# Emulating SNR Variation in a Satellite Communication Link

Satellite communication links are affected by channel noise that can degrade signal quality and system performance. This noise may be caused by thermal variation in system components, electromagnetic interference, or adjacent channel crosstalk from other satellite transmitter signals. Crosstalk signals occur as either random interference or intentional jamming. These effects degrade the signal-to-noise ratio (SNR) and must be accurately emulated to test and optimize satellite links.

In this demonstration, the Maury Microwave ACE9000 Advanced Channel Emulator with the AWGN option dynamically adds noise to a digitally modulated I/Q waveform to emulate changing link conditions. A digital QAM signal generated by a VSG is passed through the ACE9000 where an AWGN profile is applied, modulated by a triangular noise pattern. As the noise level changes, the constellation points observed on the VSA spread out and smear around ideal symbol positioning, illustrating how variations in SNR impact signal quality between a ground station transmitter and satellite receiver.
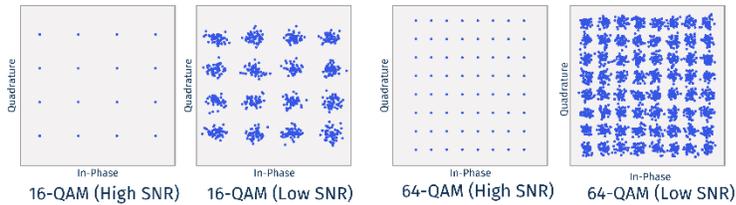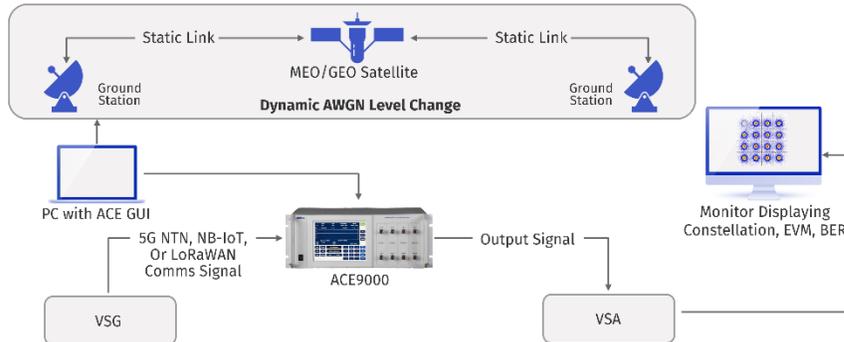

Effect of AWGN on 16-QAM and 64-QAM constellations.
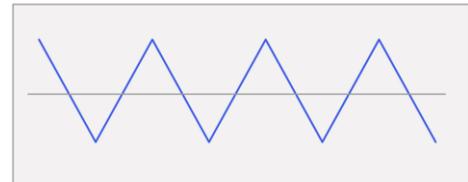
Triangular noise profile to vary SNR.

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/satellite-2026 to learn more about Maury solutions.