

## LocoMate ROOF™ | DSRC Roof Mounted device for Connected Car

### Key Benefits

#### Hardware

- USB Powered Device
- Plug, Play & Test
- 5.85 GHz to 5.9 GHz
- Embedded Antenna without Cable Loss
- Integrated with Bluetooth and GPS
- Maximum Line of Site range to 1KM
- Throughput up to 27 Mbps
- FCC/CE/ROHS/USDOT Certified

#### Software

- WAVE Standards Support
  - IEEE 802.11p
  - IEEE 1609.2
  - IEEE 1609.3
  - IEEE 1609.4
  - SAE J2735
  - VAD/CAMP
- 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



Intelligent Transportation Systems America Member



OmniAir Certified Member



Approved US Dept of Transportation Qualify Product List Vendor



The CAR-2-CAR Communication Consortium Member



WAVE standard support 1609.2, 1609.3, 1609.4



SAE J2735 Support



Bluetooth Support for Mobile



Dedicated Short Range 5.9 Communication 802.11p



CAN BUS Support

### Product Highlights - The First DSRC Roof Mount Device without Cable Loss

An integration of GPS, DSRC, and Bluetooth, LocoMate™ ROOF is ideal for safety and V2X applications by allowing vehicles on the road to talk to each other or to another road side unit. 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: Collision Avoidance, Emergency Vehicle Management, Train Crossing, Tolling, Commerce Applications (\$), Truck Platooning, Taxi Management and Geo-Fencing.

LocoMate™ Roof communicates using DSRC Wi-Fi to receive traffic safety information from vehicles who have CONNECTED CAR technology and through Intersections (V2I). LocoMate™ comes integrated with GPS (LESS than 1 meter accuracy), Bluetooth and high-power 802.11p radios.

Recommended Accessories: Development Board and On-Board Development Platform

**WAVE Protocols**

- 802.11p (WAVE)
- IEEE 1609.2
- IEEE 1609.3
- IEEE 1609.4
- SAE J2735
- VAD/CAMP

**Frequency**

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

**DSRC Radio**

- Integrated High-Power DSRC 5.9 GHz Radio
- Power: +24dBm at 16QAM, from -40°C- +85°C

**GPS Device**

- GPS with embedded RF antenna
- Accuracy Less Than <1 meter

**Bluetooth**

- Communicate to smart phones using bluetooth
- Communicate to CAN via Bluetooth

**Multi-channel operation**

- Consistent 3 mS channel switch time

**Supplementary 802.11 MAC features**

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

**Power Supply**

- Standard 5V Micro USB Charger

**Channel Access**

- Alternative, continuous

**Channel Switching**

- Consistent 3 mS switch time at every 50 mS
- Multichannel channel access and switching

**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 (must have another OBU)
- Android support on smartphone applications

**Interactive Communication**

- ssh/telnet

**IP Protocols**

- ipv4 / ipv6

**Network Configuration**

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

**US DOT VAD 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
- Bluetooth Activity
- GPS Fixed Achieved
- Power On

**Human Machine Interface**

- Smart phones HMI device w/ bluetooth interface

**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, SAE J2735
- 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
54M		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	24±1dBm	-95±2dBm
16QAM	18 Mbps	24±1dBm	-83±2dBm
64QAM	27 Mbps	21±1dBm	-77±2dBm
Other Specifications			
Operating Temperature	-40°C to +85°C (output power specified over full temperature profile)		
Channel Bandwidth	10 MHz, 20 MHz (FCC "Class C" Mask Compliant)		

### Ordering Information

LocoMate Roof™ Roof Mounted Connected V2X  
 Part # OBU-213  
 Unit Dimensions 8.4cm x 10.5 x 1.6 cm  
 Unit Weight 293 grams  
 Package Dimensions 21.7 x 12.2 x 6.6cm  
 Package Weight 350g  
 Power Requirements 5V DC, 900mA

For sales information please contact :  
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### About Arada Systems

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.