

**THE STUDY OF THE ATMOSPHERE AND IONOSPHERE OF PLANET VENUS BY
EMPLOYING RADIO SCIENCE TECHNIQUES**

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The VeRa radio science instrument onboard ESA's Venus Express spacecraft uses simultaneous One-Way radio signals at X-band and S-band (wavelengths 13 cm and 3.6 cm) for the sounding of the Venus neutral atmosphere and ionosphere in a radio occultation experiment. The almost polar orbit of Venus Express provides the opportunity to investigate the atmosphere at all planetocentric latitudes, including day-night variations of its structure and signal absorption effects caused by gaseous components such as H₂SO₄, CO₂ and N₂. An Ultra-Stable Oscillator provides a high quality onboard frequency reference source for the One-Way radio link. Using coherent measurements at the two wavelengths allows the separation of dispersive media effects. Instrumentation in the ground stations on Earth employ both Closed Loop and Open Loop receiver systems to record the highly dynamic amplitude, phase and polarization of the received signals during Venus occultation. The microwave radio beam is strongly refracted by the dense atmosphere of Venus. In order to guide the signal with maximum power through the atmosphere, special limb-tracking maneuvers are performed with the spacecraft's parabolic reflector antenna to compensate for the ray-bending effect. It is shown that successful execution of the experiment and subsequent data analysis critically depends on not only the availability of high-precision time and reference systems but also the prior knowledge about the planet and its atmosphere from earlier missions.

1. INTRODUCTION

The exploration of Venus from space began in the early 1960's. Several American and Soviet flyby