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Radio Wave Propagation Handbook for Communication on and Around Mars

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Abstract

This handbook examines the effects of the Martian environment on radio wave propagation on Mars and in the space near the planet. The environmental effects include these from the Martian atmosphere, ionosphere, global dust storms, aerosols, clouds, and geomorphologic features. Relevant Martian environmental parameters were extracted from the measurements of Mars missions during the past 30 years, especially from Mars Pathfinder and Mars Global Surveyor. The results derived from measurements and analyses have been reviewed through an extensive literature search. The updated parameters have been theoretically analyzed to study their effects on radio propagation. This handbook also provides basic information about the entire telecommunications environment on and around Mars for propagation researchers, system engineers, and link analysts. Based on these original analyses, some important recommendations have been made, including the use of the Martian ionosphere as a reflector for Mars global or trans-horizon communication between future Martian colonies, reducing dust storm scattering effects, etc. These results have extended our wave propagation knowledge to a planet other than Earth. The tables, models, and graphics included in this handbook will benefit telecommunication system engineers and scientific researchers.

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