

VHF/UHF Ultra-Wideband Measurements

of

Scattering Targets in Foliage

by

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This paper discusses a system which was designed to investigate several performance parameters of UWB (Ultra-Wide Band) foliage penetration and radar scattering in the VHF-UHF frequency range. The goals of the experiment include: 1) a study of UWB radar propagation through foliage, including both attenuation and dispersion of this coherent wideband energy, 2) study of the clutter scattering from the woods under wideband coherent illumination, 3) study of the distortion in the target impulse signature caused by interactions with nearby trees and foliage, and 4) study seasonal and possibly diurnal changes for the UWB case.

The system uses the "Big Ear" radio telescope as a support structure for SAR images. One portion of this telescope is a tilting reflector, 100 ft. high by 340 ft. long. The top edge of the tilting reflector provides a 340 ft. long track for a dual polarized UWB rhombic antenna cart assembly which is used to provide SAR imaging of the woods 150 ft. beyond, and targets concealed therein. The SAR image system provides data at declination angles from 10 degrees to 50 degrees, over the frequency range of 200 to 2000 MHz. Data were gathered over both 120 ft. and 240 ft. scan lengths, and for downrange distances up to 350 ft.

The stepped frequency radar system is based on a Hewlett Packard 8753 Network Analyzer, but the transmit signal has a pulse modulator and amplifier just before the transmit antenna. There is a matching pulse modulator and low-noise preamplifier in front of the receive input of the network analyzer. The system is typically operated with a 170 nsec pulse length, a pulse rep rate of 1 MHz, and a frequency step increment of 1.25 MHz.

Coherent SAR images have been generated for the woods with several targets included in the scene. The data provides information over 200 MHz to 2000 MHz and for HH, HV and VV polarizations. The measurements were performed with full summer foliage (August) and under fall foliage (October) conditions.