

## **High-resolution measurements of naturally occurring HF waves in Geospace**

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High-resolution rocket-borne and ground-based measurements of ionospheric upper hybrid and Langmuir waves and related phenomena have always presented difficulties because the high frequency of these phenomena, typically 1-10 MHz, require high sample rates to achieve full resolution. In recent years high speed analog to digital converters and digital radio receivers make these measurements possible on a wider scale, although dealing with the resulting large quantities of data remains a challenge. Nevertheless recent experiments employing a variety of strategies have made significant contributions to understanding ionospheric HF waves. Recent ground-based data show the prevalence of several types of structure in radio emissions, such as flickering at 10-30 Hz may be related to source region plasma inhomogeneity. Recent rocket-borne data show evidence for fine structures of waves near the upper hybrid frequency trapped in density enhancements, as well as structured Langmuir waves and whistler mode waves. A review of recent developments motivates ongoing experiments to identify the generation mechanisms and explore remote sensing applications of these waves.