A leader in RFID

Emerging DSRC Technology

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Agenda

- Sirit Technologies and Radio Frequency Identification Background
- DSRC Industry Consortium “DIC”
- 5.9 GHz DSRC - Definition and Tolling Viewpoint
- DSRC Industry Players
- Need and Uses regarding Vehicle Safety and Mobility
- A New Form of Communications
- Regulatory and Frequency Allocation
- Standards under Development
- Issues being Worked
- DSRC Outlook and VII Program Plan
- Realistic Scenario - OBU and RSU Implementation
- Summary
Sirit & Radio Frequency Identification (RFID) Background

- Located in Toronto, Canada, Loughborough, United Kingdom and Dallas, Texas
- 10 years experience in developing and providing RFID readers and tags products in:
  - E-Commerce (13.56 MHz)
  - Supply Chain Logistics (ISO 18000 / EPC, 868-928 MHz)
  - Tolling and Parking/Access Control, E-470 in Colorado and Title 21 in California (915 MHz)
  - DSRC Technology (5.9 GHz)
DSRC Industry Consortium “DIC”

- Sirit is a participating member in the DSRC Industry Consortium Prototype Development with Mark IV, Raytheon and TransCore
  - Sirit is responsible for the Test Lead
- Sponsored by U.S. DOT (FHWA), administrated by ARINC and coordinated by Highway Electronics
- Other DSRC industry activities involve:
  - Federal DOT
    - Technical implementation, Prototype, Business planning, Policy, Outreach & Test Program
  - State DOTs
  - Vehicle Infrastructure Integration (VII) /National VII Coalition
    - First public workshop in San Francisco (February 2005)
  - OmniAir (certification/application)
  - IBTTA and ITS America
5.9 GHz DSRC

- DSRC (WAVE mode) = Wireless Access Vehicular Environment using Dedicated Short Range Communications
- DSRC has different regions meanings in transportation industry
  - North America (5.9 GHz)
  - Europe (5.8 GHz, CEN TC278)
  - Asia (Japan, 5.8 GHz/ARIB T75)
- Uses IEEE 802.11 Chipset Technology “Wi-Fi” and provides wireless communication in linking the business, home and car
- Major focus around Highway Safety and Mobility
- From standpoint of Tolling Industry, 5.9 GHz is:
  - ‘Tag’ of the Future in 2010 Decade
    - Probably built-in (device) versus added-on (tag)
  - Standardized Technology
  - Requires new In-lane Equipment
    - Non-interference = simple, graceful migration
- U.S. DOT could “MANDATE” the Technology for Safety
Need and Uses

Safety and Mobility
- New system is needed to reduce fatalities (42,000 annually) and relieve increasing traffic congestion
- U.S. DOT’s Priority one is “Intersection / Road Departure Collisions” Prevention
  - Other high priorities include collision avoidance, crash responses and vehicle based safety data
- VII (vehicle infrastructure integration) team identified ~110 use cases in public safety, vehicular mobility, consumer and commercial applications like
  - Traffic Probe Data, Emergency Braking Notification, Intersection Signal Violation Warning, Weather Advisory and Private Service
- New Information Services to Customers: Traffic, Precise Maps and Weather
A New Form Of Communications

What is it for?  
Existing DSRC (e.g. Toll tags)  
plus a whole new range of vehicle communications uses

Featuring:
- Vehicle to roadside
- Vehicle to vehicle
- Mobile connection (up to 120mph)
- Very high data rates (up to 27 Mbps)
- High Availability & Low Latency (50ms) Prioritization Service
- Very long range (300m nominal, up to 1000m)
- Modem for any on-board device (IVN) or network (IPv6)

Used for:
- Signage
- Collision avoidance
- Fee collection
- Internet access
- (And many others)
Regulatory

- Allocated 5.825 - 5.925 MHz with seven 10 MHz channels
  - * Dedicated Primary Use *
- Public safety and private applications
- Governed by Use of standards
- OBU (vehicle): License by rule
- RSU (roadside unit): Geographic license with site registration through frequency coordination
Frequency Allocation

Canadian Special License Zones*

Directional and OMNI Control Channel

Power Limit

Uplink

Downlink

Shared Public Safety/Private

Dedicated Public Safety

OMNI Public Safety

OMNI Control Ch 172

OMNI Public Safety/Private Ch 174

OMNI Public Safety/Private Ch 176

Directional Public Safety

Public Safety/Private Ch 178

Directional Public Safety/Private Ch 180

Directional Public Safety/Private Ch 182

Uplink

Downlink

Frequency (GHz)

Canadian Special License Zones*

March 2005
# Standards under Development

- ASTM 2213  Physical Layer (Original)
- IEEE 802.11p  Physical Layer
- IEEE 1609.1  Resource Manager
- IEEE 1609.3  Network Services (Channelization)
- IEEE 1609.4  Prioritization
- IEEE 1556  Security
- SAE xxx  Message Set & Data Dictionary
Issues Being Worked

- Security & Privacy
  - OBU Address Randomized (prevents tracking and gives anonymity)
  - Licensed Transmitters
  - Authenticated RSU Application Announcements (prevents bogus messages)
  - Link Level Encryption (prevents eavesdropping)
  - Certificate Authentication
- Network Management (Availability, Data access/ownership)
  - No Data Retention
  - Authorized end users
- Certification and Applications
- Policy (Privacy, Liability & Data Ownership)
- Nationwide Capability, Deployment and Long Term Stability
DSRC Outlook

2002 2003 2004 2005 2006 2007 2008 2009 2010

- Architecture Standard
- Lower Layers (LL) Standard
- UL Revision
- IEEE Upper Layers (UL) Standard
- LL Test Standard
- LL Test Rev
- Test
- UL Test Standard
- Layer 1, 2 Prototype
- Full Prototype
- Security
- ISO Networking and Probe Data Standards
- Message Set Standards
- Auto Industry Evaluation and Input
- FCC Rule Development
- Outreach to State DOTs
- DEMO
- FCC Rule Refinement
- Initial Application Deployment
- Mature Application Deployment
- Safety Application Deployment
- Auto / Commercial Industry and Government Application Development
- Standards Maintenance
- Product Development
- New Product Certification
- Initial Certification
- Production
- Original
- New
- Industry Only

International Symposium of Advanced Radio Technologies
March 2005
Vehicle Infrastructure Integration Initiative Plan

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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</thead>
<tbody>
<tr>
<td>07/04/05</td>
<td>Completed definition of VII architecture and development costs to implement</td>
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<tr>
<td>12/04/05</td>
<td>Complete prototype testing [802.11] and III prototypes available for VII test program</td>
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<tr>
<td>12/04/05</td>
<td>Business plan for implementation complete</td>
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<tr>
<td>12/01/05</td>
<td>Privacy Policy defined for public sector and private sector</td>
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<tr>
<td>12/31/06</td>
<td>POC testing complete and initiate FOT</td>
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<tr>
<td>01/01/06</td>
<td>Selection of ICA application for POC test</td>
</tr>
<tr>
<td>01/01/07</td>
<td>Selection of ICA application for FOT</td>
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Realistic Scenario - OBU & RSU Implementation

OBU (Vehicle):
- Assumption: Mid-2008 Deployment Decision by Automotive OEMs
- Normal OEM design/implement cycle: 3 years
  - Some indications this could happen in 2 years
  - Therefore, first vehicles could appear in 2010

RSU (Roadside):
- Assumption: Mid-2008 Deployment Decision by U.S. DOT
- First Safety Priority: Intersections
- Current Plan: Equip 400,000 intersections over 6 years starting 2009
Summary

- WAVE DSRC is Emerging Technology with Integrating Performance
- Standardized Technology & Product Availability for Large Scale Deployment for 2010 Decade
- U.S. DOT and Automotive OEMs will be the Decision Makers anticipated in 2008
- Multiple Uses in Vehicle / Public Safety and Commercial Applications
- Commercial Marketing / Advertisement Possibilities in the Vehicle
- Less Expensive and Real-time Response than current Satellite Systems
- Could be leveraged for ETC / Open Road Tolling Usage
- Leverage from 802.11 Wi-Fi and GPS Positioning Deployments