

A WIDE-BAND DUAL-POL VHF MICROSTRIP ANTENNA  
FOR SEA-ICE THICKNESS MEASUREMENT

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Presented in this paper are the design, characterization and test results of a dual-polarized and broadband multi-layer VHF (127-172 MHz) microstrip antenna. The antenna with 30% bandwidth has been developed for an aircraft (Twin Otter) field experimental system (FES) to measure the sea ice thickness. This FES is equipped with a new instrument technology: a combined spatial- and frequency-domain interferometer providing angular and frequency correlation functions (ACF/FCF) between two radar waves with different frequencies (in the VHF band), incidence angles and observation angles. The FES system requires two separate measurements from different altitudes (1.0 Km and 1.2 Km), with each measurement being at separate frequencies. The nominal central frequencies for each measurement are 137 MHz and 162 MHz with 20 MHz bandwidth each.

A lightweight antenna is required for placement outside a Twin Otter Aircraft passenger door. The antenna gain is required to be greater than 8 dB so that the FES system is sensitive to the weak backscatter return of the sea-ice sea water interface. The cross-polarization is required to be below 20 dB from the peak of the co-pol. A four capacitive feeding approach (instead of two orthogonal probes- one for each polarization) for the antenna with 180-degree hybrid connecting the two opposing probes is used to suppress the higher order modes presented in the thick multi-layer antenna substrate (total thickness is 29 cm). This approach allows for simultaneously reducing the antenna cross-polarization level below 20 dB, and the mutual coupling between probes. These four capacitive feeds are attached to the lower resonant (137 MHz) patch layer. The top layer resonates at 162 MHz, and is fed through the energy coupling from the bottom patch layer. A wide antenna bandwidth is achieved (127 MHz to 172 MHz) with antenna gain greater than 8 dB for both polarizations. The antenna has dimensions of 117 cm x 117 cm x 29 cm. A breadboard antenna element has been fabricated and tested. Excellent agreement is shown between theoretical and measured results.

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