having a gain 10 dB over that of the figure-8 loop uncombined with the vertical sensor.

4) The 180° ambiguity, or the inability of the standard loop to distinguish supplementary bearings, does not exist for the LSCA. More important to the average DXer than this DF (direction-finding) characteristic, however, is the array's capacity to null out a strong station thereby unveiling weaker stations lying in the opposite direction, stations not heard previously because of necessarily peaked QRM or an undesired null.

5) The null. This fact was not appreciated by the author until after a night of DXing with the LSCA: The null of the LSCA is tremendous in size, capable of reducing not just a few degrees of bearing, but, in the author's case, e.g., all of the U.S.A. and Canada! Below is a table comparing relative null sizes of the LSCA and the figure-8 loop (F8L). Decibels down are referenced to each respective peak, assuming both peaks to be equal in gain (see 3 above):

	-10dB	-20dB	-30dB	-40dB	-50dB	-60dB	-70dB
Figure-8 Loop:	60°	29°	14°	8°	4°	2°	1°
LSCA:	180°	120°	82°	57°	40°	29°	18°

Note that these are ideal antennas being compared. Any figure-8 loop capable of a -70dB null must be considered a precision instrument! Many DXers are quite satisfied with but -40dB of attenuation.

6) Proof of Performance. Using only a crude set-up with a long-wire sensor the author has accomplished the following feats of DX:

a) WINZ-940, a 50-kw Top-40 station only 4 miles from the author's location and beaming toward same with a cardioid pattern of its own, was nulled beyond detection during evening hours, permitting clear reception of Radio Punto Fijo, lying in the opposition direction of WINZ. Interesting to note that WINZ's splash was still present on adjacent channels!

b) On a Monday morning, 45 minutes were taped of AFCN-1340, Guantanamo Bay, with signal averaging 30dB over the background "noise". Audible traces of CMGU were present.

7) Advantages over the figure-8 loop. The cardioid reception pattern of the LSCA has several advantages over the figure-8 loop: a) The LSCA can differentiate between stations on collinear bearings, determining exact direction of an unknown station and eliminating one collinear station while peaking the other. b) Experiments show that the LSCA has the capacity to peak 3, even 4, stations, one at a time, operating on the same channel (e.g., 3 stations on 1250 kHz, 120° apart - any one may be peaked 20dB over the remaining two). The figure-8 loop is limited to only two stations in practical application. c) The extremely broad null of the LSCA permits the attenuation of many stations in a broad region, whereas the figure-8 loop generally nulls only one station at a time. d) Properly constructed, the LSCA's null will eliminate any interfering station, regardless of polarization errors (the null is tuned in with a pot, coil, and capacitor, so that any null that is not perfect is considered being "detuned").

8) ... and the disadvantages. a) The null is too broad for the LSCA to be of much use in high-precision direction finding. b) Two interfering stations on opposite bearings cannot be nulled. c) Using the LSCA, especially tuning the null, is a test of patience.

9) In conclusion. The Loop-Sensor Cardioid Array far outshines the ordinary figure-8 loop in all respects except as a high-precision direction finder. Its addition to the DX den is high recommended. The author considers its wide null to be its greatest asset, useful on crowded channels such as the graveyards. As construction details come to light, and DXers contribute to its perfection, the LSCA should prove to be the greatest advance in medium-wave DX antennas since the loop itself.

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