Communication Machinery Corporation

EmulationEngine™

Data Sheet

- **802.11 Station Emulation.** Create fully configurable *Virtual Stations* (*vSTA*™) that emulate 802.11 Wireless Local Area Network stations each with its own IP and MAC address.
- **64 Stations on a single emulator.** Emulate 1 to 64 concurrent 802.11 users on a single small device, greatly reducing the cost, complexity and control issues of testing with multiple PCs.
- **Scalability and capacity testing of Wireless LANs and 802.11 products.** Multi-station traffic load and stress testing of performance, end-user capacity and system scalability.
- **802.11 traffic is generated per individual *vSTA*.**
  - **Internal** – Data traffic is generated by each *vSTA* in the EmulationEngine (Ping) and actively injected through the 802.11 *vSTA*s into AP and WLAN system under test.
  - **External** - Data is sourced from a third party load generator, injected over 802.3 Ethernet, mapped to each *vSTA* by either MAC or IP address, and forwarded over the WLAN by the emulator.
- **Each *vSTA* is an individually authenticated, associated 802.11 station.**
- **Support for WEP, DHCP, RTS/CTS, Fragmentation.**
- **Support for 802.11a, b or g**. Emulator comes in three product versions:
  - EmulationEngine 11a: 802.11a support
  - EmulationEngine 11b: 802.11b support
  - EmulationEngine 11a/b/g: multi-mode emulator; selectable support for 11a, b or g

Major System Components

vSTA - Virtual 802.11 Station

- Each *vSTA* has unique, user-configurable MAC and IP addresses.
- *VSTAs* support 802.11 Authentication, Association, Deauthentication and Disassociation.
- WLAN 802.11 frames are transmitted and received using configurable *vSTA* MAC and IP addresses.
- *vSTA* traffic loading is generated or forwarded per individual *vSTA*.
- Support for DHCP, RTS/CTS, Fragmentation, system level Power Save Mode and Transmit Power control.
- Maintain persistent *physical* station state & perform Scan/Join portion of 802.11 association state machine.

User Interface – Command and Control

- Web-based user interface for command, control and configuration.
- Command Line Interface (CLI) supports automation and scripting control.
- User interacts with *vSTAs* in real-time.
- Full user control of *vSTA*, load application attributes, statistics and monitoring

Perl SDK – Application Programming Interface

- Create Perl scripts that configure an EmulationEngine, vSTA, and perform other functions programmatically as provided by the EmulationEngine CLI.

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EmulationEngine™ Data Sheet

EEDashBoard™ - Monitor a Test

- Collect and log performance data in real-time.
- Graphically display system and *vSTA* statistics during test execution.
- Export monitor data to PC in a comma-separated values (CSV) text file.

EEScheduling™– v*STA* Sequence Control

- Inject *vSTA*s into a running test at a user pre-defined quantity and rate.
- Emulates real world user loading environment for more accurate user-in-the-loop testing.

EEScenario™ – Test Definition File

- Logical construction encompassing key aspects of a multiple *vSTA* test run.
- Aggregate *vSTA*s into logical Groups to simulate processes or other significant loading profiles.
- Save within non-volatile memory in the EmulationEngine or to a PC for repeat tests and sharing of test set-up.

Internal Mode – Traffic Generator, Ping

- Fully configurable ICMP Echo Request/Reply traffic is sent to selectable hosts from each *vSTA*.
- Separate receive and transmit processes use each individual *vSTA*'s IP address then increments *vSTA* statistics and computes packet round trip times.

External Mode – 3rd Party Traffic Integrator

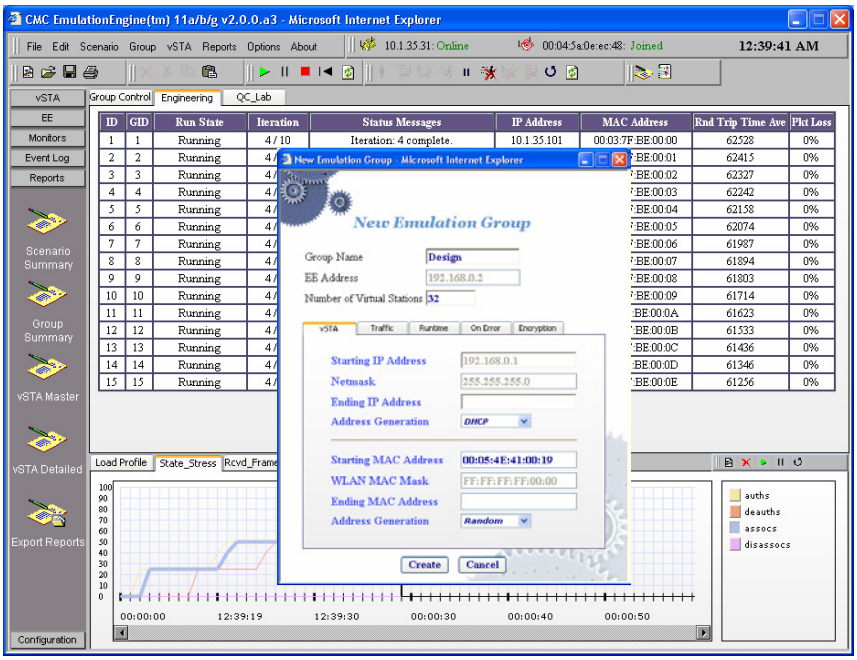
- Data traffic loading is applied from a 3rd party traffic generator over emulator's 802.3 Ethernet port and forwarded over the WLAN as 802.11 traffic by the emulator.
- Data streams from the traffic generator are mapped to each *vSTA* in two selectable modes:
  - Layer 2 Capture: captures frames based on 802.3 traffic MAC source address and forwards through vSTA.
  - Layer 3 Capture: captures frames based on IP source address.

EEAnalyst™ - Analyze Test Data

- Collect test summary and individual *vSTA* statistics from test run.
- View and print multiple types of reports by group or by *vSTA*.
- Collect time stamped (µSec) log/audit trail of commands, responses and notifications per each *vSTA* executed during testing.
- Archive test statistics and data logs to PC as comma-separated values (CSV) file.

Monitoring and Results - Statistics Counters

- Counters from the following categories can be selected for viewing as monitors in the Web browser and as reports at the end of a test:
  - Management Counters
  - Ping Statistics
  - Signal Quality Indication
  - Frame Counts
  - Error Statistics



EmulationEngine

Dimensions
L = 9.25 inches
W= 6.38 inches
H = 1.63 inches

Ports
(1) 10/100Base-T, RJ-45(UTP)
(1) RS-232 (DB9)
(1) Power - 5V DC, 2.5A

Standards
IEEE 802.11a
IEEE 802.11b
IEEE 802.11g
IEEE 802.3
IEEE 802.3u
IEEE 802.1d

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EmulationEngine™ 11a/b/g

Specifications

Communication Machinery Corporation's EmulationEngine™ product family is a valuable new category of testing tools. It enables 802.11 product developers, WLAN installers, and wireless network administrators to do capacity and stress testing of wireless networks and 802.11 products through direct and user-controlled emulation of multiple "virtual" wireless stations (vSTA™).

- Wi-Fi Station Emulation (*vSTA*™)
- 802.11a, 802.11b or Multi-Mode 11a/b/g Emulator
- Up to 64 Concurrent Wi-Fi Users Per Emulator
- Test 802.11 Product Performance, Capacity and Scalability
- Multi-Station WLAN Load and Stress Testing
- *vSTAs* are Individually 802.11 Authenticated & Associated
- Supports WEP, DHCP, RTS/CTS, Fragmentation
- 802.11 Traffic is Generated Per Individual *vSTA*
- Integrates with 3rd Party Network Traffic Generators

Features

- Supports IEEE 802.11a, 802.11b, 802.11g
- Emulates up to 64 concurrent virtual stations (vSTAs)
- Interaction with virtual stations in real time
- Configuration and monitoring of virtual stations
- Internally inject load into a System Under Test (SUT)
- Externally forward load from third-party traffic generator into a System Under Test
- Log and performance statistics data
- vSTA support: 802.11 Authentication, Association, De-authentication, Disassociation
- ICMP Echo Request/Reply (Ping)
- WEP Encryption (Shared static key for authentication and data) per virtual station
- Persistent connection to the System Under Test
- Command Line Interface (CLI) and Web-Based User Interface.
- Telnet and Serial Port access to the CLI
- Automatically configure and run multiple virtual stations via the CLI

Web-Based User Interface Supports:

- Different types of graphs per time and virtual station
- Export of event log and statistics data
- Scenario scheduling to bring virtual stations online in a time appointed manner
- User defined virtual station groups based on end-user requirements
- Multiple types of reports
- The ability to save test scenario files in order to repeat a test
- Configuration and monitoring of virtual stations include: copy and paste, printing, and add and delete virtual stations
- The ability to select a System Under Test
- The ability to set up groups and select individual virtual stations to run through the 802.11 state machine

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Hardware

Standards: IEEE 802.3, 802.3u, 802.1d, 802.11a, 802.11b, 802.11g

Ports:

- (1) 10/100Base-T Ethernet, RJ-45(UTP)
- (1) RS-232 (DB9)
- (1) Power - 5V DC, 2.5A

Frequency Range: 802.11a: 5GHz Unlicensed National Information Infrastructure (UNII) band, 802.11b/g: 2.4 GHz band.

Modulation Technology: Orthogonal Division Frequency Multiplexing (OFDM) and Complementary Code Keying (CCK)

Receiver Sensitivity:

- 54, 48, 36, 24, 18, 9, 6 Mbps OFDM
- 11, 5.5 Mbps CCK
- 2 Mbps QPSK (Quadrature Phase Shift Keying)
- 1 Mbps BPSK (Binary Phase Shift Keying)

Media Access Control: CSMA/CA

Wireless Frequency Range:

- 2.4 to 2.4825 MHz
- 5.150 to 5.850 GHz

LEDs: Power, Ethernet Link/Activity, Wireless Activity

Antenna Type: Tri-mode dual 5dBi dipole antennas with diversity, Power software configurable.

Physical Dimensions:

- L = 9.25 inches
- W= 6.38 inches
- H = 1.63 inches

Temperature

- Operating: 0°C to 55°C (32°F to 131°F)
- Storing: -20°C to 65°C (-4°F to 149°F)

Humidity: 5%-95%, non-condensing

Safety and Emissions: FCC

Channels supported in GHz: 802.**11a**: 36(5.180), 40(5.200), 44(5.220), 48(5.240), 52(5.260), 56(5.280), 60(5.300), 64 (5.320), 149 (5.745), 153 (5.765), 157 (5.785), 161 (5.805), 165 (5.825). 802.11**b/g**: 1 (2.412), 2 (2.417), 3 (2.422), 4 (2.427), 5 (2.432), 6 (2.437), 7 (2.442), 8 (2.447), 9 (2.452), 10 (2.457), 11 (2.462).

Software

EmulationEngine Core:

- IEEE 802.11a, 802.11b, 802.11g
- Maximum number of vSTAs: 64

Performance:

- Average Latency per frame (uSec) at 54 Mbps: EmulationEngine-to-SUT: minimum 263, maximum 609, average 279. SUT-to-EmulationEngine: minimum 279, maximum 574, average 315.
- Internal traffic ping rate: 4 pings/sec/vSTA with packet size 0...1024 bytes. Maximum rate: 4 x 64 vSTA=256 packet/sec
- Rate of vSTA authentication/association management frames: 1 authentication or association each 50 milliseconds

Network Management: Web-Based browser with JavaScript and Command Line Interface (CLI)

Web-Based User Interface:

- Maximum number of groups per Scenario: 10
- Maximum monitors per Scenario: 4

Encryption:

- Cipher Encryption Mode: Shared WEP key per vSTA
- Authentication: Open-system and shared keys per vSTA
- Shared keys: up to 4 keys
- Shared WEP encryption keys: 64-, 128-, 152-bit

RTS/CTS: Support for RTS/CTS

Fragmentation: Fragment Threshold support

Rates: 802.**11a**: 6, 9, 12, 18, 24, 26, 48, 54 Mbps. 802.**11b**: 1, 2, 5.5, 11 Mbps. 802.**11g**: 1, 2, 5.5, 11, 6, 9, 12, 18, 24, 36, 48, 54.

Circular Event Log: up to 8000 records

Telnet Sessions: up to 4

Maximum 802.3 packet size: 1518 bytes

802.11 Emulation: Fully emulates 802.11 station states in terms of: authentication, association, disassociation, de-authentication

Operational Mode: Constant Awake Mode (CAM)

External mode: IP traffic only

Internal Log-In: user name and password

Flash size: 3.0 MBytes Total/1.2 MBytes Available for storing scenarios, event logs and statistics

Throughput per vSTA per Packet Length in External Mode

NOTE: All performance data was collected in an open air enterprise environment. Performance results may vary depending on the device being tested as the EmulationEngine assesses the entire System Under Test (SUT).

All values in this table are Mbps	64 Bytes			1024 Bytes			1518 Bytes		
	11a	11b	11g	11a	11b	11g	11a	11b	11g
Bi-Directional 1 vSTA	3.15	0.51	1.01	26.29	4.64	7.45	30.89	5.44	9.14
Bi-Directional 30 vSTAs	3.14	0.45	0.97	26.22	4.56	7.12	30.58	5.33	9.02
Bi-Directional 59 vSTAs	3.16	0.46	0.82	26.19	4.52	6.44	30.64	5.29	8.96
EmulationEngine-to-SUT 1 vSTA	2.76	0.36	2.53	25.02	4.08	22.42	30.29	5.06	26.72
EmulationEngine-to-SUT 30 vSTAs	2.75	0.36	2.42	25.05	3.98	22.14	30.13	4.99	26.88
EmulationEngine-to-SUT 59 vSTAs	2.79	0.34	2.43	25.09	3.93	21.53	30.01	4.98	26.91
SUT-to-EmulationEngine 1 vSTA	2.71	0.65	2.22	24.58	5.16	20.48	29.14	6.07	23.81
SUT-to-EmulationEngine 30 vSTAs	2.71	0.64	2.24	24.61	5.17	19.11	29.33	6.12	24.87
SUT-to-EmulationEngine 59 vSTAs	2.69	0.63	2.27	24.82	5.24	18.31	29.75	6.25	25.51

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	64Bytes	128Bytes	256Bytes	512Bytes	1024Bytes	1280Bytes	1518Bytes
Maximum 802.3 Sustainable Rate without Web-Based User Interface	76.19Mbps	86.48Mbps	92.75Mbps	96.23Mbps	98.08Mbps	98.46Mbps	98.70Mbps
	148,810pps	84,460pps	45,290pps	23,496pps	11,973pps	9,616pps	8,128pps
802.11a: Maximum 802.3 rate with Web-Based User Interface	2.56Mbps	5.12Mbps	9.83Mbps	18.02Mbps	27.85Mbps	30.72Mbps	34.00Mbps
	5000pps	5000pps	4800pps	4400pps	3400pps	3000pps	2800pps
802.11b: Maximum 802.3 rate with Web-Based User Interface	0.51Mbps	0.80Mbps	1.61Mbps	2.59Mbps	4.28Mbps	4.30Mbps	5.08Mbps
	1000pps	781pps	781pps	634pps	523pps	420pps	419pps
802.11g: Maximum 802.3 rate with Web-Based User Interface	2.20Mbps	4.19Mbps	7.41Mbps	13.57Mbps	21.57Mbps	22.97Mbps	24.50Mbps
	4300pps	4100pps	3619pps	3314pps	2634pps	2244pps	2018pps

Notes: 1) Frames include TCP/IP header plus data packet, 2) Data Packet is the payload within the frame, 3) pps = Packets-per-Second.

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5GHz/2.4GHz

Dual Band Wireless Mini-PCI Adapter

Model no. NL-5354MP Aries

Up to 108Mbps

Feature	Benefit
Flexible design for embedded system	Can be designed for OEM project /embedded system
2.4GHz IEEE802.11b/g (draft) standard and 5GHz IEEE802.11a standard compliant	Fully interoperable with IEEE802.11a/b/g (draft) compliant products.
Up to 54Mbps and 108Mps (turbo mode) high-speed data rates	Capable of handling heavy data payloads such as MPEG video streaming
Up to 152-bit WEP data encryption with TKIP	Powerful data security.
IEEE802.1x Client support (Optional)	Enhances authentication and security.
Dynamic Frequency Selection (DFS) support	Provides flexible selection of the best frequency to allow mobility among all existing IEEE802.11a/b/g networks.
Transmission Power Control (TPC) support	Offers flexibility to adjust RF output power.
Multi-country Roaming (802.11d) support	Automatically adjusts regulatory domain to operate in different countries.

General

Data Rates (Auto-rate capable)	**802.11a :** 6, 9, 12, 18, 24, 36, 48, 54 & 108Mbps (Turbo Mode) **802.11g :** 6, 9, 12, 18, 24, 36, 48 & 54Mbps. **802.11b :** 1, 2, 5.5, 11Mbps.
Network Standards	WECA (Wi-Fi & Wi-Fi5), IEEE802.11 , IEEE802.11a , IEEE802.11 g draft, IEEE802.11b, draft IEEE 802.11e, f, h, and i standards
Compliance	FCC Part 15 Class B , ETSI 300.328, ETSI 300 826, CE mark
Drivers	Windows 98/ME/2000/XP
Operational voltage	3.3 V
Security	• IEEE802.1x Support for LEAP (Optional) • WPA - Wi-Fi Protected Access (64,128,152-WEP with TKIP) • AES (Advance Encryption Security) Support

RF Information

Frequency Band	**802.11a** • 5.15~5.25GHz, 5.25~5.35GHz, 5.725~5.825GHz

	802.11b/g • 2.412~2.462GHz(US) • 2.412~2.484GHz(Japan) • 2.412~2.472GHz(Europe ETSI) • 2.457~2.462GHz(Spain) • 2.457~2.472GHz(France)
Media Access Protocol	CSMA/CA with ACK
Modulation Technology	**802.11a/g :** OFDM (64-QAM, 16-QAM, QPSK, BPSK) **802.11b :** DSSS (DBPSK, DQPSK, CCK)
Receive Sensitivity	**802.11a :** -84dBm @ 6Mbps -77dBm @ 18Mbps -70dBm @ 48Mbps -82dBm @ 9Mbps -75dBm @ 24Mbps -68dBm @ 54Mbps -79dBm @ 12Mbps -73dBm @ 36Mbps **802.11b/g :** -91dBm @ 1Mbps -84dBm @ 6Mbps -75dBm @ 24Mbp -90dBm @ 2Mbps -82dBm @ 9Mbps -73dBm @ 36Mbps -89dBm @ 5.5Mbps -79dBm @ 12Mbps -70dBm @ 48Mbps -87dBm @ 11Mbps -77dBm @ 18Mbps -68dBm @ 54Mbps
Transmit Output Power (Typical)	**802.11a :** 18dBm +/-2 @6-24Mbps 15dBm +/-2 @54Mbps 17dBm +/-2 @36Mbps 13dBm +/-2 @108Mbps 16dBm +/-2 @48Mbps **802.11 g :** 20dBm +/-2dBm @ 6~24Mbps 17dBm +/-2dBm @ 48 Mbps 19dBm +/-2dBm @ 36 Mbps 15dBm +/-2dBm @ 54 Mbps **802.11b :** 20dBm +/-2dBm for all rates
Physical	
Interface	Mini PCI Type 3A
Connector	2 x U.FL connectors
Dimensions (HxWxL)	4.8mm x 59.6mm x 50.9mm (0.2in x 2.3in x 2in)
Weight	15 g (0.53 oz.)
Environmental	
Temperature Range	0°C to 55°C (32°F to 131°F) - Operating -40°Cto 70°C(-40°F to 158°F) - Storage
Humidity (non-condensing)	5%~95% Typical

Update by 2003/7/4

All specifications are subject to change without notice.