

Coplanar Side-Fed Tightly Coupled Ultra-Wideband Array for Polar Ice Sounding

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Abstract—We developed a planar ultra-wideband (UWB) dual-polarized tightly coupled bowtie antenna array for ground-based polar ice sounding radar. The antenna-array operates over 180 – 620 MHz with a fractional bandwidth of 3.4:1. The broadband performance is obtained with the tightly coupled antenna elements. By carefully integrating the impedance matching network into one arm of the bowtie antenna and using a ferrite core for common mode suppression, this coplanar side-fed array avoids the use of vertical balun and separate antenna matching network. The size of the full-array is 2.8 m × 2.8 m with a weight of only 90 kg, including 24 power distribution boards and 144 feed cables. The thickness of the antenna-array is 12.7 cm, which is only about 0.08λ at the lowest operating frequency. We used this antenna-array as a part of a surface-based UWB ice-sounding radar system for measurements over the Greenland ice sheet during the 2019 summer field season. The UWB radar coupled with the array enabled fine-resolution mapping of deep internal layers extending from about 1 km to very close to bed located at 2.6 km.