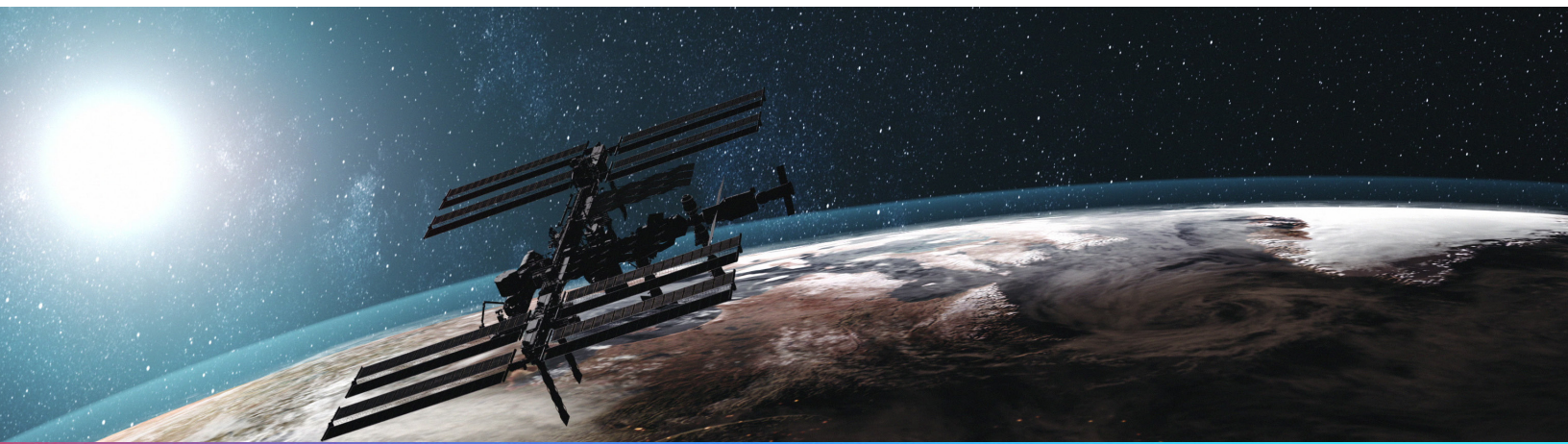


# ACE9000 Advanced Channel Emulator



[Datasheet](#)



# ACE9000 ADVANCED CHANNEL EMULATOR

The Advanced Channel Emulator (ACE) is a powerful hardware/DSP based test platform to allow a variety of impairments to be inserted in real-time, enabling testing of a range of wireless receivers, UHF/ VHF Radios, satellite payloads and satellite fixed & mobile ground and airborne transceivers in a controlled laboratory environment. The ACE is signal agnostic and is offered with instantaneous bandwidths from 72MHz to 600MHz. Optional DSP based functions will allow users to insert RF impairments for RF link emulation. Mobile digital receiver multipath testing, payload emulation and hardware emulation modeling.

The ACE is the follow on platform to dBm's highly acclaimed satellite link emulator (SLE) product line and will run all existing dynamic data files developed for the SLE, allowing a simple cost effective upgrade path as communication systems become more bandwidth intensive and sophisticated. ACE takes testing to the next level with accurate simulation of phase continuous propagation delays, flat-fading, path loss, frequency hopping, phase shift and Doppler shifts, allowing systems engineers to create realistic, full-duplex path scenarios for closed-loop testing of a wide range of digital receivers. The ACE may be configured with up to four independent simplex channels per chassis and operates at an IF of 140 MHz or 1125MHz (bandwidth dependent). Optional internal L-band tunable RF Up/Down converters and external C, S, X, and Ku, Ka band RF converters may be added to expand the frequency range.

Test parameters can be entered via the touch sensitive graphical color front panel, by downloading files from internal memory or by downloading data through the high speed Ethernet port. All non-volatile memory used to store dynamic data files, system configuration data and any customer sensitive information reside on a SD card and can be removed from the instrument to easily comply with military/classified laboratory restrictions.

The powerful DSP engine in the ACE9000 series allows optional Rayleigh, Rician and normal multipath fading (up to twelve paths per channel) and digital additive white Gaussian noise (variable occupied bandwidth) impairments to be added to the link.

The ACE can be upgraded to provide payload and hardware influenced impairments emulation such as IMUX, OMUX filter emulation, programmable phase noise and group delay, amplitude ripple, gain compression distortion, nonlinearity (AM/AM, AM/PM) and IF filter simulation.



## SPECS

- > Satellite to fixed/mobile Ground Station
- > Satellite to Satellite RF Link Testing
- > Satellite Payload Emulation
- > ACE9072, 72MHz bandwidth
- > ACE9125, 125MHz bandwidth
- > ACE9300, 300MHz bandwidth
- > ACE9600, 600MHz bandwidth

## APPLICATIONS

Typical applications for the ACE include:

- > Earth terminal testing
- > Satellite payload testing
- > Satellite system integration test beds
- > Mobile transceiver testing
- > UHF/VHF Radio testing
- > UAV Testing
- > Atmospheric scintillation (time dispersive delay) modeling

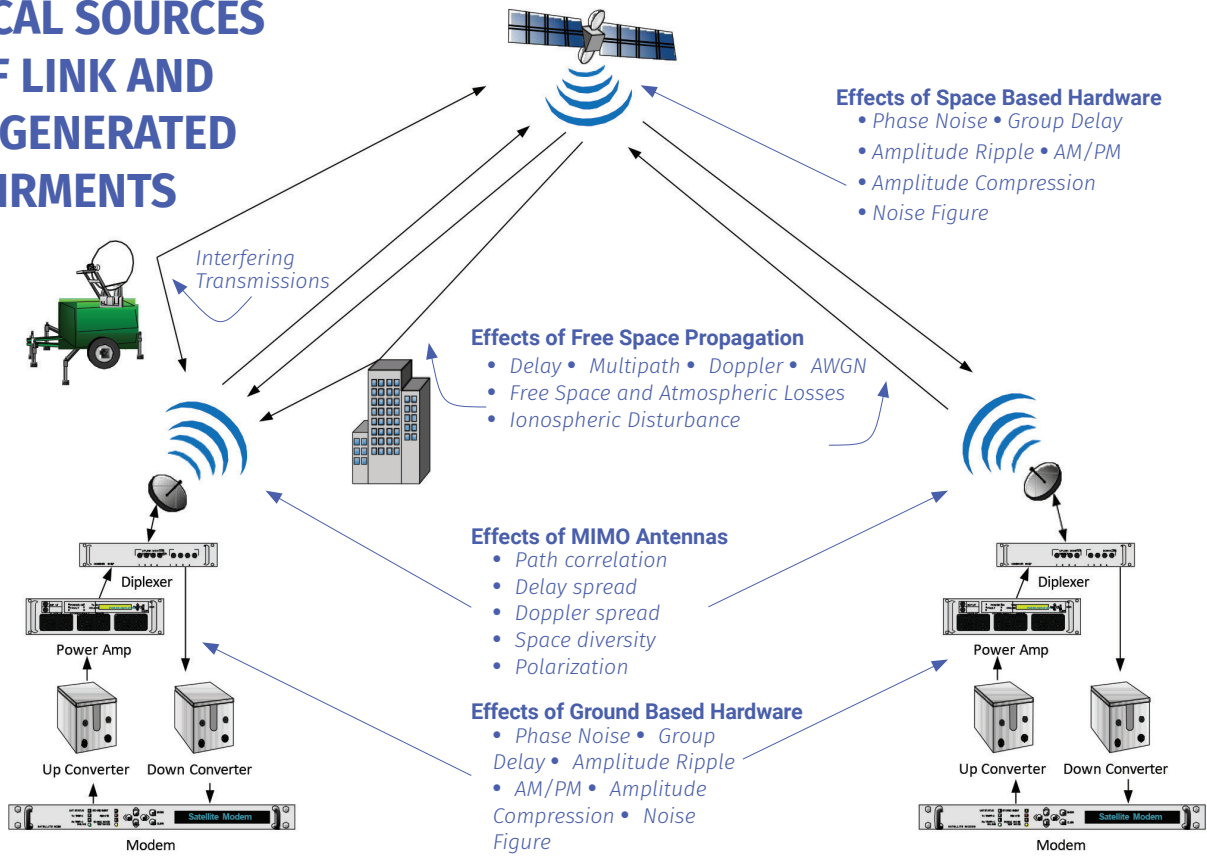
## FEATURES

- > RF Link emulation (delay, Doppler, path loss, phase shift frequency hopping)
- > Multipath Fading, 12 paths
- > Additive White Gaussian Noise
- > Payload impairments (IMUX, OMUX, group delay, amplitude ripple, phase noise, AM/AM AM/PM non-linearity, interfering signals)
- > Removable non-volatile memory to meet military/classified laboratory requirements

## EXPANDABLE ARCHITECTURE

Up to four chassis with four channels each (16 channels total) may be configured with precise synchronization. A very high speed digital bus is used to provide timing and correlation between any multipath-paths of any channel in any chassis. All communications between the user and the ACE is via a high speed LAN port or color touch sensitive front panel display.

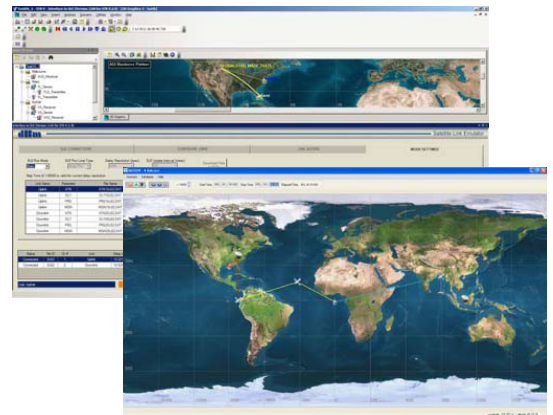
# TYPICAL SOURCES OF RF LINK AND H/W GENERATED IMPAIRMENTS



Contact factory for additional information on optional DSP packages to be loaded into the ACE9000 platform to perform Payload and/or ground based hardware impairments emulation

## MODELING SOFTWARE

The latest satellite orbit modeling software, SATGEN II, generates link parameter files formatted specifically for the ACE. The new SATGEN offers an enhanced graphic interface which easily identifies when transceivers are within line sight communication. Up to 8 transceivers can be configured for each channel. Types of transceivers include fixed earth terminals, ground vehicles, ships, and aircraft, all which can be programmed to move along a defined path with variable velocity. The capability to model any satellite orbit is carried over from the previous SATGEN version. SATGEN generates files for delay, Doppler, and path loss. A new sophisticated path loss model includes atmospheric gas losses as a function of frequency, temperature and humidity, in addition to the free space losses.



In addition the ACE9000 series can accept Analytical Graphics STKtm generated data files for sophisticated emulation of satellite to satellite communication, UAV's, and other moving terminals such as ships and COM's on the move.

## RF CONVERTERS

Maury offers an extensive range of external multi-channel RF Up/Down frequency converters to extend the use of the ACE9000 Advanced Channel emulator to operate at a wide variety of end to end testing at actual operational microwave link frequencies.

All frequency converters have standard ethernet and IEE-488.2 control interfaces and can also be controlled directly by the ACE9000 to allow seamless and easy integration for a powerful test solution.



# ACE9000

## ADVANCED CHANNEL EMULATOR

### SPECIFICATIONS (LINK MODE)

MODEL NUMBER	ACE9072	ACE9125	ACE9300	ACE9600
<b>Center frequency</b>	140MHz or 1125MHz*	1125MHz	1125MHz	1125MHz
<b>1 dB RF bandwidth</b>	72 MHz	125MHz	300MHz	600MHz
<b>Minimum delay per channel</b>	7 $\mu$ s	7 $\mu$ s	7 $\mu$ s	7 $\mu$ s
<b>Maximum delay per channel</b>				
Full bandwidth	700ms	700ms	700ms	700ms
Reduced bandwidth	1,400ms	1,400ms	1,400ms	1,400ms
<b>Number of independent channels</b>	1, 2, 3 or 4			
<b>RF input power</b>	0 dBm max.			
<b>RF output power</b>	0 dBm max			
<b>In-band spurious suppression</b>	-55 dBc typ, -45 dBc max			
<b>Noise floor</b>	IF option: -143 dBm/Hz typical, L-band option: - 138dBm/Hz typical			
<b>Amplitude ripple</b>	IF option: <0.5 dB p-p, L-band option: < 1.5 dB p-p			
<b>Group Delay</b>	IF option: < 5 ns p-p, L-band option: < 8 ns p-p			
<b>VSWR</b>	<1.5:1 max into 50 ohms			
<b>Delay</b>				
Range:	7 $\mu$ s to 700 msec @ 72MHz & 125MHz BW 7 $\mu$ s to 700 msec @ 300MHz & 600MHz BW			
Resolution:				
Static mode	0.01Hz			
Dynamic mode	0.1 ps			
Slew rate:	0.1 ps/sec up to 2 us/ms			
Relative accuracy:	$\pm$ 1 ns plus 10MHz reference			
<b>Frequency offset</b>				
Range:		$\pm$ 6.0 MHz		
Resolution:		0.01Hz		
Absolute accuracy:		based on 10MHz, reference $\pm$ 0.01Hz		
<b>Attenuation</b>				
Range:		0 dB to 70 dB		
Resolution:		0.10 dB		
Slew rate:		>70 dB/ms		
Accuracy:		$\pm$ 0.20 dB		
<b>Phase Offset</b>				
Range:		0 to 359.9 $^{\circ}$		
Resolution:		0.1 $^{\circ}$		
Accuracy:		<1 $^{\circ}$		
<b>Internal L-band Converters</b>				
Range		700MHz to 2300MHz (center frequency)		
Tuning step		1MHz		
<b>Additive White Gaussian Noise</b>				
Crest factor:		>16 dB		
Repetition Interval:		>24 hrs		
PDF Accuracy:		<1% from theoretical Gaussian over 6.666 $\mu$ s		
Noise bandwidth:		same as signal passband		
Spectral density flatness:		<0.1 dB p-p max		
Noise density amplitude range:		-103 dBm/Hz typ, to instrument noise floor		
Noise density amplitude resolution:		$\leq$ 0.01 dB		
Noise density amplitude accuracy:		$\pm$ 0.2 dB		
<b>Eb/No</b>				
Ratio resolution:		0.01 dB		
Rate accuracy:		$\pm$ 0.2		

# ACE9000

## ADVANCED CHANNEL EMULATOR

### SPECIFICATIONS CONTINUED

<b>Multipath Fading</b>	
No. of paths:	12
<b>Path characteristics</b>	
Dynamic profile update rate:	1 sec, affecting Doppler, delay, AoA, and attenuation
Distribution types:	CW, Rayleigh, Rician, log normal and off
Spectral distribution shape (Ray, Rice):	$\text{SQRT} \{1-(f/f_d)\}$ with 6 dB peak @ $f_d$
PDF:	within 0.5 dB of theoretical from 10 dB above to 30 dB below mean
Level crossing rate:	$\pm 2.5\%$ from theoretical, -30 dB to +9 dB
Attenuation range:	0 to 30 dB
Attenuation resolution:	0.1 dB
Doppler spread:	0 to 10 KHz
Doppler resolution:	1 Hz
Delay range:	0 to 10 usec
Delay resolution:	1 ns
Rician K factor:	-10 to 20 dB
K factor resolution:	1 dB
Correlation:	0 to 100%, 1% steps
Angle of arrival range:	0 to 180°
Angle of arrival resolution:	1°
<b>Dynamic mode</b>	
Dynamic parameters:	Delay, Frequency offset, Attenuation, AWGN, Phase
Profile update rate:	1, 2, 5, 10, 20, 50, 100, 200, 500, and 1000 msec
Dynamic parameters:	Multipath, RF frequency
Profile update rate:	100, 200, 500, and 1000 msec
Update rate accuracy:	based on 10 MHz reference
Triggering:	front panel keypad, LAN, external signal or slaved to master chassis
Triggering accuracy:	synchronized to begin on the 2nd update clock after trigger
Dynamic data file memory size:	>virtually unlimited (SD memory 32 GB)
<b>Control and Interface</b>	
Local:	Front panel
Remote:	<RJ45, IEEE-802.3
<b>Internal Frequency reference error</b>	< 2.5 PPM
<b>Primary power</b>	
Voltage:	85 – 264 VAC autoranging
Frequency:	47 – 440 Hz
Consumption:	470 VA max.
Fuse:	8A slow-blow
<b>Operating ambient temp</b>	+10°C to +40°C
<b>Dimensions</b>	17" W x 7.0" H x 21" D
<b>Weight</b>	
1 Channel:	37 lbs, with option L: 40 lbs
2 Channel:	38 lbs, with option L: 44 lbs
4 Channel:	50 lbs, with option L: 52 lbs



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