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A DIPOLE ARRAY FOR VHF

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SUMMARY

A VHF antenna has been developed at Comissão Nacional de Atividades Espaciais (CNAE) at São José dos Campos (Lat. 23°S; Long. 46°W). The half-power beam width of this solid array of dipoles is about 7°E-W and 12°N-S at a wavelength of 2.04 meters.

The purpose of constructing this array was to acquire actual design parameters necessary to build a larger VHF array with an effective aperture of a couple of thousand square meters, enabling high-resolution sky surveys, measurements on scattering properties of the outer solar corona by occultation of radio sources by the corona and, under favourable observing conditions, interplanetary scintillations of small diameter radio sources caused by electron density irregularities of the solar plasma.

Large dipole arrays on meter and decameter wavelengths have been used to make similar measurements [1,2,3,4,5,6]

The basic element of the array is a colinear element comprising 8 fullwave dipoles, shown in Figure 1(a). In all there 8 such rows with the dipoles polarized in the E-W direction. Half wave sections of twin lead transmission line are used to couple lightly the 8 dipoles to a traveling wave feed line of characteristic impedance of 400 ohms. Figure 1(b) shows the method of connecting two rows.

Each dipole was adjusted to present at its center a purely resistive impedance of 3000 ohms at 147 MHz. Figure 2 shows the variation of the dipole impedance with frequency.

Each traveling wave line was terminated on either ends in its characteristic impedance. The VSWR on this line was found to be less than 1.25 at the center. A partial reflecting screen was mounted $\lambda/8$ below the dipoles and had a width of 0.5λ symmetrical with respect to each row of dipoles.

To preserve the bandwidth of the system and provide equal path-lengths from each row of dipoles to the receiver, a branching feed method was used throughout. This is shown in Figure 3. Low Noise Preamplifiers were used at the antenna to overcome cable loss between the antenna and the receiver.

Total power receiving method was used. The receiver consisted of two stages of RF and three stages of IF amplification, a square-law detector, an LF amplifier and an FET-chopper. A predetection bandwidth of 500 KHz and an integration time of 1 second were used.

Figure 4 shows a specimen recording of the Quiet-sun flux taken on December 12, 1970 when the sun was almost overhead and passed through the antenna main beam. This flux density is expected to be about $(10^{-23} Wm^{-2} Hz^{-1})$.

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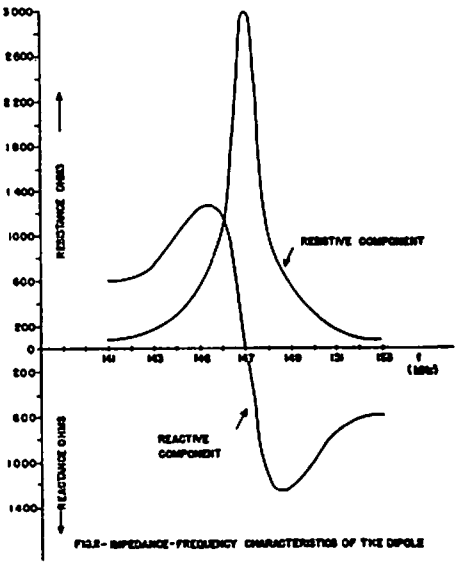

FIG.2 - IMPEDANCE-FREQUENCY CHARACTERISTICS OF THE DIPOLE

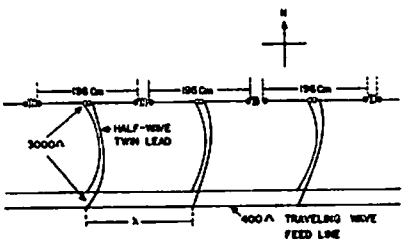

FIG. 1(a) - DETAILS OF THE COLINEAR BASIC ELEMENT

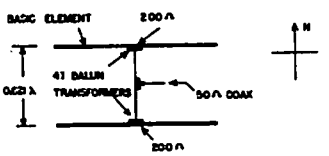

FIG. 1(b) - COMBINATION OF TWO ROWS

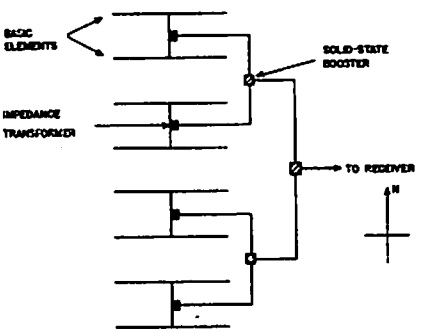

FIG.3 BRANCHING FEEDER SYSTEM OF THE ARRAY

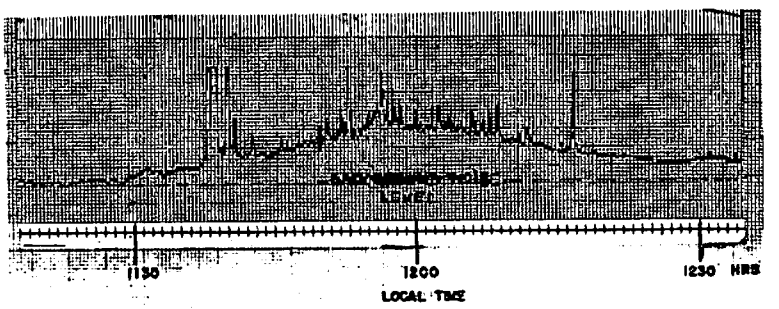

FIG.4 - SAMPLE RECORDING OF QUIET-SUN FLUX MADE ON 12 DECEMBER 1970