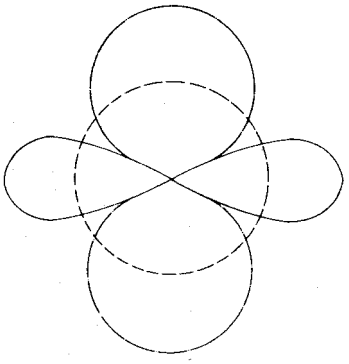
hy-gain
electronics corporation
N.E. Highway 6 — Lincoln, Nebraska

CITIZENS BAND
ENGINEERING REPORT

PHASED CLR AND GCLR VERTICALS FOR ADDITIONAL GAIN AND LOW ANGLE RADIATION

DESCRIPTION: Two or three identical Model CLR or GCLR colinear antennas can be installed as a phased array. When excited directly by RF energy, gain is achieved by control of the directional pattern.

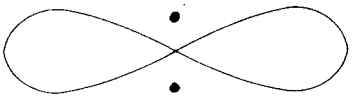


This directional pattern control results in added gain by sharpening lobe patterns and concentrating the radiated energy at very low angles. Signal flutter is reduced and reception is vastly improved. Phased arrays will reduce installation height requirements and extend the stations' range.

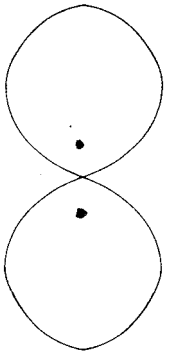
BI-DIRECTIONAL ARRAY

THEORY OF OPERATION:

The most effective spacing for a bi-directional array is ½ wave length. When two verticals are excited "in phase" the radiation is broadside to the plane of the verticals, offering substantial gain and bi-directional characteristics. Side nulls offer excellent signal cancellation to the undesired direction.



When excited "out of phase," these same verticals can be made to give an "end fire" or bi-directional pattern in the opposite direction through the plane of the verticals. This then nulls out signals in the opposite directions. More gain is exhibited by the "broadside" pattern over the "end fire" arrangement, but the "end fire" arrangement offers a wider frontal pattern.



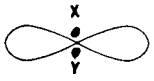
Both arrangements offer an excellent advantage over a single vertical since either phasing combination exhibits noticable signal gain with side attenuation of undesired signals. This added gain and low angle vertical directivity is the secret of success from the phased vertical array.

Phased Hy-Gain "topper whips" can also make a desirable and effective directional array when phased and spaced properly.

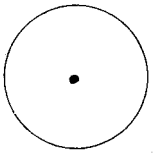
Phased verticals may be spaced either one quarter wave or one half wave depending upon gain and directional characteristics. The nulls of the phased array are extremely sharp and very pronounced.

Typical arrangements of phased arrays and their electrical specifications are illustrated below.

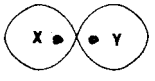
TOP VIEW HORIZONTAL DIRECTIVITY



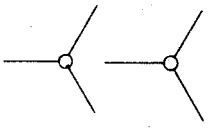
"BROADSIDE" GAIN 3.86DB



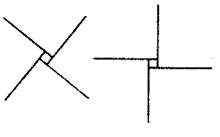
SINGLE GRND. PLANE



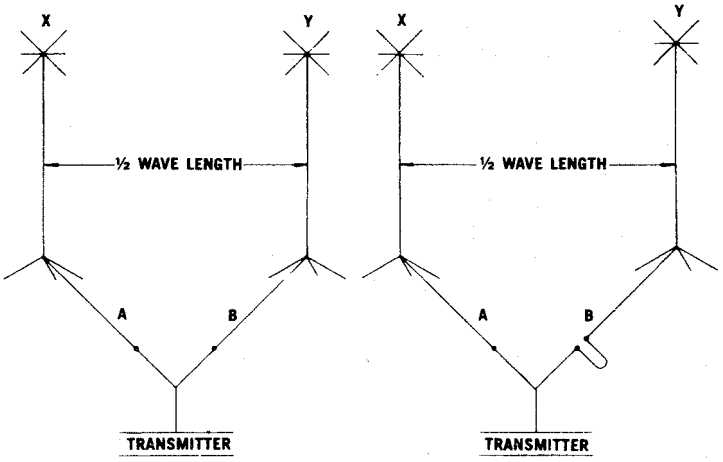
"END FIRE" GAIN 2.3DB



CLR RADIAL ARRANGEMENT



GCLR RADIAL ARRANGEMENT



When feedline "A" is the same length as feedline "B" the currents arrive at the base of each antenna at the same time, giving the "inphase" broadside, pattern.

When feedline "A" is ½ wave length shorter than feedline "B" the current arrives at antenna "X" ½ wave length sooner (180°) than at antenna "Y" giving the "out of phase" end fire, pattern.

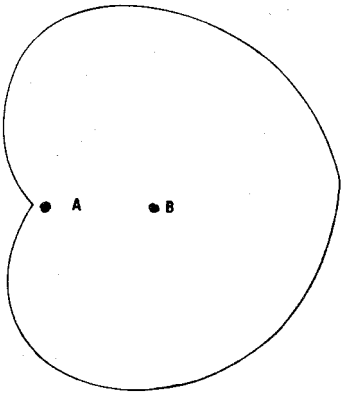
ELECTRICAL SPECIFICATIONS

	Broadside	End Fire
Pattern Width, half power points	60°	80°
Gain over single vertical	3.86 DB	2.3 DB
Side Attenuation	30 DB	20 DB
Impedance	52 OHMS	52 OHMS
Directional characteristics	Bi-directional	Bi-directional

CARDIOD ARRAY:

THEORY OF OPERATION:

When two or three identical verticals are excited directly and fed 90° out of phase with a spacing of ¼ wave length, a cardiod pattern results. This pattern may be switched in either direction. By inserting a ¼ wave length delay line the antenna will "fire" or be directive to that particular element.



TWO VERTICALS

The beam pattern for two ¼ wave length verticals will be approximately 120°. An arrangement of three switchable verticals gives a 60° pattern in six selectable directions.

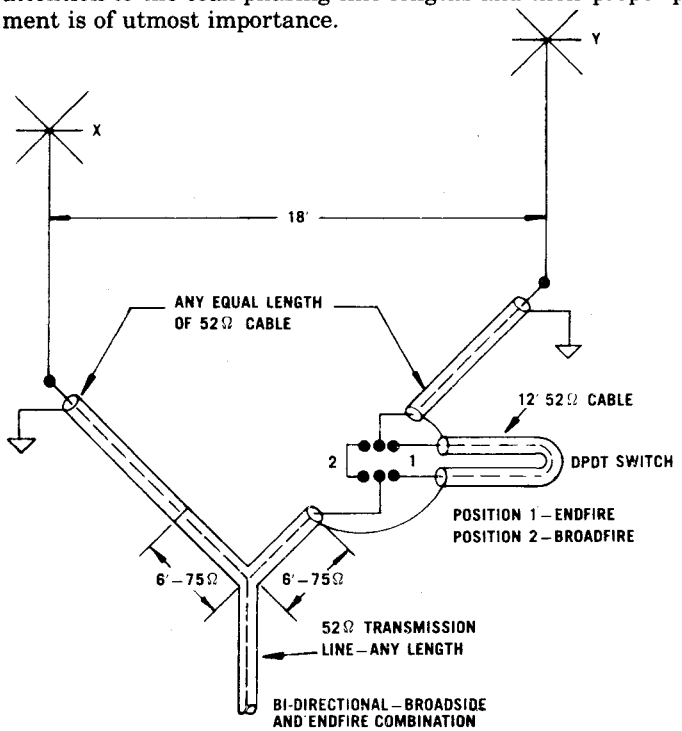
ELECTRICAL SPECIFICATIONS

	Two Phased Verticals	Three Phased Verticals
Pattern width, half power points	120°	60°
Gain over single vertical	4.5 DB	4.5 DB
Side Attenuation	20 DB	20 DB
Rear Attenuation	30 DB	30 DB
Impedance	52 OHMS	52 OHMS
Directional characteristics	uni-directional	uni-directional

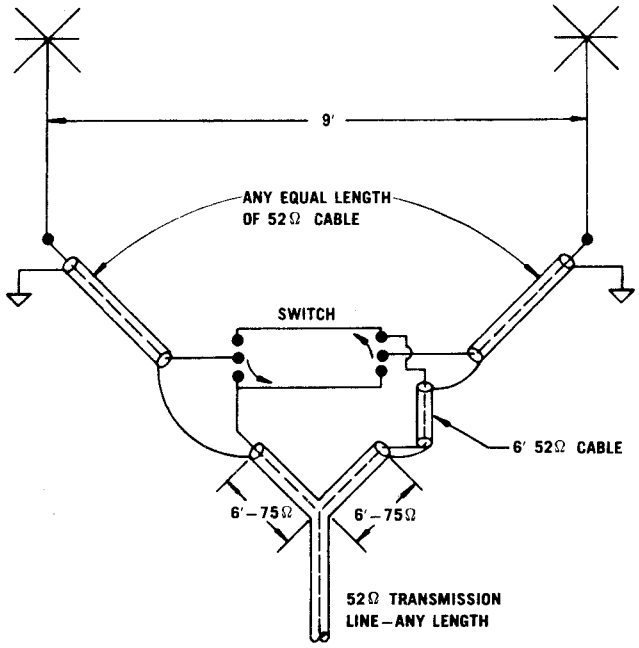
FIELD TESTS: Actual field test comparing one CLR for the phased array results in doubling the receiver's sensitivity and offering up to 12 DB of signal increase. An attenuation of up to 30 DB is noticeable on the phased CLR's with half wave spacing. With a quarter wave spacing up to 20 DB. Cardioid, 30 DB front to back attenuation.

INSTALLATION: ½ wave spacing refers to a full 18 foot spacing between the two vertical CLR antennas. A ¼ wave spacing refers to 9 foot separation between the vertical CLR's. Each antenna must be mounted at the same height above ground and be so arranged according to their radiation pattern to offer radiation in the desired direction.

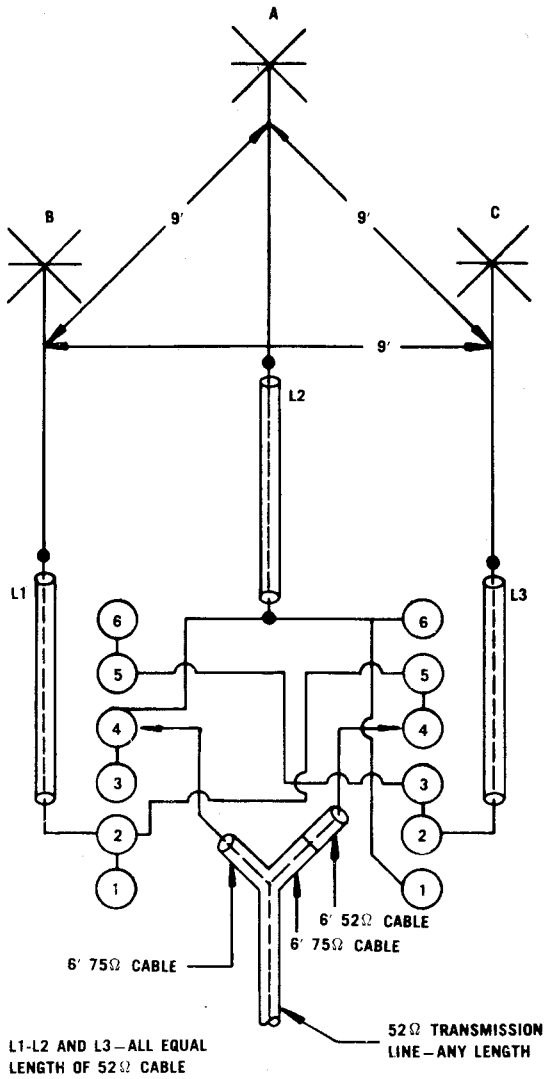
"End fire" directivity offers a larger area of radiation at slightly reduced gain as compared to the "broadside" arrangement. The "broadside" arrangement is recommended for communications at greater distances whereas the "end fire" arrangement would be so arranged to cover a larger area of communications. Special attention to the coax phasing line lengths and their proper placement is of utmost importance.



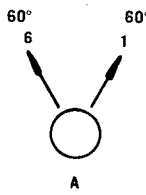
BI-DIRECTIONAL – BROADSIDE AND ENDFIRE COMBINATION



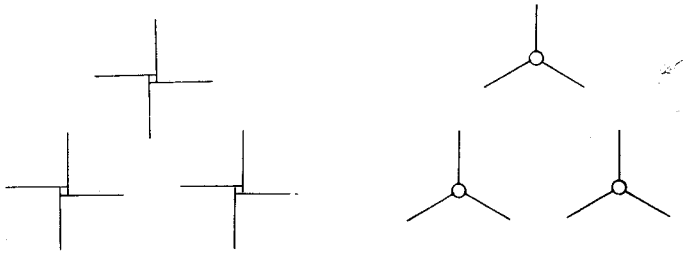
CARDIOD – UNIDIRECTIONAL WITH TWO SELECTABLE DIRECTIONS



360° CARDIOID ARRANGEMENT



TOP VIEW THREE VERTICALS



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