



Validating 5G NTN Performance Through Realistic Satellite Link Emulation

Satellite communication links introduce a range of impairments that can challenge reliable 5G NTN performance. As satellites move relative to user equipment (UE), the changing signal path produces time-varying propagation delay, while high orbital velocities, particularly in low-Earth orbit (LEO) satellites, can impose significant Doppler shifts on the received signal. These conditions require 5G NTN devices to track and compensate for changes in signal timing and frequency to maintain reliable connectivity. Satellite links are also affected by variations in path loss, atmospheric scintillation, AWGN, and multipath fading, creating a complex, continuously changing RF environment that must be accurately recreated during testing.

The Maury Microwave ACE9000 Series Advanced Channel Emulator emulates these real-world link conditions in a controlled laboratory environment. The ACE9000 can apply impairments including delay, Doppler/frequency offset, attenuation, phase offset, AWGN, and multipath fading, allowing engineers to evaluate receiver and system performance under repeatable satellite-channel conditions.

In this demonstration, two Callbox Minis create an end-to-end 5G NTN connection, with one emulating the network and the other the UE. The 5G NTN signal passes through the ACE9000, which applies channel impairments to emulate dynamic satellite link conditions and assess system performance before deployment.

Demo Setup



Target Users

Target users include design engineers and system integrators working on satellite communications systems and NTN.

2900 Inland Empire Blvd., Ontario, CA 91764 USA

+1 909 987 4715 +1 909 987 1112 sales@maurymw.com maurymw.com

Product Overview

ACE9000 Advanced Channel Emulator

The ACE9000 Advanced Channel Emulator (ACE) 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 GUI Application

The ACE Client GUI is a comprehensive application that enables the remote control of all ACE functions, graphically displays impairment file contents, and provides wizards for creating custom profiles for payload impairments. The ACE Client GUI 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 maurymw.com/info/eumw-2026 to learn more about Maury solutions.

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maurymw.com