LocoMate™ | Dual DSRC Classic On Board Unit

**Key Benefits**

**Hardware**
- Wireless access for vehicular environment
- 5.700 to 5.925 GHz frequencies
- 10 MHz and 20 MHz channel bandwidth
- Dual DSRC Radios
- Radios designed by Arada Systems
- High throughput for varied applications
- Efficient handling of WSMP (WAVE Short Messaging Protocol) + IP traffic
- USDOT ASD SPEC

**Software**
- WAVE Standards Support
  - 802.11p, 1609.2, 1609.3, 1609.4
- Safety Messaging Alert System like
  - Emergency Electronic Brake Light
  - Forward Collision Warning
  - Curve Speed Warning
- SPat/MaP message processing
- Fast channel switching capabilities
- Switching capability between control and service channels
- Multi-channel synchronization
- Exclusive packet control
  - TX power control per packet
  - Data rate control per packet
- Remote application support
- Software development kit (SDK)

**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)
- <= 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

**Security**
- Security Credential Management System (SCMS)
- Certificate Revoke List (CRL)
- Local Certificate Management
  - Misbehaviour Report
  - CRL Handling

**Product Highlights**

An integration of GPS and Wi-Fi, LocoMate™ CLASSIC OBU with Dual DSRC Radios, is ideal for telematic 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 Transportation’s 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 OBU comes in a small form factor for in-vehicle deployment and comes with a full DSRC WAVE software solution and applications for integration with Smart Phones to ease the human-user-interface. The solution comes integrated with GPS (with better than 1 meter accuracy), Bluetooth and high-power 802.11p radios.
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

GPS Device
• GPS with external RF antenna
• Accuracy <1m

Bluetooth
• OBU – Bluetooth radio allows sniffing Bluetooth radios around the OBU

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

Output Power
• 5.9 GHz: +23dBm at 64QAM from -40°C to +85°C

Platform
• Linux/Unix compatible
• SDK with C libraries

Database Configuration
• CLI
• Database file backup, restore

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

Interactive Communication
• ssh/telnet

Network Protocol
• ipv4 / ipv6

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

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

US DOT VAD spec
• QPL vendor

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
• USB storage access

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 Port I, BSM Port 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
<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>10 MHz Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>172</td>
<td>5860</td>
</tr>
<tr>
<td>174</td>
<td>5870</td>
</tr>
<tr>
<td>176</td>
<td>5880</td>
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<td>178</td>
<td>5890</td>
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<td>180</td>
<td>5900</td>
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<tr>
<td>182</td>
<td>5910</td>
</tr>
<tr>
<td>184</td>
<td>5920</td>
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</table>

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>20 MHz Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>173</td>
<td>5865</td>
</tr>
<tr>
<td>175</td>
<td>5875</td>
</tr>
<tr>
<td>177</td>
<td>5885</td>
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<td>179</td>
<td>5895</td>
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<tr>
<td>181</td>
<td>5905</td>
</tr>
<tr>
<td>183</td>
<td>5915</td>
</tr>
</tbody>
</table>

Throughput Traffic Test Results Half-Rates on Channel 172 (Mbps) Without Channel Switch

<table>
<thead>
<tr>
<th>Rates</th>
<th>3M</th>
<th>4.5M</th>
<th>6M</th>
<th>9M</th>
<th>12M</th>
<th>18M</th>
<th>24M</th>
<th>27M</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCP</td>
<td>2.36</td>
<td>3.37</td>
<td>4.34</td>
<td>6.32</td>
<td>7.97</td>
<td>11.23</td>
<td>13.54</td>
<td>14.75</td>
</tr>
<tr>
<td>UDP</td>
<td>2.38</td>
<td>3.50</td>
<td>4.37</td>
<td>6.99</td>
<td>9.00</td>
<td>12.96</td>
<td>15.81</td>
<td>17.32</td>
</tr>
</tbody>
</table>

Throughput Traffic Test Results Full-Rates on Channel 175 (Mbps) Without Channel Switch

<table>
<thead>
<tr>
<th>Rates</th>
<th>6M</th>
<th>9M</th>
<th>12M</th>
<th>18M</th>
<th>24M</th>
<th>36M</th>
<th>54M</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCP</td>
<td>4.7</td>
<td>6.7</td>
<td>9.8</td>
<td>12.9</td>
<td>16.6</td>
<td>22.630</td>
<td>27.782</td>
</tr>
<tr>
<td>UDP</td>
<td>5.0</td>
<td>7.2</td>
<td>10.5</td>
<td>14.52</td>
<td>18.661</td>
<td>26.022</td>
<td>32.231</td>
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</tbody>
</table>
### Specifications

<table>
<thead>
<tr>
<th>TCP/UDP Throughput in Different Channels</th>
</tr>
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<tbody>
<tr>
<td></td>
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<tr>
<td>TCP (Mbps)</td>
</tr>
<tr>
<td>WAVE operation in 20 MHz (max. phy rate=54 Mbps)</td>
</tr>
<tr>
<td>WAVE operation in 10 MHz (max. phy rate=27 Mbps)</td>
</tr>
<tr>
<td>WAVE operation in 10 MHz, with periodic channel switch</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Average per Packet Latency Values with Different Content Type Messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain</td>
</tr>
<tr>
<td>Average packet interval with 100 mS transmit periodicity</td>
</tr>
<tr>
<td>Latency</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>802.11p Radio Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulation</td>
</tr>
<tr>
<td>BPSK</td>
</tr>
<tr>
<td>16QAM</td>
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<tr>
<td>64QAM</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Other Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna Interface</td>
</tr>
<tr>
<td>Operating Temperature</td>
</tr>
<tr>
<td>Channel Bandwidth</td>
</tr>
</tbody>
</table>

### Ordering Information

LocoMate Dual DSRC Classic 200 OBU-On-Board Unit

- 200: Standard OBU
- 201: Standard OBU + Bluetooth
- 202: Standard OBU + CAN
- 203: Standard OBU + Bluetooth + CAN
- 204: Standard OBU + Storage (4 GB)
- 205: LocoMate VAD Kit (includes the standard OBU plus, quiet state board, Fakra connector, Delphi connector, 4 GB flash drive, surge protection compliant SAE J1113-11)
- 206: LocoMate ASD Kit

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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.