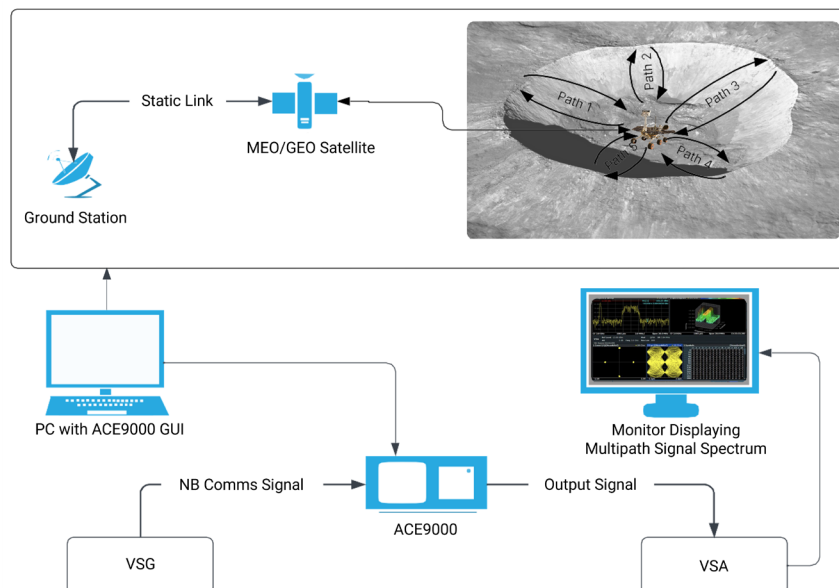


Emulation of Multipath Effects in Satellite Communications

Due to operating in such demanding, complex conditions, space-based communications face several critical challenges that can degrade signal integrity, one of which is multipath signal propagation. In this scenario, the transmitted signal reflects off various obstacles before reaching the receiver. The reflected signal travels along different paths and reaches the receiver at different time intervals, which can lead to interference, weaken signal strength, and distort the transmission.

At SATELLITE 2025, a Maury Microwave demonstration showcases how the ACE9000 Advanced Channel Emulator can simulate multipath impairments on a communications link, specifically between a lunar rover inside a Moon crater and a terrestrial ground station, with a MEO/GEO satellite acting as a relay. To start, a vector signal generator (VSG) generates a narrowband communications signal, which is fed into the ACE9000. The emulator then simulates realistic multipath effects, where the signal interacts and reflects off the edges of the Moon crater, creating several paths for the signal to travel. After the impaired signal is processed through a vector signal analyzer (VSA), a monitor displays a multipath signal spectrum to visualize the impact of multipath propagation on signal quality.

Demo Setup



Target Users

Target users include design engineers and system integrators working on space-based communications networks that need to overcome the effects of multipath signal propagation.

Product Overview

ACE9000 Advanced Channel Emulator

The ACE9000 Advanced Channel Emulator is the most advanced non-terrestrial RF channel emulation solution to date. The emulated impairments include delay, signal Doppler, attenuation, phase offset, AWGN, frequency hopping, payload, and multipath fading. The instrument can house up to four 600 MHz instantaneous bandwidth channels. Impairment emulation can be set to fixed values in Static Mode, or continuously changed in real time in Dynamic Mode without any phase discontinuities.

KEY SPECIFICATIONS AND FEATURES:

- 600 MHz of instantaneous bandwidth per channel
- Timing synchronization up to 16 channels
- Link emulation including:
 - Phase continuous delay, Doppler, and attenuation changes
 - AWGN and Eb/No
 - 12 tap (path) multipath fading with Rayleigh, Rician, and CW. Angle of Arrival (AOA), k-factor, and correlation controls
 - RF frequency-agile up/down converters
- Payload emulation including:
 - IMUX/OMUX amplitude and group delay distortion
 - Amplifier compression (AM/AM and AM/PM)
 - Phase noise
- Static and dynamic link emulation
- Ephemeris data generation using SATGEN
- Remote instrument control through ACE Client application

ACE Client Application

The ACE Client is a comprehensive application that enables the remote control of all ACE9600 functions, graphically displays impairment file contents, and provides wizards for creating custom profiles for payload impairments. The ACE Client also enables signal capture, which generates both time and frequency domain plots of the excitation signal and the output signal after the application of impairments.

More Resources

Visit info.maurymw.com/satellite-2025 to learn more about Maury Microwave solutions.

