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A CROSSED YAGI AERIAL FOR USE IN A.P.T. RECEPTION

1. For the reception of APT cloud pictures in the 136-137 MHz band, a circularly polarized antenna with a gain of 10 to 13 db is required for good reception with the receivers being used by the Meteorological Department. At present 8 turn helical antennae having gain of 13 db are being used at Bombay and Pune (Datar 1971). At Delhi, Calcutta and Madras stacked Yagi type of antenna (Dasgupta 1971) are being used. Design of a crossed Yagi aerial for use with an antenna pedestal recently developed by the department is reported here.

2. The antenna specifications were arrived at by taking into consideration the transmission characteristics of polar orbiting satellite (NOAA series) and the sensitivity (1·0 μV close circuit for 26 db S/N ratio) of the APT receiver currently in use by the Meteorological Department. The specifications are :

1. Frequency	:	135-140 MHz
2. Gain	:	10-12 db
3. Polarization	:	Circular
4. Beamwidth	:	45° HPBW

3. The satellite transmits linearly polarized radio waves but it is necessary to have circular polarization for the receiving aerial to take into account de-polarization due to Faraday rotation

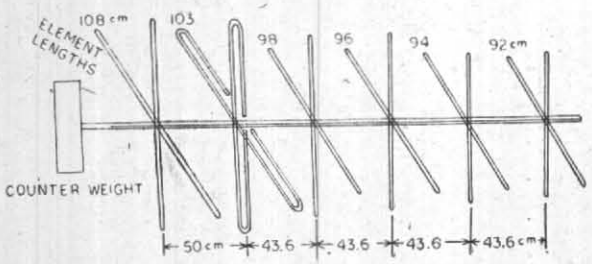

Fig. 1. Schematic drawing of crossed Yagi-aerial
Note : 1. All elements are of 3/8″ dia. brass pipes
2. Boom is of 1″ sq. aluminium pipe

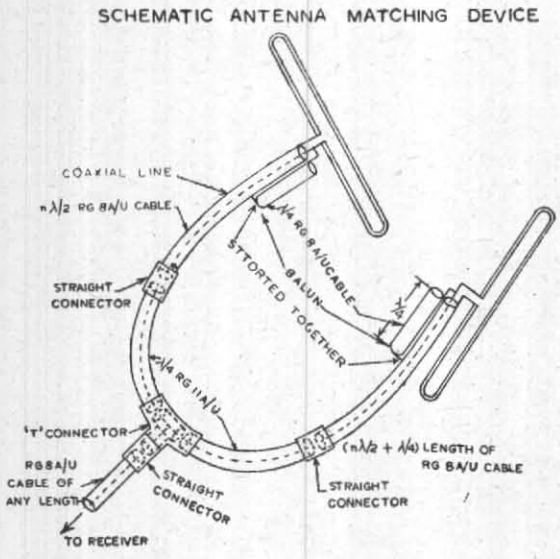

Fig. 2. Schematic antenna matching device

in the ionosphere and changing orientation of the transmitting antenna during the passage of the satellite with respect to the receiving antenna. Circular polarization beam can be obtained by using a helical antenna (Kraus 1950) or by using a crossed Yagi antenna (Jasik 1961). For the same gain, the helical antenna is heavier and longer compared with a crossed Yagi. Mechanical fabrication of Yagi is simpler than that of a helical antenna.

4. Circular polarization can be achieved with two crossed linearly polarized aerials placed on the same boom and connected with a phase difference of 90°. In the present design two 6-element Yagi aerials optimized to give a gain of 10-12 db were mounted on the same boom as a crossed Yagi aerial. Fig. 1 shows a schematic diagram of the of the aerial. The design of the Yagi aerial in respect of the element lengths and spacings has been arrived at experimentally based on the designs described in Jasik (1961) and the ARRL antenna hand book. The details of the element lengths and spacings are shown in Fig.1.

5. A Yagi antenna with 6 elements has a feed point impedence of about 10-12 ohms and has to be stepped up for connection to any standard cable. Folded dipole made up of a single brass tube is used to step up the impedence by a factor of four for connection directly to a standard 50 ohms coaxial cable. Fig. 2 gives the details of the device used for getting circular polarization and for matching. The two folded dipoles are connected with two 50 ohms coaxial cables (RG 8/U) one of them being longer than the other to introduce the required phase difference. The ends of these two cables are connected together through two lengths of RG 11/U each $\lambda/4$ in length to a common point, connected to the receiver using a 50Ω coaxial cable. These matching sections which act as quarter wave transformers raise the impedence at the junction point to near 50 ohms (Fig.2). At the feed point balanced to unbalanced transformer, *i.e.*, $\lambda/4$ coaxial cable shorted to the main cable which works as short circuited quarter wave line is used to minimize the unbalanced currents.

6. The aerial is fabricated on a hollow aluminium tube with a 1″ square cross section. All elements were made out of 3/8″ brass tubes. These elements were fixed on the aluminium tube by drilling through hole of 3/8″ diameter. The coaxial cables forming the matching sections were used with UHF type connectors as indicated in Fig. 2.

7. The antenna described was used operationally and found to give good performance. The present design resulted in a simple light weight aerial. The total weight of the aerial is about 10 kg and requires only a simple antenna pedestal for tracking purposes.

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