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IEEE Guide for Wireless Access in Vehicular Environments (WAVE) Architecture

IEEE Vehicular Technology Society

Sponsored by the
Intelligent Transportation Systems Committee

IEEE
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IEEE Std 1609.0™-2019
(Revision of IEEE Std 1609.0-2013)

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Approved 08 February 2019

IEEE-SA Standards Board

Abstract: The wireless access in vehicular environments (WAVE) architecture and services necessary for WAVE devices to communicate in a mobile vehicular environment are described in this guide. It is meant to be used in conjunction with the family of IEEE 1609 standards as of its publication date. These include IEEE Std 1609.2™, IEEE Standard Security Services for Applications and Management Messages; IEEE Std 1609.3™, Networking Services; IEEE Std 1609.4™, Multi-Channel Operation; IEEE Std 1609.11™, Over-the-Air Electronic Payment Data Exchange Protocol for Intelligent Transportation Systems (ITS); IEEE Std 1609.12™, Identifiers; and IEEE Std 802.11™ in operation outside the context of a basic service set.

Keywords: dedicated short range communications, DSRC, IEEE 1609.0™, OBU, onboard unit, Provider Service Identifier (PSID), roadside unit (RSU), WAVE, WAVE service advertisement, WAVE Short Message, WAVE Short Message Protocol, wireless access in vehicular environments, WSA, WSM, WSMP

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

PDF: ISBN 978-1-5044-5493-3 STD23520
Print: ISBN 978-1-5044-5494-0 STDPD23520

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Introduction

This introduction is not part of IEEE Std 1609.0™-2019, IEEE Guide for Wireless Access in Vehicular Environments (WAVE) Architecture.

This document is a revision of IEEE Std 1609.0-2013, modified to be compatible with, and in alignment to the 1609 family of standards that underwent major revisions during 2015. The revisions resulted in the publishing of IEEE Std 1609.2-2016, IEEE Std 1609.3-2016, IEEE Std 1609.4-2016, and IEEE Std 1609.12-2016.

This revision has also been modified to reflect a more up to date current state of Connected Vehicle programs and activities and progress in the US. Department of Transportation (USDOT) ITS program in general.

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1. Overview

A wireless access in vehicular environments (WAVE) system is a radio communication system intended to provide seamless, interoperable services to users of a transportation system. These services include intelligent transportation system (ITS) services recognized by the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) and many others contemplated by the automotive and transportation infrastructure industries around the world. Specifically, the WAVE system provides communications between vehicles and infrastructure, and communications among vehicles. This guide provides an overview of the system, its components, and its operation. It is intended to provide a context within which to better understand the content of the related IEEE WAVE standards documents, which include IEEE Std 1609.2™, IEEE Std 1609.3™, IEEE Std 1609.4™, IEEE Std 1609.11™, and IEEE Std 1609.12™, as well as IEEE Std 802.11™ [stations communicating outside the context of a Basic Service Set (BSS), or OCB].[1]

The term dedicated short range communications (DSRC) is sometimes used in the U. S. to refer to radio spectrum or technologies associated with WAVE. For example, U. S. Federal Communications Commission (FCC) documents (FCC ET Docket No.98–95, RM-9096 [B15]) allocate spectrum to "mobile service for use by DSRC systems operating in the Intelligent Transportation System (ITS) radio service," and the Society of Automotive Engineers (SAE) has specified messages in SAE J2735 "for use by applications intended to utilize the 5.9 GHz dedicated short range communications for wireless access in vehicular environments."[2] Outside the U. S., DSRC may refer to alternate radio technologies, such as M5 defined in ISO 21215 [B50], G5 defined in ETSI 302 663 [B8], or similar technologies.

1.1 Scope

This guide describes the architecture and operation of a WAVE system based on IEEE 1609 standards and IEEE Std 802.11.

1.2 Aspects of a WAVE system

1.2.1 Introduction

ISO/IEC 42010:2007 [B55] is a recommended practice for architectural description of software-intensive systems, and defines several aspects of any system: an environment or context, stakeholders who typically

[1]Information on references can be found in Clause 2.
[2]The numbers in brackets correspond to those of the bibliography in Annex A.