ARADA SYSTEMS

Fueling Advanced Intelligent Transportation Systems

LocoMate™ RSU | Road Side Unit with NEMA Enclosure

Key Benefits

Hardware

- Wireless access for vehicular environment
- 5.700 to 5.925 GHz frequencies
- 10 MHz and 20 MHz channel bandwidth
- Weather proof NEMA, IP67 rated enclosure
- Fully Power-Over-Ethernet enabled
- Options for 2 DSRC radio
- Utilize radio designed by Arada Systems
- High throughput capability for varied Applications
- Efficient handling of WSMP (WAVE Short Messaging Protocol) and IP traffic

Software

- WAVE Standards Support
  - 802.11p
  - 1609.2
  - 1609.3
  - 1609.4
  - SAE J2735
- Fast channel switching capabilities
- Switching capability between control and service channels
- Multi-channel synchronization between service users
- Exclusive packet control
  - tx power control per packet
  - data rate control per packet
- Remote application support
- Software development kit (SDK) for application development

WAVE Mode

- Support for 5.9 GHz spectrum with 10 MHz channel width
- Support for WAVE data and management frames
- Support for multi channel (control channel and service channel) using single radio
- <= 3 mS channel switch time irrespective of traffic conditions
- Can preempt messages in transmit queue
- Support for multiple priority queues
- Support for GPS-based synchronization

ITSA MEMBER — Intelligent Transportation Systems America Member

OmniAir Certified Member

US DOT CERTIFIED — Approved US Department of Transportation Qualify Product List Vendor

C2C — The CAR-2-CAR Communication Consortium Member

1609 WAVE SUPPORT 2 3 4 — WAVE standard support 1609.2, 1609.3, 1609.4

SAE J2735 — SAE J2735 Support

PoE — Power-over-Ethernet

DSRC 802.11p 5.9 — Dedicated Short Range 5.9 Communication 802.11p

Product Highlights

An integration of GPS and Wi-Fi, LocoMate™ RSU is ideal for telematic applications by allowing vehicles on the road to talk to each other or to another road side unit (RSU). The special Industrial Grade NEMA enclosure option provides for special outdoor Road Side Unit deployment.

It is fully compliant with Omni-Air's certification and is used in worldwide deployments including the US Department of Transportations' Safety Pilot in Ann Arbor, Michigan. Product applications include: Signal Coordination, Emergency Vehicle Management, Train Crossing,Tolling, Taxi Management, Geo-Fencing, MESH, and CLOUD.

LocoMate™ RSU comes in an industrial outdoor NEMA rated enclosure that allows for seamless outdoor deployments with a full DSRC WAVE software solution. The solution comes integrated with GPS, Bluetooth and high-power 802.11p radios.

WAVE Protocols
- 802.11p (WAVE)
- EEE 1609.2
- IEEE 1609.3
- IEEE 1609.4
- SAE J2735

Frequency
- 5.85 - 5.925 GHz
- 5.7 - 5.8 GHz (Europe)

DSRC Radio
- High power miniPCI optimized for 5.9 GHz
- 5.9 GHz: +23dBm at 64QAM from -40°C- +85°C

GPS Device
- GPS with internal RF antenna
- Accuracy <1m

Power Supply
- 802.3af PoE compliant
- IEC60950 compliant

Multi-channel operation
- Consistent 3 mS channel switch time

Supplementary 802.11 MAC features
- Control Channel (CCH) and Service Channels coordination
- 50 mS channel dwell time
- CCH for broadcast, high-priority and single-use safety messages and SCH for IP data

Channel Access
- Alternative, continuous

Channel Switching
- Consistent 3 mS switch time at every 50 mS

Software Queuing
- Transmit queues per channel
- Prioritized channel access queues, with configurable channel access parameters

Database Configuration
- CLI
- Database file backup, restore

Platform
- Linux/Unix compatible
- SDK with C libraries

Interactive Communication
- ssh/telnet

IP Protocols
- ipv4 / ipv6

Network Configuration
- Wired and DSRC
- ipv4 configuration
- ipv6 configuration
- SIT Tunnel Support

US DOT RSE spec
- QPL vendor

GPS Applications
- Approx. 1m accuracy
- Path history implementation
- Path prediction implementation

Local Time Synchronization
- GPS along with PPS

Security
- Signing and verification of messages, encryption and decryption of messages
- Signing and verification of WSAs

Message Logging
- DSRC Transmit packets, DSRC Receive Packets, Ethernet packets
- System events
- Heartbeat messages with configuration (ipv4 or ipv6)
- Log offload configuration (ipv4 or ipv6)
- Wave Service Announcement configuration

LEDs
- DSRC packet transmission
- Firmware upgrade

Software Development Kit
- Linux based tool chain
- Application library
- Sample applications
- Programmer guide
- User guide
- SAE J2735 ASN library
- Sample applications include the following J2735 message formats: BSM, SPAT, MAP, TIM
- Sample applications include GPS data extraction

Data and Management Planes
- UDP/TCP and WAVE Short Messaging Protocol (WSMP) support
- Manages WAVE Basic Service Set (WBSS)
- Application management

Channel Bandwidth
- WAVE mode (802.11p) at 5.9 GHz: reduced to 10 MHz, supports 20 MHz channels

DSRC Message Set - SAE J2735
- BSM Part I, BSM Part II
- SPAT, MAP, TIM

Flash/RAM
- 16 MB Flash
- 64 MB SDRAM (512 Mbits)

Shared Library
Applications Shared Library with Windows/Linux support for application development

Applications Support
- Menu-driven tool
- IP based applications
- WSM-based applications
- Periodic transmit of GPS data
- Remote and logging applications

Certificate Management
- 1609 certificate update
- Support for time limited 1609 certificate

DSRC Channel Support	
10 MHz Channels	Frequency (MHz)
172	5860
174	5870
176	5880
178	5890
180	5900
182	5910
184	5920
20 MHz Channels	Frequency (MHz)
173	5865
175	5875
177	5885
179	5895
181	5905
183	5915

Throughput Traffic Test Results Half-Rates on Channel 172 (Mbps) Without Channel Switch								
Rates	3M	4.5M	6M	9M	12M	18M	24M	27M
TCP	2.36	3.37	4.34	6.32	7.97	11.23	13.54	14.75
UDP	2.38	3.50	4.37	6.99	9.00	12.96	15.81	17.32

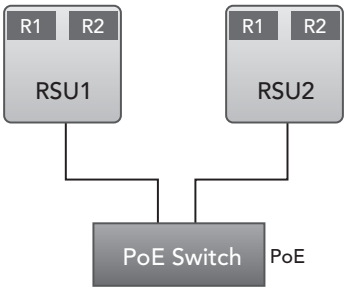
Throughput Traffic Test Results Full-Rates on Channel 175 (Mbps) Without Channel Switch		
20 MHz Data Rates	TCP	UDP
6M	4.7	5.0
9M	6.7	7.2
12M	9.8	10.5
18M	12.9	14.52
24M	16.6	18.661
36M	22.630	26.022
48M	27.782	32.231

TCP/UDP Throughput in Different Channels		
	TCP (Mbps)	UDP (Mbps)
WAVE operation in 20 MHz (max. phy rate=54 Mbps)	27.780	32.231
WAVE operation in 10 MHz (max. phy rate=27 Mbps)	14.75	17.32
WAVE operation in 10 MHz, with periodic channel switch	6.9	8.6

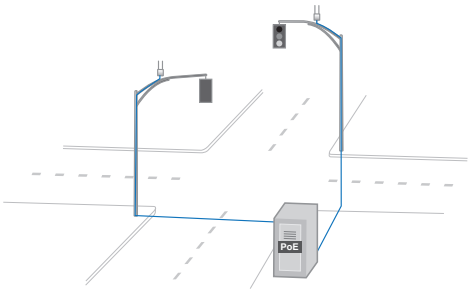
Average per Packet Latency Values with Different Content Type Messages			
	Plain	Sign/Sign Verify	Encrypted/ Decrypted
Average packet interval with 100 mS transmit periodicity	102 mS	112 mS	139 mS
Latency	2 mS	10 mS	35-40 mS

802.11p Radio Specifications			
Modulation	Data Rate	TX	RX
BPSK	3 Mbps	23±1dBm	-95±2dBm
16QAM	18 Mbps	23±1dBm	-83±2dBm
64QAM	27 Mbps	23±1dBm	-77±2dBm
Other Specifications			
Antenna Interface	N-Connector		
Operating Temperature	-40°C to +80°C (output power specified over full temperature profile)		
Channel Bandwidth	10 MHz, 20 MHz (FCC "Class C" Mask Compliant)		
Operating Voltage/Current	Input Voltage Range: 48-52V DC / 400mA Max.		

Antenna Information			
Antenna Configuration	V.S.W.R. (MAX) 1.5:1	Antenna Gain	12 dBi
Antenna Type	Collinear	Impedance	50 Ohms
Radiation	Omni Directional	Polarization	Vertical
Vertical Beam Width	8 Degrees	Horizontal Beam Width	360 Degrees
Maximum Power	100 watts	Max, nominal, Min. EIRP	34dBm, 30dBm, 10dBm



LocoMate™ 202 RSU Kit



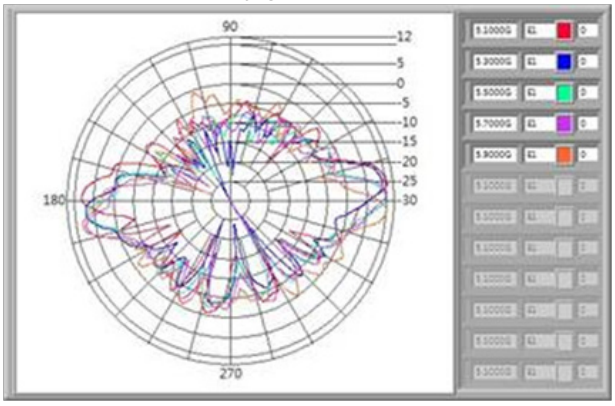
Deployment Scenario

Ordering Information

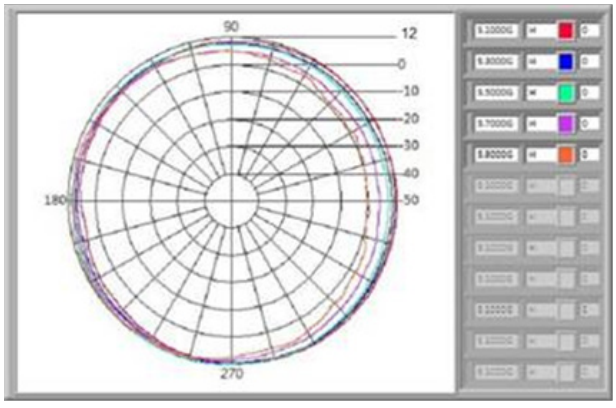
LocoMate™ 200 RSU (Single unit, single radio)
Unit Dimensions 23.5 x 25.5 x 6.5 cm
Unit Weight 1.1 Kg
Package Dimensions: 40 x 24 x 9 cm
Package Weight 2.3 Kg
sales@aradasystems.com

Antenna Patterns

E-Plane



H-Plane



ARADA SYSTEMS

www.aradasystems.com

Arada Systems is a leader in technologies meant for vehicle-based communication networks, particularly for applications such as toll collection, vehicle safety services, and commerce transactions via cars. LocoMate™ is being evaluated for real-time communication between vehicles and roadside access points or other vehicles creating a real-time public safety network.

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