



Dedicated Short Range Communications (DSRC)

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ITS Standards Advisory

ITS Standards Advisories provide the transportation community with information and guidance on key activities related to ITS standards. Standards Advisories are distributed monthly by the U.S. Department of Transportation's **ITS Standards Program**, with each Advisory focusing on a single ITS application and its corresponding standards. Standards Advisories highlight important, recent standards activities for the selected ITS application and provide links to more detailed information and resources. ITS Standards Advisories are posted on the ITS Standards Program web site at www.its-standards.net. Please e-mail the following address if you would like to be notified by e-mail when a new ITS Standards Advisory is posted on the web: flood@volpe.dot.gov.

If you are new to working with ITS standards, refer to the following introductory information.

- Frequently Asked Questions (FAQs) at the ITS Standards web site, www.its-standards.net/FAQ.htm
- The ITS Specialist at your [FHWA Resource Center](#) or [Division Office](#)

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DSRC Standards: What's New?

What is DSRC?

Dedicated Short Range Communications (DSRC) allows high-speed communications between vehicles and the roadside, or between vehicles, for ITS; it has a range of up to 1,000 meters. Potential DSRC applications for public safety and traffic management include:

- Intersection collision avoidance
- Approaching emergency vehicle warning
- Vehicle safety inspection
- Transit or emergency vehicle signal priority
- Electronic parking payments
- Commercial vehicle clearance and safety inspections
- In-vehicle signing
- Rollover warning
- Probe data collection
- Highway-rail intersection warning.

DSRC applications now in use include electronic toll collection, and electronic credentialing and monitoring of commercial vehicle operations (CVO). Current applications operate at 915 MHz and primarily use proprietary technology, although some standards-compliant devices have been developed.

The new 5.9 GHz frequency permits much higher data-transmission rates than the lower-frequency 915 MHz band and provides 75 megahertz of spectrum for

DSRC applications. The 915 MHz frequency has only 12 megahertz of spectrum available, which is shared with cordless telephones, garage door openers, and many other non-licensed wireless applications. In the case of 5.9 GHz, other users in the band include military radars and satellite communications systems.

Standards Development Status

ASTM and Institute of Electrical and Electronics Engineers (IEEE) committees develop the standards necessary to implement DSRC. The committees include a variety of representatives from the private and public sectors. ITS America is serving in the role of primary interface with the Federal Communications Commission (FCC).

Since the FCC allocated the 5.9 GHz band for DSRC in October 1999, the ASTM standards committee has been working on the standards for this new service. ASTM approved the first new DSRC standard, ASTM E2213-02, in May 2002 for layers 1 and 2, the physical and data link layers of the open systems interconnection (OSI) model of network architecture. In October 2002, ASTM published this standard. The committee is currently working on DSRC standards for the upper OSI layers in cooperation with the IEEE.

The full title of ASTM E2213-02e1 is *Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems* —

5 GHz Band Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) Specifications. The standard extends IEEE 802.11a into the high-speed vehicle environment. IEEE 802.11a is a standard governing wireless local area networks (LANs). Basing 5 GHz

DSRC on IEEE 802.11a allows expedited development of devices from available chip sets and promotes the interoperability of DSRC devices in wireless LAN environments. The new standard coexists with ASTM E2158-01, the standard for DSRC at 915 MHz.

FCC Rulemaking Targets DSRC

ITS America and DSRC

The new ASTM standard was the basis for a submission to the FCC by ITS America (ITSA), which recommended an approach to licensing the new spectrum. The DSRC community asserted that this licensing approach would, among other effects, enable DSRC to share the band with a minimum of interference from other uses. In addition, ITSA suggested that the FCC adopt the ASTM standard and require its use for all DSRC devices built for the 5.9 GHz band. ITSA's position on the FCC's DSRC rulemaking is found at:

[http://www.itsa.org/subject.nsf/Files/DSRC_NPRM_Summary/\\$file/DSRC_NPRM_Summary.DOC](http://www.itsa.org/subject.nsf/Files/DSRC_NPRM_Summary/$file/DSRC_NPRM_Summary.DOC). A sample of ITSA's recommendations is as follows:

- FCC adoption of the ASTM-DSRC Standard means faster market acceptance, the creation of incentives for manufacturers to build devices for the largest possible market, and the assurance to users that a particular technology will not be rendered obsolete later by a different technology.
- Public safety activities should be the dominant use of the band and be given priority over private transmissions. However, public safety and private users should share the band so that a larger overall market for DSRC devices and services would be created quickly.
- The broader FCC definition of "non-traditional" public safety entities should be used. A definition

for "non-public safety" DSRC operation might include some commercial activities.

- The shared, site-specific licensing scheme is designed, in part, to avoid any auctioning of spectrum.
- "Non-voice" should be deleted from the definition of DSRC service. The term "commercial environments" should be replaced with "private environments," because the word "commercial" may be construed as meaning "cellular-based commercial, two-way voice services."

FCC Action

On November 15, 2002, the FCC released a Notice of Proposed Rulemaking (NPRM) soliciting public comment on how to best utilize the 75 MHz in the 5.9 GHz band for DSRC for ITS. The FCC has largely adopted ITSA's recommendations for the implementation of DSRC at 5.9 GHz and placed them in the public record.

The NPRM sought public comment on the licensing rules suggested by ITS America. March 17, 2003 was the closing date for comment submittal. After reviewing the comments to the NPRM, the FCC will issue its first ruling on the uses of the spectrum and its proposed licensing approach later this year. The NPRM is found at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FC-C-02-302A1.pdf.

DSRC Applications

Planned Deployments

The Michigan Department of Transportation is conducting a field operational test of several applications of radio communications for traffic management. One application plans to use DSRC to warn motorists of imminent changes to their operating environments, such as the approach of an emergency vehicle or an upcoming work zone. The project, DIRECT (Driver Information Radio using Experimental Communication Technologies), was initiated in June 2002, and should be completed by December 2003.

The Michigan DOT is conducting the DIRECT project in partnership with other public agencies and private industry.

With the Emergency Vehicle Warning System (EVWS), an emergency vehicle (EV) equipped with a 5.9 GHz DSRC on-board unit (OBU) will transmit a message to motorists' OBUs giving the EV's location and direction of travel. The EV can also send messages to traffic signals along its route to trigger green lights. The highest priority will be given to the EVWS application over other functions using the

same channel of communication, such as Construction Zone Traveler Information or Route Specific Traveler Information.

Actions to Take Now

State and regional toll highway agencies and trucking agency regulators continue to expand current DSRC

applications operating at 915 MHz. Deployment of these applications is expected to continue. As 5.9 GHz DSRC devices come to market, an application such as electronic toll collection will be able to use both bands without interference, ensuring the continued viability of legacy devices.

Standards Resources

Technical Assistance

Technical assistance for DSRC (as well as other applications) is available in a number of formats.

- **The ITS JPO Standards Program Web Site** is the first stop for information on the DSRC standards. The site contains a wealth of information on ITS standards, including the status of the DSRC standards. Visit <http://www.its-standards.net/>.
- **An ITS Specialist** is available at each of the four FHWA Resource Centers to provide guidance on issues related to ITS standards. Visit www.fhwa.dot.gov/field.html for contact information.
- **The ITS Field Support Team** is a major new technical assistance program sponsored by the Standards Program. (Visit <http://www.its-standards.net/Documents/FSTflyer.pdf> for more details.) The ITS Field Support Team offers intensive consultation and support on a broad range of standards-related issues, including:
 - Assessment of current system
 - Development of project specifications
 - Review of existing contracts and specifications
 - Identification of appropriate contracting and procurement mechanisms
 - Development of test plans
 - Evaluation of systems for contract compliance and conformance to specifications.
- **The ITS Standards Contacts Database** contains contact information for state-level deployers who have used, are using, or are planning to use DSRC standards. Individuals in the database are available for informal discussions about using DSRC standards. Find the database on the ITS Standards web site at <http://www.its-standards.net/deploy.htm>.
- **The Standards Forum** is a *moderated*, on-line community of individuals interested in learning about ITS standards and sharing their experiences with colleagues. The only requirement to join the Forum is a desire to learn about ITS standards. Questions posted to the

Forum are answered quickly. Visit the forum at www.nawgits.com/stdsforum/.

Training

Training is available for ITS standards, and other standards, through the Institute of Transportation Engineers (ITE) and the Transit Standards Consortium. Training is held at locations throughout the country. The following web sites provide more detail.

- www.ite.org
- www.tsconsortium.org
- www.pcb.its.dot.gov

Links for Further Information on DSRC

The following are links for background and further information on DSRC.

- <http://www.leeamstrong.com/DSRC/DSRCHomeSet.htm>
- http://www.itsonline.com/dsrc_tbl.html
- <http://www.itsa.org/ITSNEWS.NSF/4e0650bef6193b3e852562350056a3a7/8af0fb11d6129c0885256bd100625b3c?OpenDocument>

Purchasing DSRC Standards

Standards may be purchased from <http://global.ihs.com/> or from www.astm.org.

Getting Involved

DSRC SDO

The ASTM Technical Committee (TC) E17 on Vehicle - Pavement Systems is concerned with the "principles, techniques and standards for Pavement Management Technologies, Vehicle Pavement Interactions, and Intelligent Vehicle/Highway Systems."

The Subcommittee E17.51 on Vehicle Roadside Communication is charged with developing the DSRC standard PHY and MAC layer standards. The ASTM Staff Manager for TC E17 is Daniel Smith, who can be contacted by e-mail at dsmith@astm.org or by phone at (610) 832-9727. Additional standards for DSRC are being developed by IEEE SCC32 - Standards Coordinating Committee on Intelligent Transportation Systems. For contact information, view <http://grouper.ieee.org/groups/scc32/>

FCC Rulemaking

The FCC NPRM comment period closed on March 17, 2003. You may view filed comments at http://gullfoss2.fcc.gov/prod/ecfs/comsrch_v2.cgi.

Enter the WT Docket Number 01-90 into the "Proceeding" field to view comments.

**Standards Applicable to DSRC Deployments
Standards Development Organization (SDO): ASTM**

The following section lists standards that can be used in a DSRC deployment. **Note:** The "Type" column indicates whether the standard defines data or communications (and for communications which layer of the link from physical to message definition). "SDO Status" denotes the standard's current development status as determined by the working group or committee that oversees the development of the standard. "Comment" refers to any additional information related to the status of the standard. For further information on the DSRC standards, see <http://www.its-standards.net/AAfactsheets.asp>. For information on the standards development process and its terminology, see <http://standards.ieee.org/resources/glance.html>.

Standard	Document Title	Description	Type	SDO Status	Comment
ASTM E2213-02e1	Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems — 5 GHz Band Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) Specifications	Describes a medium access control layer (MAC) and physical layer (PHY) specification for wireless connectivity using dedicated short range communications (DSRC) services.	IEEE 802.11a Extension	Published 10-02	Revision expected to go to ballot Summer 2003. E2213 Guide in development.
ASTM E2158-01	Standard Specification for Dedicated Short Range Communication (DSRC) Physical Layer Using Microwave in the 902-928 MHz Band	Gives the requirements for the physical, i.e., electrical and mechanical, interfaces and the transmission medium, i.e., air, in the 902 to 9278 MHz location and monitoring service (LMS) band.	Layer 1, Physical Layer	Published 4-99	
ASTM PS 105-99	Standard Provisional Specification for Dedicated Short Range Communication (DSRC) Data Link Layer	Defines the requirements for the open systems interconnection (OSI) reference model, layer two (data link layer), i.e., methods for ensuring data integrity.	Layer 2, Data Link Layer	Published 4-00	
IEEE 802.2-1998	Information Technology--Telecommunications and Information Exchange Between systems--Local and Metropolitan Area Networks--Specific Requirements--Part 2: Logical Link Control 1998	Describes the functions, features, protocol, and services of the logical link control (LLC) sublayer, which constitutes the top sublayer in the data link layer of the ISO/IEC 8802 LAN protocol.	Layer 2, Logical Link Control	Published 5-98 Reaffirmed 3-03	

Standard	Document Title	Description	Type	SDO Status	Comment
IEEE Std 802.11-1999	Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part 11: Wireless LAN Medium Access Control and Physical Layer Specifications	Corrects errors found in the current standard.	Layer 1, Physical Layer; Layer 2, Medium Access Control	Approved 3-99 Reaffirmed 2-03 (including recirculation)	
IEEE Std 802.11a-1999	Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part 11: Wireless LAN Medium Access Control and Physical Layer Specifications: High Speed Physical Layer in the 5 GHz band	Describes a higher speed PHY for use in fixed, moving or portable wireless local area networks. The PHY is used in conjunction with the 802.11 Medium Access Control (MAC).	Layer 1, Physical Layer; Layer 2, Medium Access Control	Approved 9-99	
IEEE Std 1455-1999	Standard for Message Sets for Vehicle/Roadside Communications	Provides the basis for interoperable, non-interfering DSRC implementations using equipment from multiple vendors.	Data Dictionary, Layers above Data Link Layer	Approved 7-99	Will be replaced by final versions of – IEEE P1609.1 IEEE P1609.2 IEEE P1609.4
IEEE P1609.1	Standard for Dedicated Short Range Communications (DSRC) Resource Manager	Describes resource manager that arbitrates requests for transponder usage	Application Manager	Current Status – Working Group/ Committee Draft	Will replace IEEE 1455; aligns with worldwide standard in development by ISO TC204/WG15
IEEE P1609.2	Standard for Dedicated Short Range Communications (DSRC) Application Layer	Describes an application layer standard to be used for 5.9 GHz DSRC.	Layer 7, Application Layer	Current Status – Working Group/ Committee Draft	Will replace IEEE 1455
IEEE P1609.3	Standard for IP Interface for Dedicated Short Range Communications (DSRC)	Describes standard that supports higher layer communication stacks, including TCP/IP.	Communication Service, Layers 3-5; Subset of ISO 21210	Current Status – Working Group/ Committee Draft	
IEEE P1609.4	Data Dictionary	Describes various standard message formats for DSRC applications at 5.9 GHz.	Device Data Dictionary	Current Status – Working Group/ Committee Draft	Will replace IEEE 1455
NTCIP 1211	Objects for Signal Control Priority	Defines the management information base for signal control and prioritization (SCP) systems through parameters that represent the configuration, status, and control information.	Device Data Dictionary	Current Status - User Comment Draft	

Standard	Document Title	Description	Type	SDO Status	Comment
NTCIP 2202	Transport Profile for Internet (TCP/IP and UDP/IDP)	Defines a combination of base standards and protocols used to provide specific functions and services for layer 3 (network or routing of packets) and layer 4 (transport or message handling) of the open systems interconnection (OSI) reference model (ISO/IEC 7498-1).	Layer 3, Network Layer; Layer 4, Transport Layer	Published 4-02	
IETF RFC 3095	Robust Header Compression (ROHC): Framework and four profiles: RTP, UDP, ESP, and uncompressed.	Specifies a highly robust and efficient header compression scheme for RTP/UDP/IP (real-time transport protocol, user datagram protocol, Internet protocol), UDP/IP, and ESP/IP (encapsulating security payload) headers. For IPv6.	Level 3, Network Layer	Current Status – Working Group/ Committee Draft	Internet draft available

Acronyms and Abbreviations

ASTM	ASTM International, formerly known as the American Society for Testing and Materials	LAN	Local Area Network
CCTV	Closed Circuit Television	LLC	Logical Link Control
CVO	Commercial Vehicle Operations	LMS	Location and Monitoring Service
DIRECT	Driver Information Radio using Experimental Communication Technologies	m	Meters
DSRC	Dedicated Short Range Communications	MAC	Medium Access Control (Layer 2)
ESP	Encapsulating Security Payload	MHz	Megahertz
ETC	Electronic Toll Collection	NPRM	Notice of Proposed Rulemaking
EV	Emergency Vehicle	NTCIP	National Transportation Communications for ITS Protocol
EVWS	Emergency Vehicle Warning System	OBU	On-board Unit
FAQs	Frequently-Asked Questions	OSI	Open Systems Interconnection
FCC	Federal Communications Commission	PHY	Physical Layer (Layer 1)
FHWA	Federal Highway Administration	RFC	Request for Comments
GHz	Gigahertz	ROHC	Robust Header Compression
IDP	Internet Datagram Protocol	RSU	Roadside Unit
IEC	International Electrotechnical Commission	RTP	Real-Time Transport Protocol
IEEE	Institute of Electrical and Electronics Engineers	SCP	Signal Control and Prioritization
IETF	Internet Engineering Task Force	SDO	Standards Developing Organization
IP	Internet Protocol	TC	Technical Committee
ISO	International Organization for Standardization	TCP/IP	Transmission Control Protocol
ITE	Institute of Transportation Engineers	UDP	User Datagram Protocol
ITS	Intelligent Transportation Systems	U.S. DOT	United States Department of Transportation
ITSA	ITS America	WG	Working Group
JPO	Joint Program Office		