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CANADA INSTITUTE FOR STI
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C.N.R.C.

A HIGH-RESOLUTION SLOTTED-WAVEGUIDE IFF ANTENNA
FOR THE AN/FPS-3 RADAR

J. Y. WONG

Declassified to:

ORIGINAL SIGNED BY
S. A. MAYMAN

Authority:

Date:

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OTTAWA

OCTOBER 1957

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ERB-456

A HIGH-RESOLUTION SLOTTED-WAVEGUIDE IFF ANTENNA
FOR THE AN/FPS-3 RADAR

The present IFF antenna used in conjunction with the AN/FPS-3 radar is the AS-295/UP antenna. This antenna consists essentially of 24 separate cavities, each cavity excited by means of a short radiator or probe. The antenna performs the dual function of transmitting and receiving vertically polarized waves in the range of frequencies from 950 to 1150 mc/s. The horizontal pattern has a half-power beamwidth of approximately 4.5° and the side lobes are about 20 decibels down from the main beam. Discussion with personnel of Air Material Command, RCAF, late in 1954, revealed that a need existed for an antenna capable of achieving greater discrimination than the present AS-295/UP. Consequently, in an attempt to satisfy this requirement, the design of an experimental high-resolution IFF antenna¹ was undertaken in our laboratories.

Since the antenna was to be mounted on top of the AN/FPS-3 radar, the maximum dimension was not to exceed 30 feet in order to provide sufficient clearance with the radome housing. Further, it was expected that the proposed antenna would possess side-lobe characteristics at least comparable with those of the AS-295/UP antenna.

The antenna consists of two non-resonant slotted-waveguide arrays with longitudinal slots located in the broad face. Each array is approximately 30 feet long. The transmitting array was designed to operate over the band of frequencies from 990 mc/s to 1040 mc/s, and the receiving array from 1080 to 1130 mc/s. Since adequate data on slot radiators in the frequency band of interest were not readily available, it was necessary to carry out the initial design at S-band. All the array parameters were computed for standard S-band (3" x 1.5") waveguide. Taking into account the appropriate scaling factor, a design for the present antenna was established immediately.

Each array is fed by means of coaxial cable through a waveguide-to-coaxial transition. The transition consists of a short section of waveguide, about 5 inches in length. A post, 1/8-inch in diameter and approximately 2.4 inches long, terminating in a type-N connector, is located about 2 inches from the short-circuited end of the transition.

The measured half-power beamwidth of either the transmitting or receiving array is approximately 2.3° . The maximum side-lobe level falls well within the specification of -20 decibels. The match of either array corresponds to a v.s.w.r. of less than 1.35.

Since the two arrays are connected to the AN/UPX-6 equipment by means of a common cable, a composite high and low pass, line-type filter was built as an integral part of the antenna system. The filter provides at least 30 decibels of insertion loss in the rejection band, and no greater than 2 decibels in the pass band.

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During the latter part of May 1955, the antenna was installed at RCAF Station Foymount in order to determine its performance under operational conditions. Preliminary flight trials were carried out in June 1955, and more complete trials in July 1957. A report issued by AFHQ concerning the results of these trials indicated that the performance of the antenna is equal to that of the present AS-295/UP and superior to it insofar as resolution is concerned.

Reference 1 "Design of a high-resolution slotted waveguide IFF antenna for the AN/FPS-3 radar", J.Y. Wong (NRC/REE Report ERA-299, January 1956 - Secret).

J.Y. Wong.

October 1957