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

Advanced Channel Emulator

The Advanced Channel Emulator (ACE) from dBm 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 70, 140 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, non-linearity (AM/AM, AM/PM) and IF filter simulation.

dBm

RF Test Equipment for Wireless Communications

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

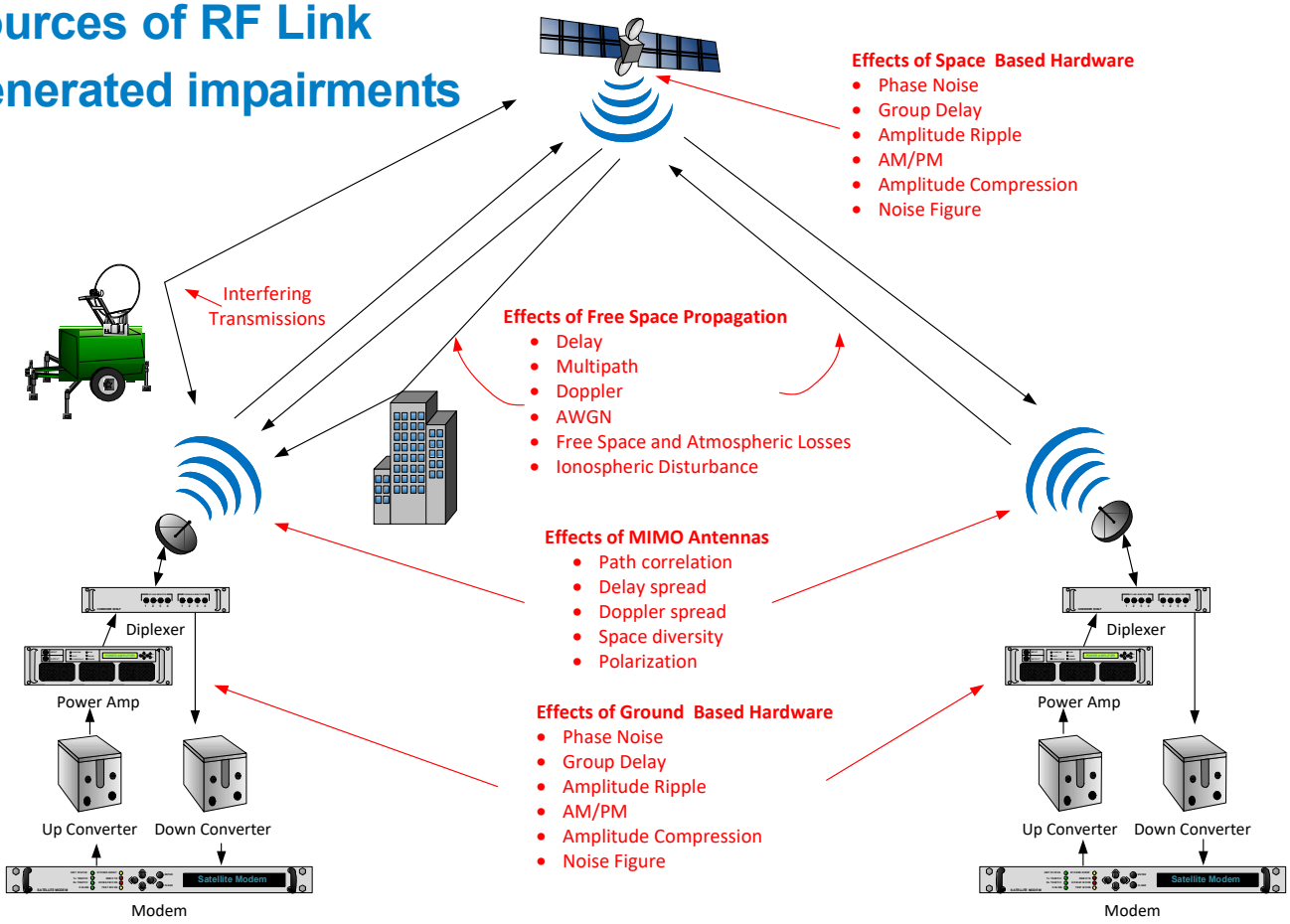
- RF Link emulation (delay, Doppler, path loss, phase shift frequency hopping)
- Multipath Fading, 12 paths
- Additive White Gaussian Noise
- Payload impairments (IMUX, OMUX, group delay, amplitude ripple, phase noise, AM/AM AM/PM non-linearity, interfering signals
- Removable non-volitile memory to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

Expandable architecture

Up to four chasses 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.

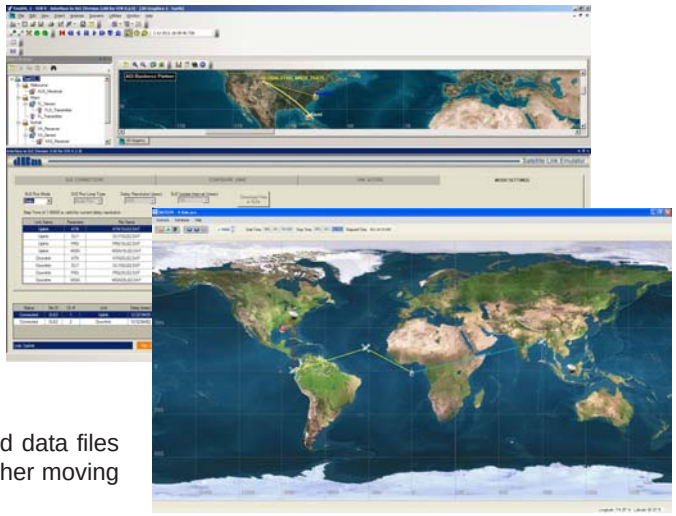
All communications between the user and the ACE is via a high speed LAN port or color touch sensitive front panel diaplay.

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



dBm's latest satellite orbit modeling software, SATGEN II, generates link parameter files formatted specifically for the ACE. The new SATGEN offers an enchanced 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 additional to the free space losses.

In addition the ACE9000 series can accept Analytical Graphics STK™ 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

dBm 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.

RF Test Equipment for Wireless Communications

Advanced Channel Emulator

Specifications (link mode)

Model number	ACE9072	ACE9125	ACE9300	ACE9600
Center frequency	1125MHz	1125MHz	1125MHz	1125MHz
1 dB RF bandwidth	72 MHz	125MHz	300MHz	600MHz
Minimum delay per channel	20us	20us	7us	7us
Maximum delay per channel	700ms	700ms	700ms	700ms

Number of independent channels	1,2, 3 or 4
RF input power	0 dBm max.
RF output power	0 dBm max
In-band spurious suppression	-55 dBc typ, -45 dBc max
Noise floor	IF option: -143 dBm/Hz typical, L-band option: - 138dBm/Hz typical
Amplitude ripple	IF option: <0.5 dB p-p, L-band option: < 1.5 dB p-p
Group Delay	IF option: < 5 ns p-p, L-band option: < 8 ns p-p
VSWR	<1.5:1 max into 50 ohms
Delay	
Range:	20us to 700 msec @ 72MHz & 125MHz BW
	7us to 700 msec @ 300MHz & 600MHz BW
Resolution:	
Static mode	0.1 ns
Dynamic mode	0.1 ps
Slew rate:	0.1 ps/sec up to 2 us/ms
Relative accuracy:	± 1 ns plus 10MHz reference
Frequency offset	
Range:	± 6.0 MHz
Resolution:	0.01Hz
Absolute accuracy:	based on 10MHz, reference ± 0.01Hz
Attenuation	
Range:	0 dB to 70 dB
Resolution:	0.10 dB
Slew rate:	>70 dB/ms
Accuracy:	± 0.20 dB
Phase Offset	
Range:	0 to 359.9°
Resolution:	0.1°
Accuracy:	<1°
Internal L-band Converters	
Range	700MHz to 2300MHz (center frequency)
tuning step	1MHz
Additive Whiite Gaussian Noise	
Crest factor:	>16 dB
Repetition Interval:	> 24 hrs
PDF Accuracy:	<1% from theoretical Gaussian over 6.666σ
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:	<=0.01 dB
Noise density amplitude accuracy:	<+/- 0.2 dB
Eb/No	
Ratio resolution:	0.01 dB
Rate accuracy:	+/- 0.2

RF Test Equipment for Wireless Communications

Advanced Channel Emulator

Specifications Con't

Multipath Fading	
No. of paths:	12
Path characteristics	
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):	SQRT $\{1-(f/fd)^2\}^{-1}$ with 6 dB peak @ fd
PDF:	within 0.5 dB of theoretical from 10 dB above to 30 dB below mean
Level crossing rate:	<+/-2.5% from theoretical, -30 dB to +9 dB
Attenuation range:	0 to 30 dB
Attenuation resolution:	0.1 dB
Doppler spread:	0 to 10KHz
Doppler resolution:	1Hz
Delay range:	0 to 10 usec
Delay resolution:	1ns
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°
Dynamic mode	
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 10MHz 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:	>vitually unlimited (SD memory 32 GB)
Control and Interface	
Local:	Front panel
Remote:	RJ45, IEEE-802.3
Internal Frequency reference error	< 2.5 PPM
Primary power	
Voltage:	85 – 264 VAC autoranging
Frequency:	47 – 440Hz
Consumption:	470 VA max.
Fuse:	8A slow-blow
Operating ambient temp	+10°C to +40°C
Dimensions	17" W x 7.0" H x 21" D
Weight	
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

Distributor

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